CVP-2006-00001
Rev. 0

Cleanup Verification Package for the 116-K-2 Effluent Trench

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

March 2006

EXECUTIVE SUMMARY

This cleanup verification package documents completion of remedial action for the 116-K-2 effluent trench, also referred to as the 116-K-2 mile-long trench and the 116-K-2 site. This site is located in the 100-KR-1 Operable Unit in the 100-K Area of the Hanford Site in southeastern Washington State. During its period of operation from 1955 to 1971, the 116-K-2 site was used to dispose of cooling water effluent from the 105-KE and 105-KW Reactors by percolation into the soil. The site also received mixed liquid wastes from the 105-KW and 105-KE fuel storage basins, reactor floor drains, and miscellaneous decontamination activities.

Site excavation and waste disposal 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 116-K-2 site indicate that all remedial action objectives for direct exposure, protection of groundwater, and protection of the Columbia River have been met (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 116-K-2 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?	Ref.
Direct Exposure – Radionuclides	1. Attain 15 mrem/yr dose rate above background over 1,000 years.	1. Maximum dose rate calculated by RESRAD is 7.77 mrem/yr (not accounting for clean backfill).	Yes	a, b
Direct Exposure – Nonradionuclides	1. Attain individual COC RAGs.	1. The concentration for hexavalent chromium (the only nonradionuclide COC) is below the direct exposure RAG.	Yes	c, d
Meet Nonradionuclide Risk Requirements	1. Hazard quotient of <1 for noncarcinogens.	1. Individual hazard quotients for the 116-K-2 site are less than 1.	Yes	c, d
	2. Cumulative hazard quotient of <1 for noncarcinogens.	2. Cumulative hazard quotients for the 116-K-2 site are less than 1.		c, d
	3. Excess cancer risk of <1 x 10^{-6} for individual carcinogens.	3. Individual excess carcinogenic risk values for the 116-K-2 site are less than 1 x 10^{-6}.		c, d
	4. Attain a total excess cancer risk of <1 x 10^{-5} for carcinogens.	4. Cumulative excess carcinogenic risk values for the 116-K-2 site are less than 1 x 10^{-5}.		c, d
Groundwater/River Protection – Radionuclides	1. Attain single-COC groundwater and river protection RAGs.	1. Radionuclide COCs are not predicted to migrate to groundwater or the Columbia River within 1,000 years.	Yes	a, b
	2. Attain National Primary Drinking Water Standards: 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.	2. Radionuclide COCs are not predicted to migrate to groundwater or the Columbia River within 1,000 years.		
	3. Meet drinking water standards for alpha emitters: the more stringent of the 15 pCi/L MCL or 1/25th of the derived concentration guide per DOE Order 5400.5.	3. Radionuclide COCs are not predicted to migrate to groundwater or the Columbia River within 1,000 years.		
	4. Meet total uranium standard of 21.2 pCi/L.[e]	4. Uranium was not identified as a COC for the 116-K-2 waste site.	NA	
Groundwater/River Protection – Nonradionuclides	1. Attain individual nonradionuclide groundwater and river cleanup requirements.	1. Residual hexavalent chromium concentrations are not predicted to leach to groundwater or the Columbia River at concentrations exceeding the applicable water quality criteria.	Yes	a, b, c, d

Table ES-1. Summary of Cleanup Verification Results for the 116-K-2 Waste Site. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?	Ref.
Other supporting Information	1. 116-K-2 (east) sample variance calculation (Appendix C)			f
	2. 116-K-2 (west) and overburden sample variance calculation (Appendix C)			g
	3. 116-K-2 overburden sample variance calculation (Appendix C)			h
	4. 116-K-2 (east) sample location design (Appendix C)			i
	5. 116-K-2 (west) and overburden sample location design (Appendix C)			j

[a] *116-K-2 Trench (East End) RESRAD Calculation*, 0100K-CA-V0058, Rev. 0, Washington Closure Hanford, Richland, Washington.
[b] *116-K-2 Trench (West End) RESRAD Calculation*, 0100K-CA-V0063, Rev. 0, Washington Closure Hanford, Richland, Washington.
[c] *116-K-2 Trench (East End) Cleanup Verification 95% UCL Calculations*, 0100K-CA-V0056, Rev. 1, Washington Closure Hanford, Richland, Washington.
[d] *116-K-2 Trench (West End) Cleanup Verification 95% UCL Calculations*, 0100K-CA-V0061, Rev. 0, Washington Closure Hanford, Richland, Washington.
[e] Uranium limits selected in the *Amendment to the Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington* (ROD) (EPA 1997) and *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b) were based on 1/25th of the derived concentration guidelines from DOE Order 5400.5. Since the time of ROD signature, the U.S. Environmental Protection Agency has promulgated a more restrictive MCL of 30 μg/L for total uranium (65 *Federal Register* 76708). Based on the isotopic distribution of uranium in the 100 Areas, the 30 μg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038 (BHI 2001a).
[f] *116-K-2 Mile Long Trench Variance Calculation*, 0100K-CA-V0055, Rev. 0, Washington Closure Hanford, Richland, Washington.
[g] *116-K-2 Mile Long Trench Variance Calculation (Phase 2, West)*, 0100K-CA-V0064, Rev. 0, Washington Closure Hanford, Richland, Washington.
[h] *116-K-2 Overburden Variance Calculation*, 0100K-CA-V0065, Rev. 0, Washington Closure Hanford, Richland, Washington.
[i] *116-K-2 (East End) Trench Shallow & Deep Zone Sampling Plan*, 0100K-CA-V0057, Rev. 0, Washington Closure Hanford, Richland, Washington.
[j] *116-K-2 (West End) Trench Shallow, Deep Zone and Overburden Sampling Plan*, 0100K-CA-V0062, Rev. 0, Washington Closure Hanford, Richland, Washington.

COC = contaminant of concern
NA = not applicable
RAG = remedial action goal
MCL = maximum contaminant level (drinking water standard)
RESRAD = RESidual RADioactivity (dose model)
UCL = upper confidence limit

Attachment ES-1
Waste Site Reclassification Form

Date Submitted: 3/2/06 **Originator:** R. A. Carlson **Phone:** 373-1440	**Operable Unit(s):** 100-KR-1 **Waste Site ID:** 116-K-2 **Type of Reclassification Action:** Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number:** 2006-002 **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 116-K-2 waste site has been remediated to meet the cleanup standards specified in the 1997 *Amendment to the Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington,* U.S. Environmental Protection Agency, Region 10, Seattle, Washington (EPA/AMD/R10-97/044). Remedial actions were performed so as to not preclude any future uses (as bounded by the rural-residential scenario), to allow unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep), and to protect groundwater and the Columbia River. Institutional controls are required for the site to prevent drilling or excavation into deep zone soils. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 116-K-2 Effluent Trench* (CVP-2006-00001), Washington Closure Hanford, Richland, Washington.

J. Zeisloft DOE-RL Project Manager	Signature	3/28/06 Date
NA Ecology Project Manager	Signature	Date
L. E. Gadbois EPA Project Manager	Signature	March 23, 2006 Date

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ACRONYMS AND ABBREVIATIONS

COC	contaminant of concern
CVP	cleanup verification package
DQA	data quality assessment
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
MTCA	*Model Toxics Control Act Cleanup Regulation*
NaI	sodium iodide
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 116-K-2 waste site was remediated in accordance with the *Amendment to the Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington* (hereafter referred to as the ROD Amendment) (EPA 1997). Remedial action objectives (RAOs) and remedial action goals (RAGs) for this site are documented in the *Interim Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington* (hereafter referred to as the ROD) (EPA 1995) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005b). 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 Amendment and conducted for the 116-K-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 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 2005b). The waste site COCs presented in Table 1 were refined from the list presented in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2001) for the 116-K-2 waste site (BHI 2004).

Soil cleanup levels were established in the interim action ROD based on a limited ecological risk assessment. A baseline risk assessment for the river corridor portion of the Hanford Site began in 2004, which includes a more complete quantitative ecological risk assessment. That baseline risk assessment will be used as part of the final ROD for this site.

2.0 SITE DESCRIPTION AND SUPPORTING INFORMATION

The 116-K-2 waste site is part of the 100-KR-1 Operable Unit in the 100-K Area. The site consists of a former radioactive liquid effluent disposal trench, approximately 1,200 m (4,000 ft) long, 14 m (45 ft) wide at the top, and 4.6 m (15 ft) deep. The site is located immediately northeast of the former 116-K-1 crib and runs parallel to the Columbia River (Figure 1).

The 116-K-2 trench was excavated in 1955 to replace the 116-K-1 Crib and received mixed liquid waste effluent until the last of the 100-K Area reactors was shut down in 1971 (Carpenter and Cote 1994). Liquid waste was discharged to the trench by the retention basin drain system (100-K-55 and 100-K-56 pipelines) and consisted of

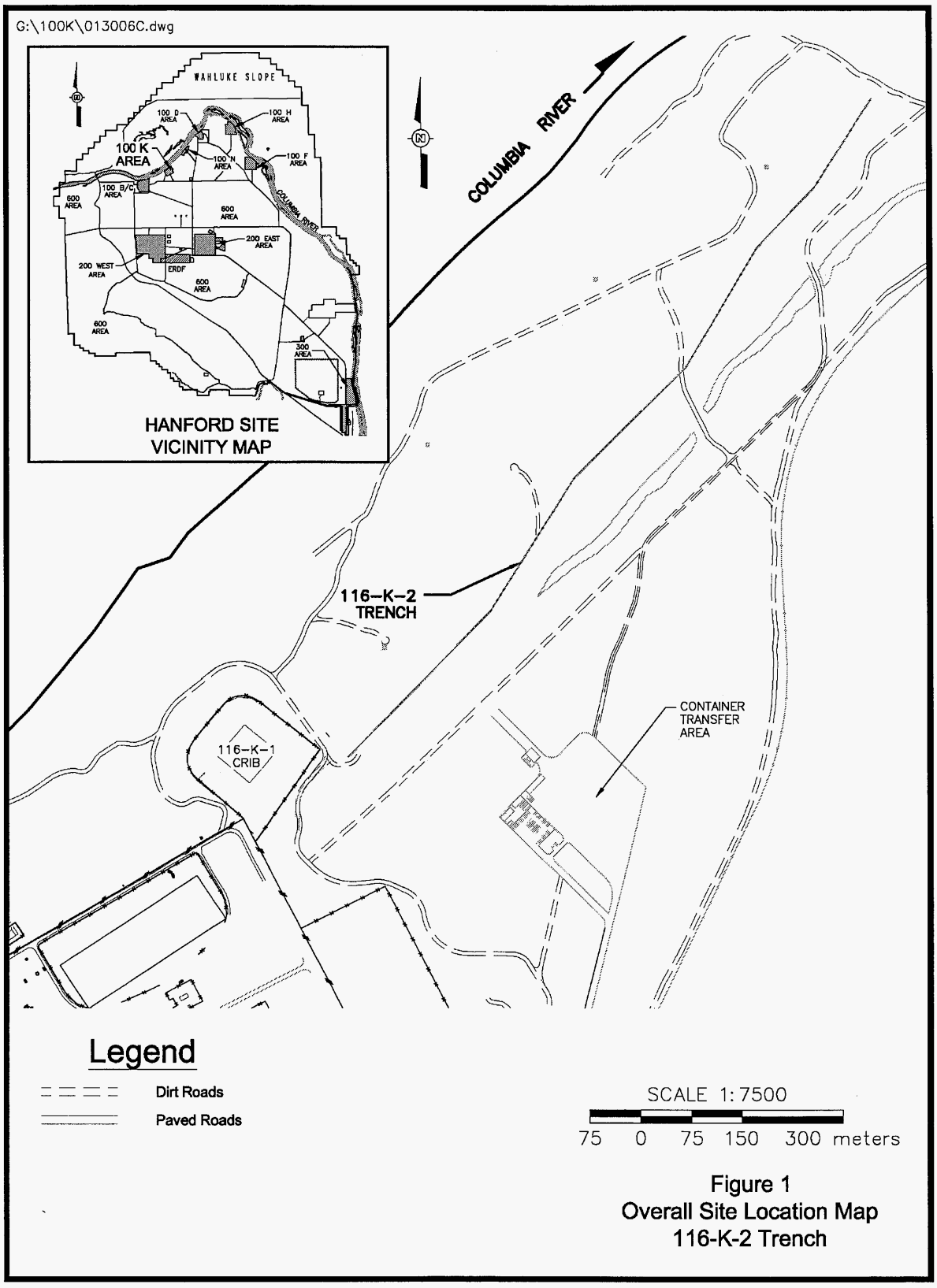
Table 1. 116-K-2 Remedial Action Goals.

COCs	Direct Exposure RAG[a]	Groundwater Protection RAG (pCi/L)[b]	Columbia River Protection RAG (pCi/L)[b]
Carbon-14	15 mrem/yr (cumulative)[a]	4 mrem/yr (cumulative)[b]	4 mrem/yr (cumulative)[b]
Cesium-137			
Cobalt-60			
Europium-152			
Europium-154			
Nickel-63			
Plutonium-239/240		1.2	1.2
Strontium-90		8[c,d]	8[c,d]
COC	**Direct Exposure RAG (mg/kg)**	**Soil RAG for Groundwater Protection (mg/kg)**	**Soil RAG for Columbia River Protection (mg/kg)**
Hexavalent chromium	2.1[e] 240[f]	4.8[g]	2[h]

[a] Lookup values that correspond to the 15 mrem/yr dose rate are based on a generic site model and are presented in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b).
[b] Lookup values that correspond to the individual radionuclide 4 mrem/yr dose rate equivalent for beta- and gamma-emitter RAGs per National Drinking Water Standards are presented in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b). Non-uranium alpha emitters must meet drinking water standards for alpha emitters based on the more stringent of the 15 pCi/L MCL or 1/25th of the derived concentration guide per DOE Order 5400.5.
[c] Strontium-90 also contributes to the 4 mrem/yr (cumulative) dose rate for groundwater and river protection.
[d] Promulgated groundwater protection standard (40 CFR 141).
[e] WAC 173-340-750(3) Method B carcinogenic cleanup limit based on the inhalation exposure pathway, per *Calculation of Hexavalent Chromium Carcinogenic Risk* (BHI 2000a).
[f] WAC 173-340-740(3) Method B noncarcinogenic cleanup limit.
[g] Soil RAG based on "100 times groundwater cleanup" rule.
[h] Soil RAG based on 100 times dilution attenuation factor times surface water quality standard as presented in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b).
CFR = *Code of Federal Regulations*
COC = contaminant of concern
MCL = maximum contaminant level (drinking water standard)
RAG = remedial action goal
WAC = *Washington Administrative Code*

reactor cooling water effluent, overflow from the 105-KW and 105-KE Reactor Building fuel storage basins, contaminated liquid from the 105-KW and 105-KE Reactor Building floor drains, dummy decontamination waste, process cooling water following fuel cladding failures, and some special disposal (DOE-RL 1994). Up to 76,000 L/min (20,000 gal/min) of leakage through the 100-K retention basin butterfly valves was also discharged to the 116-K-2 trench. The 100-K Area was deactivated in 1971 and 1972, at which time the 116-K-2 trench was backfilled with the soil from the original excavation. A small construction tractor and all (empty) 100-K Area hydride tanks were also disposed in the trench during deactivation (Carpenter and Cote 1994).

Figure 1. Hanford Site Map and Location of the 116-K-2 Waste Site.



3.0 REMEDIAL ACTION FIELD ACTIVITIES

3.1 EXCAVATION AND DISPOSAL

Remedial action activities at the 116-K-2 waste site were conducted from February 17, 2004, to October 27, 2005. Remediation involved excavation and staging of clean overburden material and removal of contaminated soil to the extent required to satisfy the RAOs and corresponding RAGs. The previously disposed construction tractor and a small amount of concrete and steel debris were also excavated at the western end of the former trench. Contaminated materials were disposed at the ERDF.

Pre- and post-remediation topographic maps are shown in Figures 2, 3, 4, and 5. Approximately 55,540 m^2 (597,830 ft^2) of plan area was excavated, including excavation within the deep zone (greater than 4.6 m [15 ft] below ground surface) up to 7.6 m (25 ft) below ground surface. Approximately 410,000 metric tons (451,900 U.S. tons) of material from the site was removed and disposed at the ERDF.

3.2 FIELD SCREENING AND VARIANCE SAMPLING

Radiological field screening was conducted during the site remedial actions as specified in the SAP (DOE-RL 2001). Field screening was used to guide the excavation to quickly assess the presence and level of contamination. Field screening at the site included using a radiological data mapping system survey, hand-held sodium iodide (NaI) detectors, and gamma energy analyses of grab samples. The radiological mapping survey was performed over more than 50% of the site excavation surface area. The hand-held NaI detectors were used to screen excavated waste material and to screen the excavation wall and floor for potential hot spots. Gamma energy analyses were used to support waste characterization and to corroborate the radiological mapping survey and hand-held NaI detector data.

Variance analysis was performed following field screening. Because of the size of the 116-K-2 waste site, variance analysis was performed separately for overburden material and the eastern and western portions of the site. The variance analysis quantifies the variability of residual contamination (see calculation briefs in Appendix C). This information was used to determine the site-specific number of final cleanup verification samples to be collected. Initial analytical results indicated areas of excessive residual radionuclide contamination in areas A1, A2, A3, and B7 of the eastern 116-K-2 remediation footprint. Additional remediation and sampling was performed within these areas, pursuant to the SAP (DOE-RL 2005a). The analytical results for subsequent samples replaced previous samples for the purposes of variance calculations (Appendix C) as follows:

- Sampling node S-A1-3: Sample J103C1 replaced three previous sequential samples at the node (samples J03CT0, J03W01, and J03W11)

- Sampling node S-A1-10: Sample J03W02 replaced sample J03CT2

Figure 2. Pre-Remediation Topographic Plan for the Western Portion of the 116-K-2 Waste Site.

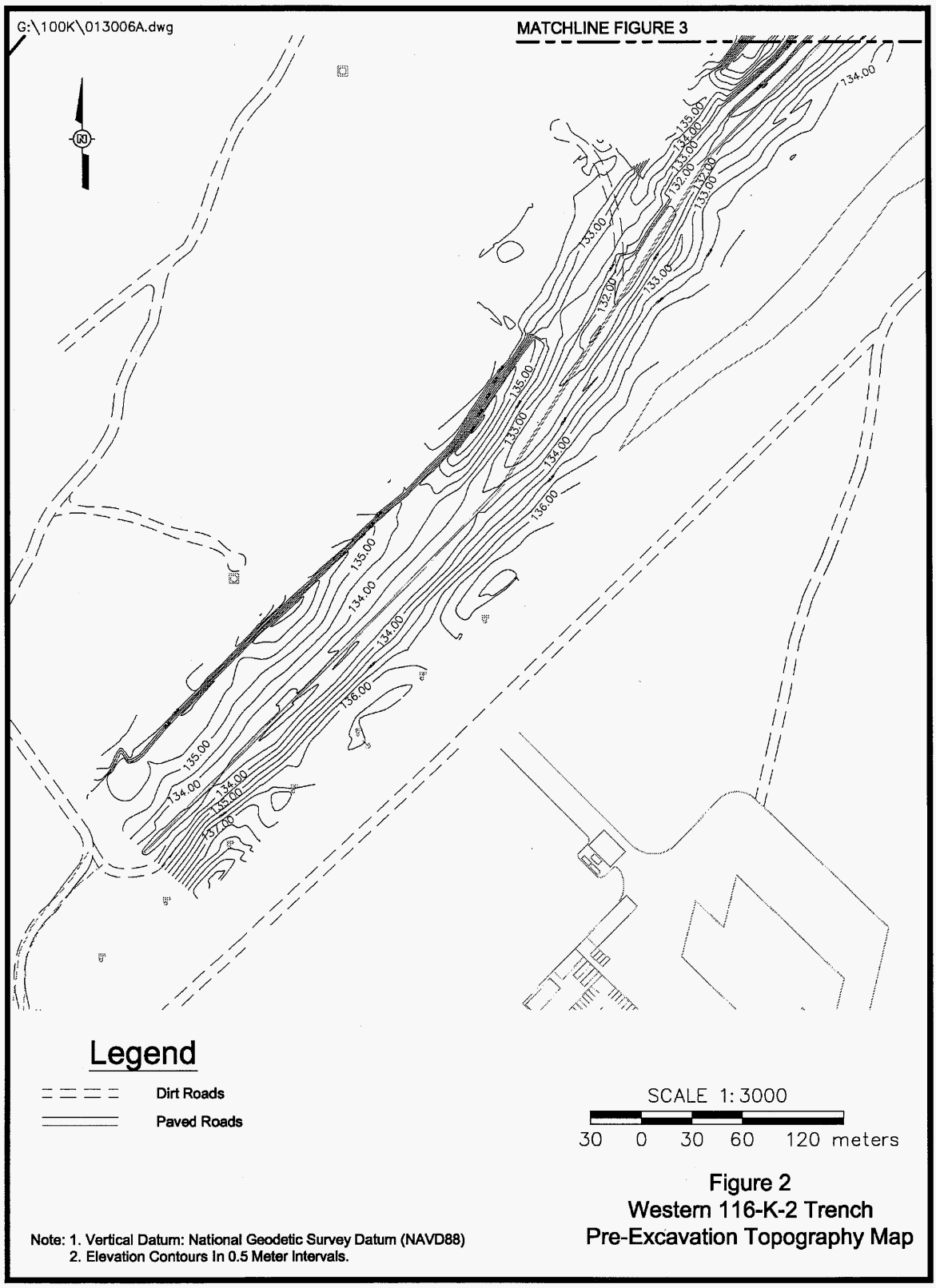


Figure 3. Pre-Remediation Topographic Plan for the Eastern Portion of the 116-K-2 Waste Site.

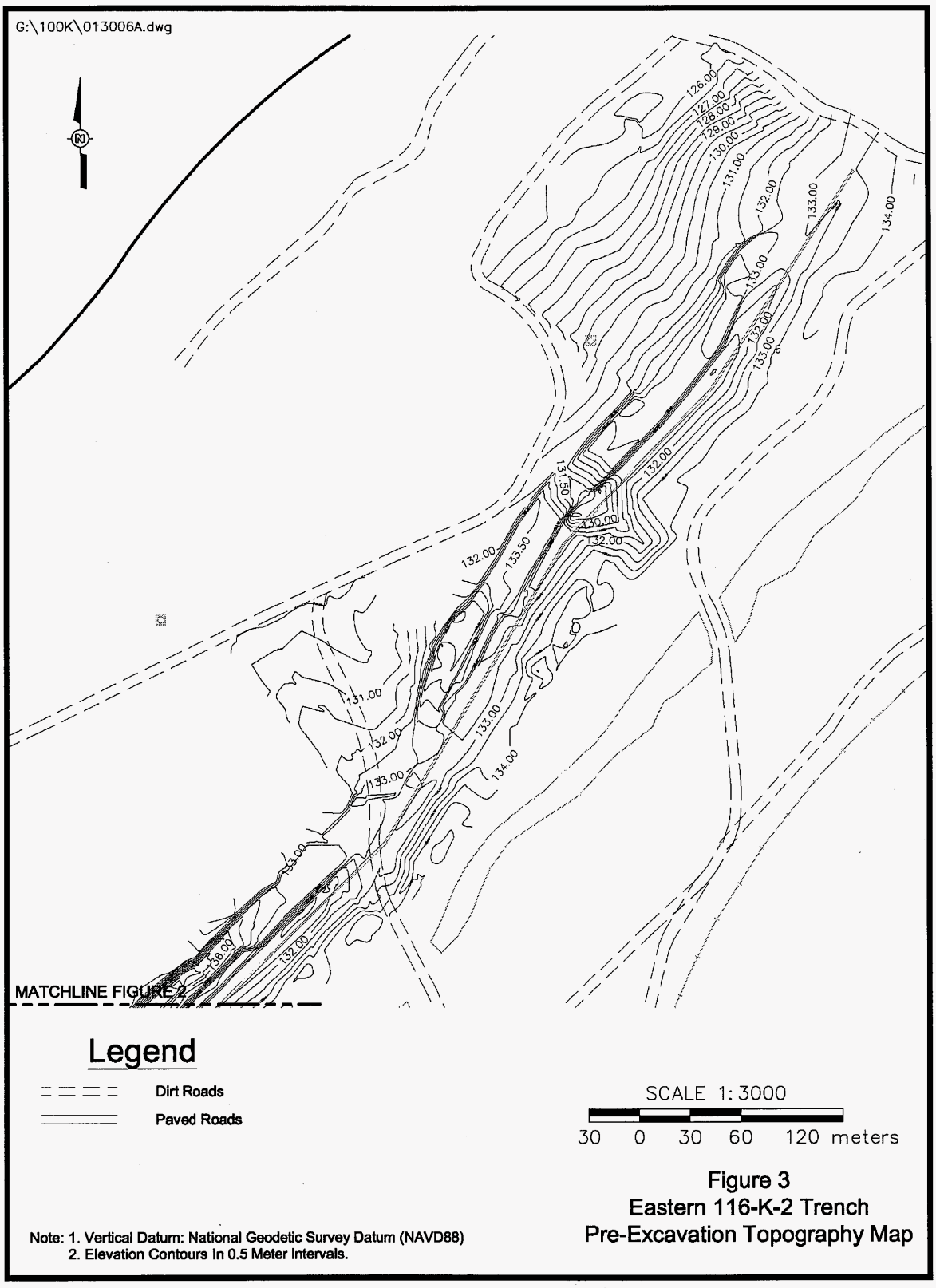


Figure 4. Post-Remediation Topographic Plan for the Western Portion of the 116-K-2 Waste Site.

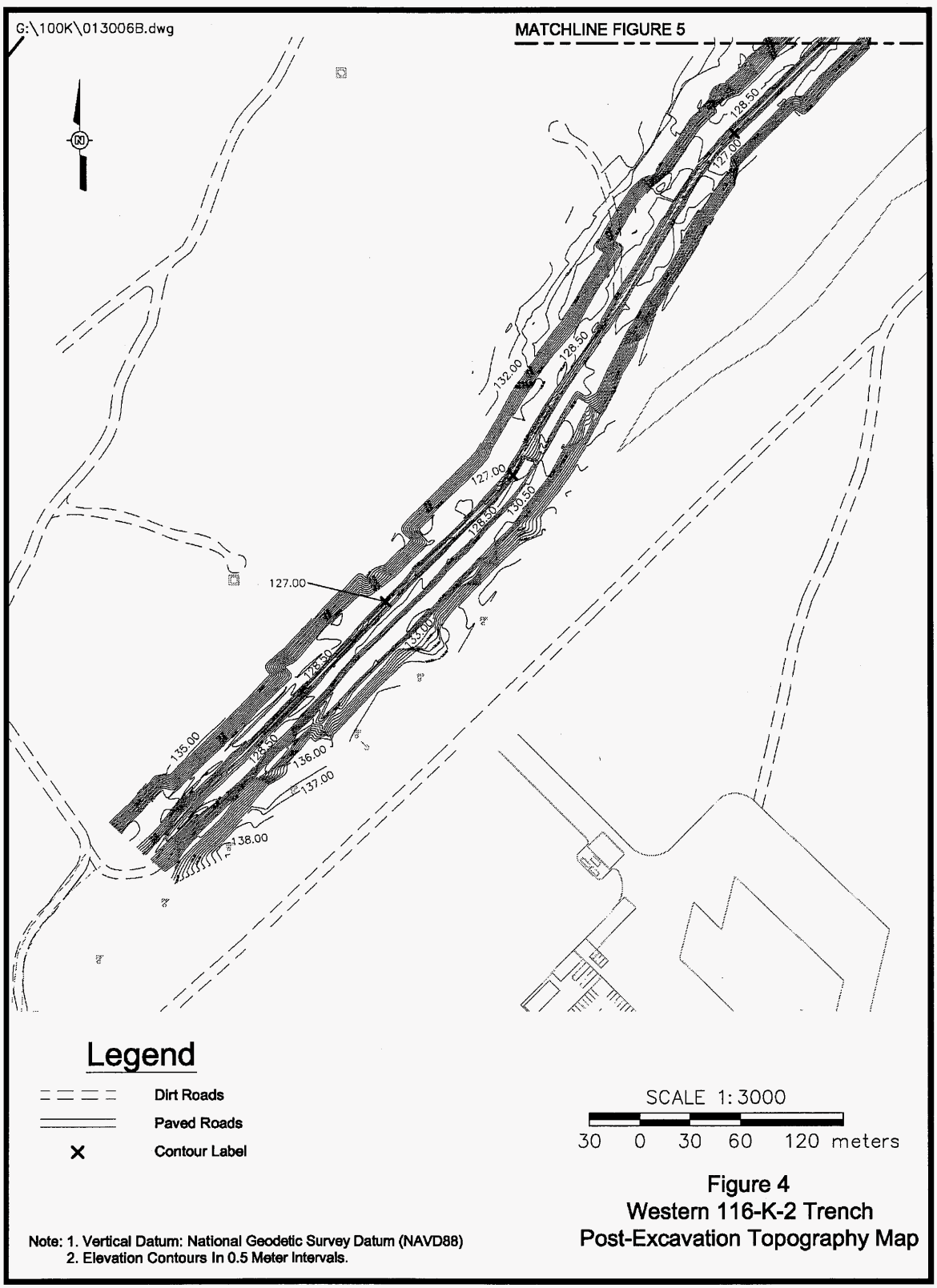
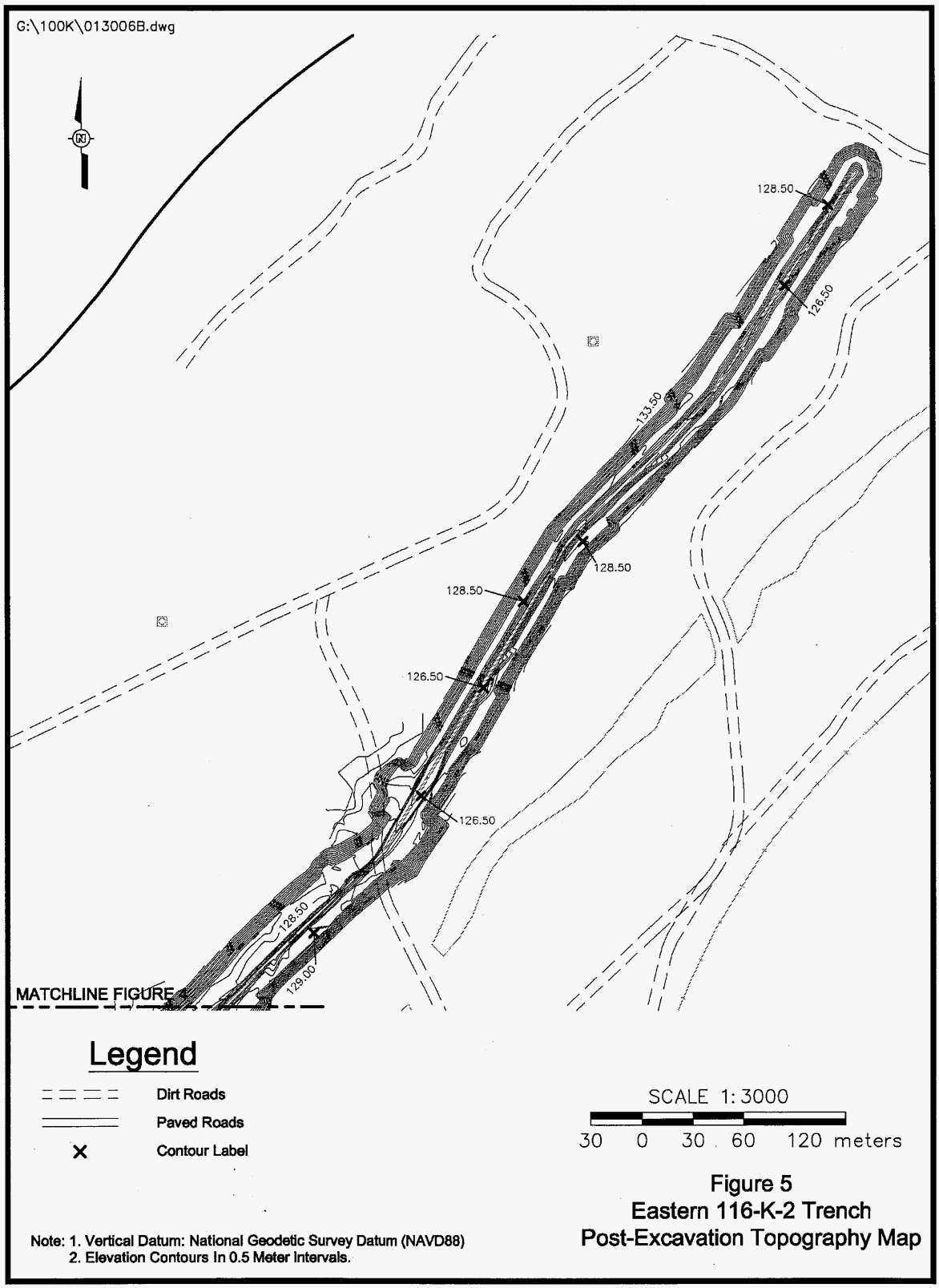


Figure 5. Post-Remediation Topographic Plan for the Eastern Portion of the 116-K-2 Waste Site.



- Sampling node S-A2-15: Sample J03W03 replaced sample J03CV0
- Sampling node S-A3-1: Sample J03W04 replaced sample J03CV1
- Sampling node S-A3-9: Sample J03W05 replaced sample J03CV5
- Sampling node S-A3-11: Sample J03W06 replaced sample J03CV6
- Sampling node S-B7-3: Sample J03W07 replaced sample J03CX6.

The results of the variance analyses indicated that the number of verification samples to be taken for each shallow zone and overburden decision subunit of the 116-K-2 site was less than the default number of four specified in the SAP (DOE-RL 2005a); therefore, four final verification samples were collected from each shallow zone and overburden decision subunit. The default number of three verification samples (DOE-RL 2005a) was collected from each deep zone decision subunit.

3.3 CLEANUP VERIFICATION SAMPLING AND ANALYSIS

Final cleanup verification sampling was conducted from July 6, 2005, to November 2, 2005 (BHI 2005), following variance analyses. The final verification samples were submitted to offsite laboratories for analysis using approved U.S. Environmental Protection Agency (EPA) analytical methods as required per the SAP (DOE-RL 2005a). Each verification sample was composed of a composite sample formed by combining soil collected at the required number of randomly selected locations within each sampling area (excluding the quality assurance/quality control samples).

The division of the 116-K-2 site excavation into decision units (i.e., shallow zone and deep zone) as shown on the sample design figures (Appendix C) 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 (i.e., shallow zone and overburden soil). The groundwater protection and river protection RAGs are applicable to soils greater than 4.6 m (15 ft) below the ground surface (i.e., deep zone).

The 116-K-2 waste site consisted of shallow zone, deep zone, and overburden decision units. The shallow zone consisted of the excavation sidewalls and floors that were less than 4.6 m (15 ft) below ground surface. The deep zone consisted of the portions of the excavation sidewalls and excavation floor that were more than 4.6 m (15 ft) below ground surface. The shallow zone decision unit for the 116-K-2 waste site contained six decision subunits, divided into four sampling areas per decision subunit. The deep zone decision unit for the site contained eight decision subunits, divided into three sampling areas per decision subunit. The overburden decision unit for the site contained two subunits, divided into four sampling areas per decision subunit. All sampling areas were further divided into 16 sampling nodes each as shown in the sample design methodology and sample location figures presented in the calculation briefs in Appendix C. Initial analytical results indicated areas of excessive residual contamination in sampling

areas A1 and A3 of the eastern shallow zone decision unit. Additional remediation was performed and additional samples collected at the sampling nodes pursuant to the SAP (DOE-RL 2005a). The analytical results for the initial samples were replaced with those for the subsequent samples for the purposes of statistical calculations, as described in the cleanup verification calculation brief (Appendix C).

4.0 CLEANUP VERIFICATION DATA EVALUATION

This section presents the evaluation and modeling of the 116-K-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 116-K-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 Hanford Environmental Information System and are summarized in Appendix A. The detailed DQA is presented in Appendix B.

4.2 CONTAMINANTS OF CONCERN 95% UPPER CONFIDENCE LIMIT

The primary statistical calculation to support cleanup verification is the 95% upper confidence limit (UCL) on the arithmetic mean of the data. The 95% UCL values for each COC are computed for each decision unit (i.e., shallow zone, deep zone, and overburden). Prior to calculating the 95% UCL, the individual sample results are reviewed and, as appropriate, adjusted per the SAP (DOE-RL 2005a). This process is summarized below.

Verification sampling summary statistics (95% UCL values) for the 116-K-2 waste site are listed in Table 2. Individual sample cleanup verification results are presented in Appendix A. In the interest of expediting field operations at the 116-K-2 waste site, statistical analysis of verification data sets was performed separately for the eastern and western portions of the shallow and deep zone decision units.

Table 2. 116-K-2 Cleanup Verification Data Set.

COCs	95% UCL Statistical Values (pCi/g)			Hanford Site Background[b] (pCi/g)	Cleanup Verification Data Set[c] (pCi/g)		
	Shallow Zone	Deep Zone	Overburden[a]		Shallow Zone	Deep Zone	Overburden
116-K-2 (East)[d]							
Carbon-14	0.70	1.26	0.68 (ND)	NA	0.70	1.26	0.68 (ND)
Cesium-137	0.56	130	0.083	1.1	0.56	130	0 (<BG)
Cobalt-60	0.018 (ND)	2.48	0.020 (ND)	0.008	0.018 (ND)	2.48	0.012 (ND)
Europium-152	0.153	62.7	0.17	NA	0.153	62.7	0.17
Europium-154	0.056 (ND)	5.4	0.068 (ND)	0.033	0.056 (ND)	5.4	0.035 (ND)
Nickel-63	3.56	880	0.689 (ND)	NA	3.56	880	0.689 (ND)
Plutonium-239/240	0.023 (ND)	6.9	0.031 (ND)	0.025	0.023 (ND)	6.9	0.006 (ND)
Strontium-90	0.143	7.12	0.062 (ND)	0.18	0.143	7.12	0 (<BG)
116-K-2 (West)[d]							
Carbon-14	0.29	1.44	0.68 (ND)	NA	0.29	1.44	0.68 (ND)
Cesium-137	1.10	117	0.083	1.1	1.10	117	0 (<BG)
Cobalt-60	0.023 (ND)	4.23	0.020 (ND)	0.008	0.023 (ND)	4.23	0.012 (ND)
Europium-152	0.626	76	0.17	NA	0.626	76	0.17
Europium-154	0.129	7.2	0.068 (ND)	0.033	0.129	7.2	0.035 (ND)
Nickel-63	1.77	650	0.689 (ND)	NA	1.77	650	0.689 (ND)
Plutonium-239/240	0.024 (ND)	4.7	0.031 (ND)	0.025	0.024 (ND)	4.7	0.006 (ND)
Strontium-90	0.201	6.3	0.062 (ND)	0.18	0.201	6.3	0 (<BG)
116-K-2 (East)[d]							
Hexavalent chromium	0.39	5.3	0.27	NA	0.39	5.3	0.27
116-K-2 (West)[d]							
Hexavalent chromium	0.23	2.4	0.27	NA	0.23	2.4	0.27

[a] Overburden material from the eastern and western portions of the 116-K-2 waste site was considered within the same decision unit.
[b] Represents the 90th percentile of the lognormal distribution (DOE-RL 1996).
[c] For overburden, anthropogenic background (DOE-RL 1996) and naturally occurring background is subtracted from all radionuclides. For other decision units (i.e., shallow zone and deep zone), only naturally occurring background (uranium) is subtracted. Refer to the 95% UCL calculation brief in Appendix C for additional details on determination of statistical values.
[d] Laboratory data, including the minimum detectable activities for the individual cleanup verification samples, are included in Appendix A and the 95% UCL calculation briefs in Appendix C.

BG = background
COC = contaminant of concern
NA = not applicable
ND = not detected (in all samples in the data set)
UCL = upper confidence limit

For 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. For nonradionuclides, a value equal to one-half the practical quantitation limit is used for data flagged with a "U" (i.e., less than the detection limit) in the calculation of the 95% UCL, as required by *Washington Administrative Code* (WAC) 173-340-740[7][g].

Statistical calculations for 116-K-2 verification data sets are presented in the 95% UCL calculation briefs (Appendix C), with results shown in Table 2. The columns on the left side of Table 2 are the COCs and the 95% statistical values before subtraction of background. The fifth column of Table 2 presents the background where values exist, and the last three columns present the statistical values adjusted for background, if appropriate, which becomes the cleanup verification data set used for RESidual RADioactivity (RESRAD) modeling.

4.3 SITE-SPECIFIC CLEANUP VERIFICATION MODEL

The statistical values summarized in Table 2 were evaluated and used to develop site-specific cleanup verification models. The 116-K-2 site cleanup verification models comprise three depth intervals: (1) the shallow zone and overburden, (2) the contaminated deep zone, and (3) the uncontaminated vadose (deep) zone. 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 2005b]), residual soil activities of nickel-63 would result in prediction of a groundwater concentration exceeding the RAG. Because this approach is overly conservative, test pit data from the analogous 116-C-1 Process Effluent Trench were used to develop a refined model of the deep zone, including an underlying portion of uncontaminated vadose zone. Schematic cross sections of this site-specific cleanup verification model are included in the RESRAD calculations in Appendix C. The elements of the RESRAD modeling are described in Section 4.4.

4.4 RESRAD MODELING

The individual radionuclide cleanup verification statistical values (Table 2) were entered into the RESRAD computer code, Version 6.3 (ANL 2005), to estimate the residential dose rate and predict the impact on groundwater and the Columbia River from residual radionuclide COC concentrations. The direct radiation exposure dose rate to the resident living in his or her basement (rural-residential scenario) was conservatively estimated by substituting (for analysis purposes) a case where the resident is standing on level ground with the soil containing concentrations representative of residual (i.e., post-cleanup) shallow zone soils. This is conservative because it ignores the potential shielding effects of concrete basement walls and any clean backfill between residual soils and the basement walls. Following the separate statistical analyses of verification

data for the eastern and western portions of the 116-K-2 site, RESRAD modeling was performed separately for each portion of the trench using the applicable data set.

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

5.0 EVALUATION OF REMEDIAL ACTION GOAL ATTAINMENT

This section demonstrates that remedial action at the 116-K-2 waste site has achieved the applicable RAGs. Sections 5.1, 5.2, and 5.3 address attainment of direct exposure RAGs, groundwater protection RAGs, and Columbia River protection RAGs, respectively. Section 5.4 documents application of the WAC 173-340-740(7)(e) three-part test, which is required for nonradionuclide COCs only.

5.1 DIRECT EXPOSURE SOIL REMEDIAL ACTION GOALS ATTAINED

5.1.1 Radionuclides

The results of the combined RESRAD dose rate estimates for the 116-K-2 site shallow and deep zone all-pathways scenarios are presented in Figures 6 and 7. These dose rates represent the contributions from soils at relevant time periods. The results of the RESRAD dose rate estimate for overburden material under the all-pathways scenario is presented in Figure 8. The dose rates for the eastern and western portions of the 116-K-2 site are largest at present (year 2006), at 4.62 mrem/yr and 7.77 mrem/yr, respectively, decreasing to 9.99×10^{-4} mrem/yr and 7.39×10^{-4} mrem/yr, respectively, in 1,000 years for the shallow zone and deep zone. The estimated dose rate in the year 2018 is 1.83 mrem/yr for the eastern portion of the 116-K-2 site and 4.33 mrem/yr for the western portion. The 2018 date corresponds to the original 30-year site cleanup schedule of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989). The dose rate for overburden soils from the site is largest at present (year 2006), at 0.740 mrem/yr, decreasing to 0.376 mrem/yr in 2018 and to 2.61×10^{-16} mrem/yr in 1,000 years. All dose rate estimates are less than the 15 mrem/yr RAG. The RESRAD computations are presented in detail in the RESRAD calculation briefs summarized in Appendix C.

Figure 6. Combined Shallow and Deep Zone Dose Rate Estimates for the Eastern 116-K-2 Site (All Radionuclides, All Pathways).

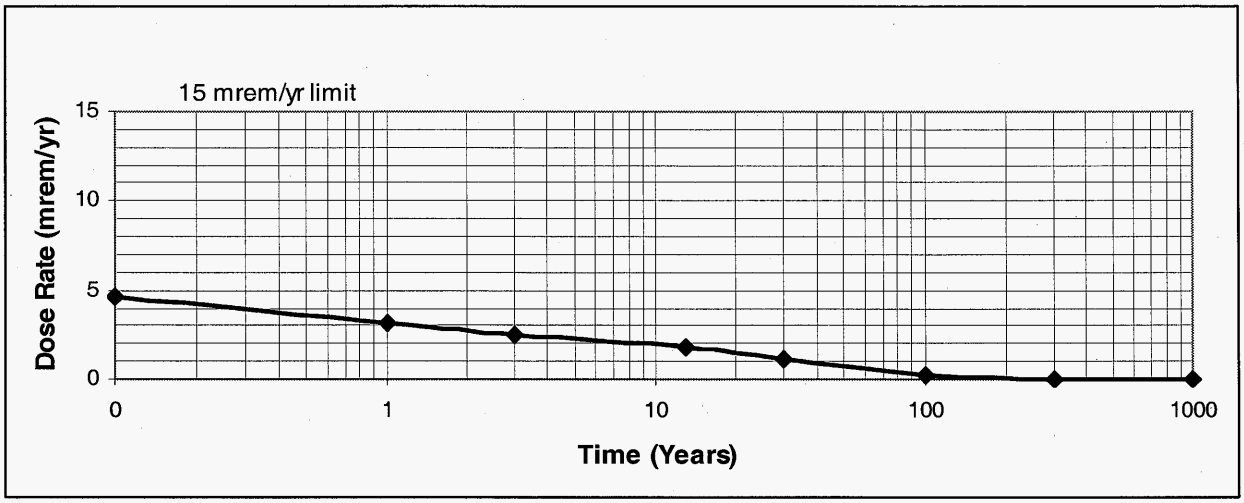


Figure 7. Combined Shallow and Deep Zone Dose Rate Estimates for the Western 116-K-2 Site (All Radionuclides, All Pathways).

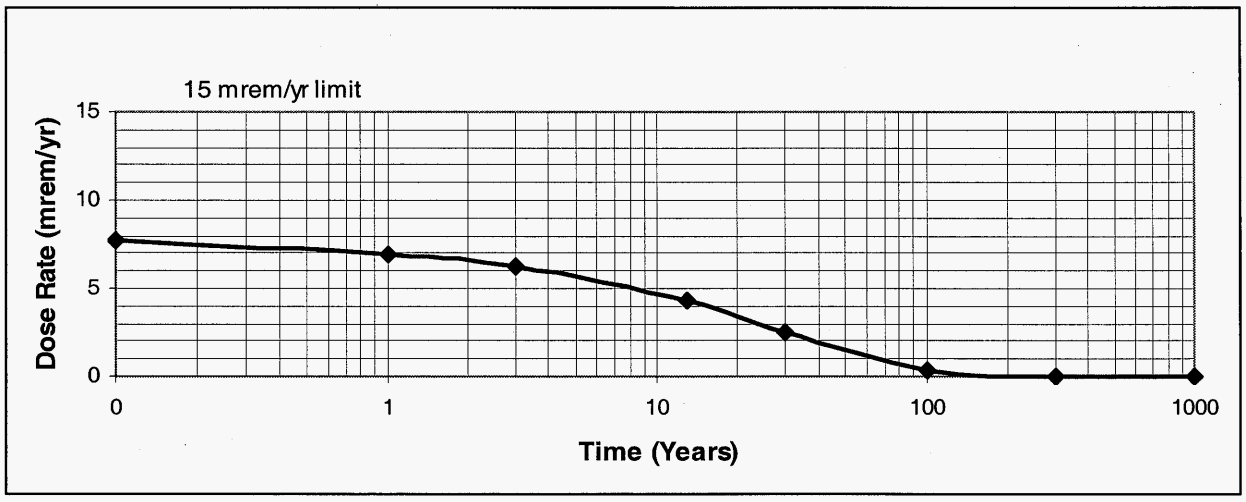
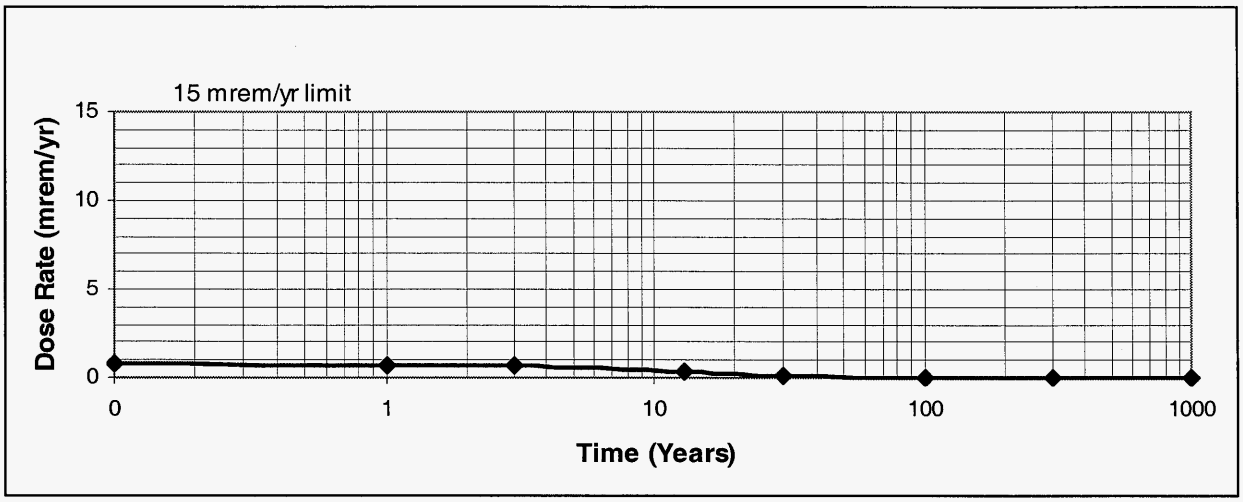


Figure 8. Overburden Dose Rate Estimates for the 116-K-2 Site (All Radionuclides, All Pathways).



5.1.2 Nonradionuclides

5.1.2.1 Direct Comparison to RAGs. Table 3 compares the shallow zone nonradionuclide cleanup verification statistical values presented in Table 2 to the direct exposure RAG presented in Table 1. Residual concentrations of hexavalent chromium, the sole nonradionuclide COC for the 116-K-2 waste site, are less than the direct exposure RAG.

5.1.2.2 Noncarcinogenic Hazard Quotient RAG Attained. For noncarcinogenic COCs, WAC 173-340-740(5)(a) and (b) specify the evaluation of the hazard quotient, which is given as daily intake divided by a reference dose (DOE-RL 2005b). This evaluation is shown in the 95% UCL calculation briefs (Appendix C). The calculated hazard quotients for statistical residual hexavalent chromium concentrations (the only nonradionuclide COC) at the eastern and western portions of the 116-K-2 site and overburden are 1.6×10^{-3}, 9.6×10^{-4}, and 1.1×10^{-3}, respectively. These values are below the individual and cumulative RAGs (a hazard quotient of 1.0 in both cases).

5.1.2.3 Carcinogenic Risk RAG Attained. For individual nonradionuclide carcinogenic COCs, the WAC 173-340-700(3) Method B cleanup limits are based on an incremental cancer risk of 1×10^{-6}. The cumulative excess cancer risk for all nonradionuclide carcinogenic COCs must be less than 1×10^{-5}. The only nonradionuclide COC at the 116-K-2 site, hexavalent chromium, is a carcinogen in the inhalation exposure pathway. The excess lifetime cancer risk estimate for residual concentrations of this COC at the eastern and western portions of the site and overburden are 1.9×10^{-7}, 1.1×10^{-7}, and 1.3×10^{-7}, respectively. These values are below the risk limit for individual COCs (1×10^{-6}) and the cumulative excess carcinogenic risk RAG of 1×10^{-5}.

Table 3. Attainment of Nonradionuclide Direct Exposure Standards.

COC	Direct Exposure RAG (mg/kg)	Cleanup Verification Data Set (mg/kg)	Direct Exposure RAG Attained?[a]
116-K-2 (East)			
Hexavalent chromium	2.1[b] 240[c]	0.39	Yes
116-K-2 (West)			
Hexavalent chromium	2.1[b] 240[c]	0.23	Yes
Overburden			
Hexavalent chromium	2.1[b] 240[c]	0.27	Yes

[a] Criterion is comparison to direct exposure RAG.
[b] WAC 173-340-750(3) Method B carcinogenic cleanup limit based on the inhalation exposure pathway, per *Calculation of Hexavalent Chromium Carcinogenic Risk* (BHI 2000a).
[c] WAC 173-340-740(3) Method B noncarcinogenic cleanup limit.
COC = contaminant of concern
RAG = remedial action goal
WAC = *Washington Administrative Code*

5.2 GROUNDWATER REMEDIAL ACTION GOALS ATTAINED

5.2.1 Radionuclides

Radionuclide COCs associated with the 116-K-2 site are not predicted to reach groundwater within 1,000 years, based on the model described in Section 4.3 and the RESRAD calculation briefs (Appendix C). Therefore, the groundwater protection RAGs have been attained.

5.2.2 Nonradionuclides

Table 4 compares the shallow and deep zone nonradionuclide cleanup verification statistical values presented in Table 2 to the soil RAG for groundwater protection presented in Table 1. Residual shallow zone concentrations of hexavalent chromium, the sole nonradionuclide COC for the 116-K-2 waste site, are less than the soil RAG for groundwater protection. However, the statistical residual concentration of hexavalent chromium in the eastern deep zone exceed this RAG. Because the soil RAG was not met, a detailed assessment of the potential impact of residual hexavalent chromium to groundwater was made using the 100-D, 100-H, and 100-F Area hexavalent chromium leach studies (BHI 1999, 2000b, and 2001b).

Table 4. Attainment of Nonradionuclide Groundwater and River Protection Standards.

COC	Cleanup Verification Data Set (mg/kg)	Soil RAG for Groundwater Protection (mg/kg)	Soil RAG for River Protection (mg/kg)	Cleanup Criteria Attained?
116-K-2 (East) Shallow Zone				
Hexavalent chromium	0.39	4.8[a]	2[b]	Yes
116-K-2 (East) Deep Zone				
Hexavalent chromium	5.3	4.8[a]	2[b]	Yes[c]
116-K-2 (West) Shallow Zone				
Hexavalent chromium	0.23	4.8[a]	2[b]	Yes
116-K-2 (West) Deep Zone				
Hexavalent chromium	2.4	4.8[a]	2[b]	Yes[c]
Overburden				
Hexavalent chromium	0.27	4.8[a]	2[b]	Yes

[a] Criterion is comparison to soil RAG for groundwater protection.
[b] Soil RAG based on "100 times groundwater cleanup" rule.
Soil RAG based on 100 times dilution attenuation factor times surface water quality standard as presented in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b).
[c] Based on the 100-D, 100-F, and 100-H Area hexavalent chromium leach studies, groundwater and surface water quality criteria will not be exceeded where hexavalent chromium concentrations in soil are less than 6.8 mg/kg.
COC = contaminant of concern
RAG = remedial action goal

The groundwater protection soil RAG is based on the *Model Toxics Control Act Cleanup Regulation* (MTCA) "100 times groundwater quality criteria" rule. The MTCA Method B hexavalent chromium cleanup level for groundwater is 48 μg/L (WAC 173-340-720(3)) based on the 1998 update to the Integrated Risk Information System data for hexavalent chromium. The near-shore river water hexavalent chromium cleanup level of 20 μg/L (surface water quality criteria of 10 μg/L [WAC 173-201A] times the dilution attenuation factor of 2) is more restrictive than the groundwater quality criteria. Based on the 100-D, 100-F, and 100-H Area hexavalent chromium leach studies, the hexavalent chromium soil concentration at which the leachate did not exceed the more restrictive surface water quality criteria was 6.8 mg/kg. Therefore, the statistical residual eastern 116-K-2 deep zone concentration of hexavalent chromium (5.3 mg/kg) will not leach to groundwater at a concentration exceeding the groundwater quality criteria and is, therefore, protective of groundwater.

5.3 COLUMBIA RIVER REMEDIAL ACTION GOALS ATTAINED

5.3.1 Radionuclides

Radionuclide COCs associated with the 116-K-2 site are not predicted to reach groundwater within 1,000 years, based on the model described in Section 4.3 and the RESRAD calculation briefs (Appendix C). The only pathway for contaminant migration to the Columbia River is via groundwater; therefore, the river protection RAGs have been attained.

5.3.2 Nonradionuclides

Residual shallow zone concentrations of hexavalent chromium, the sole nonradionuclide COC for the 116-K-2 waste site, are less than the applicable soil RAG for protection of the Columbia River (Table 4). However, the deep zone residual hexavalent chromium concentrations exceed this RAG. Because the soil RAG was not met, a detailed assessment of the potential impact of residual hexavalent chromium to groundwater was made using the 100-D, 100-H, and 100-F Area hexavalent chromium leach studies (BHI 1999, 2000b, and 2001b).

The river protection soil RAG is based on the MTCA "100 times dilution attenuation factor times surface water quality criteria" rule. The near-shore river water hexavalent chromium cleanup level is 20 μg/L (surface water quality criteria of 10 μg/L [WAC 173-201A] times the dilution attenuation factor of 2). Based on the 100-D, 100-F, and 100-H Area hexavalent chromium leach studies, the hexavalent chromium soil concentration at which the leachate did not exceed the surface water quality criteria was 6.8 mg/kg. Therefore, statistical residual 116-K-2 deep zone concentrations of hexavalent chromium (5.3 mg/kg and 2.4 mg/kg) will not leach to the Columbia River at concentrations exceeding the surface water quality criteria and are, therefore, protective of the river.

5.4 WAC 173-340 THREE-PART TEST FOR NONRADIONUCLIDES

The WAC 173-340-740(7)(e) three-part test is required for nonradionuclide statistical verification data sets. The three-part test consists of the following criteria: (1) the cleanup verification statistical value must be less than the most restrictive cleanup level, (2) no single detection within the data set can exceed two times the most restrictive cleanup criteria, and (3) the percentage of samples in the data set exceeding the most restrictive cleanup criteria must be less than 10%.

Table 5 summarizes the results of the WAC 173-340-740[7][e] three-part test for the 116-K-2 cleanup verification nonradionuclide data sets in comparison to the most restrictive applicable RAG. The table lists the most restrictive RAG (from Table 1), 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 5. Application of the WAC 173-340 Three-Part Test.

COC	Most Restrictive Applicable RAG[a]	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?
116-K-2 (East) Shallow Zone						
Hexavalent chromium	2[f]	0.39	0.85	9	0	Yes
116-K-2 (East) Deep Zone						
Hexavalent chromium	2[f]	5.3	8.7	7	100%	Yes[g]
116-K-2 (West) Shallow Zone						
Hexavalent chromium	2[f]	0.23	0.31	17	0	Yes
116-K-2 (West) Deep Zone						
Hexavalent chromium	2[f]	2.4	4.6	19	47%	Yes[g]
Overburden						
Hexavalent chromium	2[f]	0.27	0.34	9	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] Soil RAG based on 100 times dilution attenuation factor times surface water quality standard as presented in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b).
[g] Based on the 100-D, 100-F, and 100-H Area hexavalent chromium leach studies, groundwater and surface water quality criteria will not be exceeded where hexavalent chromium concentrations in soil are less than 6.8 mg/kg. The 116-K-2 deep zone passes the three-part test in comparison against this level.
COC = contaminant of concern
RAG = remedial action goal
WAC = *Washington Administrative Code*

As demonstrated in Table 5, residual shallow zone concentrations of hexavalent chromium (the sole nonradionuclide COC) at the 116-K-2 site pass the three-part test in comparison to the most restrictive applicable RAG. Residual concentrations of hexavalent chromium in the deep zone of the 116-K-2 site fail the three-part test in comparison to the most restrictive applicable RAG. However, as described in Sections 5.2.2 and 5.3.2, hexavalent chromium will not leach to groundwater or the Columbia River at concentrations exceeding applicable water quality criteria where the concentration in soil is less than 6.8 mg/kg. The 116-K-2 deep zone passes the three-part test in comparison against this threshold; therefore, the RAOs for protection of groundwater and the river have been attained.

6.0 RADIONUCLIDE RISK INFORMATION

The radionuclide RAG for direct exposure is derived from the ROD (EPA 1995) and is expressed in terms of an allowable radiation dose rate above background (i.e., 15 mrem/yr). The RAG evaluation (Section 5.0) involved using the RESRAD model to estimate total annual radiation dose rates for 1,000 years for comparison to the RAG. Radiation presents a carcinogenic risk, and the RESRAD model also calculates the excess lifetime cancer risk associated with the estimated radiation dose rates using the EPA's Health Effects Assessment Summary Tables (updated April 16, 2001, "Update of Radionuclide Carcinogenicity Slope Factors," available on the Internet at www.epa.gov/radiation/heast). The "National Oil and Hazardous Substances Pollution Contingency Plan" (40 *Code of Federal Regulations* 300) presents a target range for residual risk of 10^{-4} to 10^{-6}.

Figures 9, 10, and 11 illustrate excess lifetime cancer risk for the eastern and western portions and overburden material at the 116-K-2 site, respectively. Because of radioactive decay, the risk decreases over time. The estimated risks for the eastern and western portions of the 116-K-2 site are largest at present (year 2006), with estimates of 4.39×10^{-5} and 9.70×10^{-5}, respectively. These values decrease to 2.72×10^{-5} and 6.13×10^{-5}, respectively, in 2018, and to 8.19×10^{-9} and 6.03×10^{-9}, respectively, in 1,000 years. The estimated risk associated with the 116-K-2 overburden material is largest (8.72×10^{-6}) at present (year 2006), decreasing to 4.43×10^{-6} in 2018, and to 1.78×10^{-21} in 1,000 years. The 2018 date corresponds to the original 30-year site cleanup schedule of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989).

Figure 9. Combined Radionuclide Excess Lifetime Cancer Risk for the Eastern 116-K-2 Shallow and Deep Zone Decision Units.

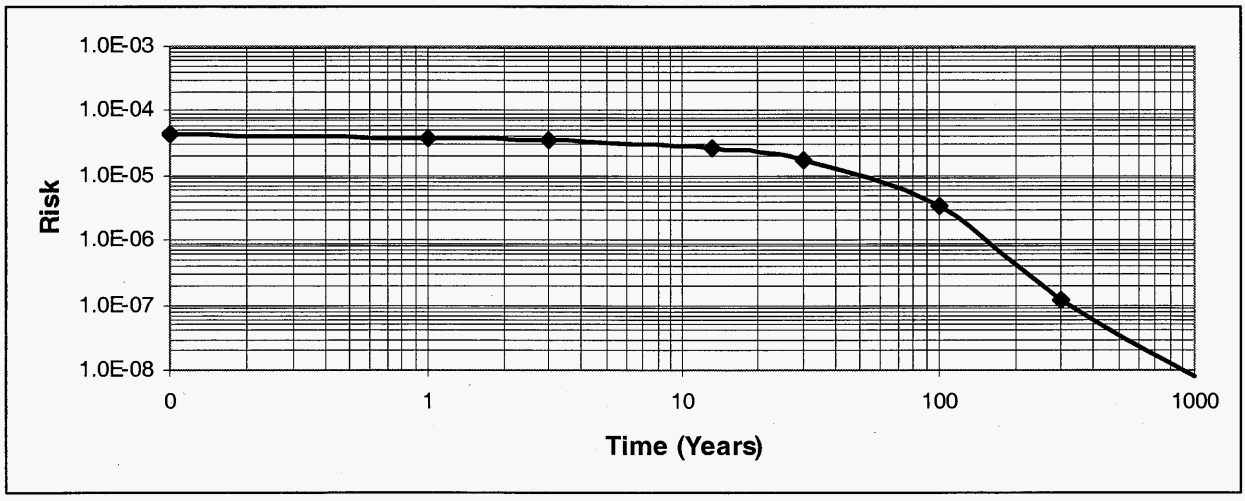


Figure 10. Combined Radionuclide Excess Lifetime Cancer Risk for the Western 116-K-2 Shallow and Deep Zone Decision Units.

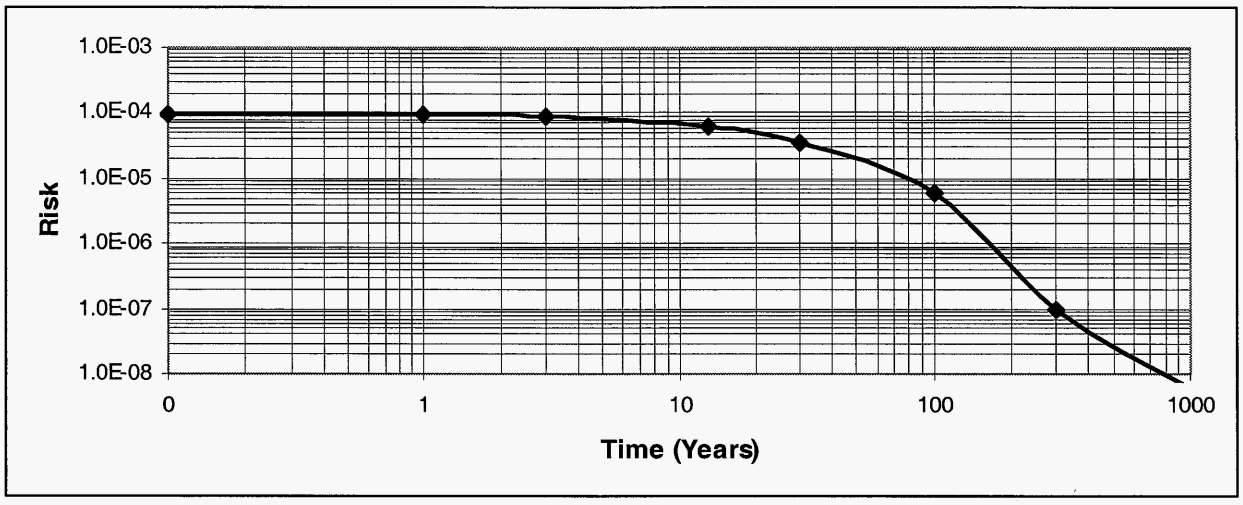
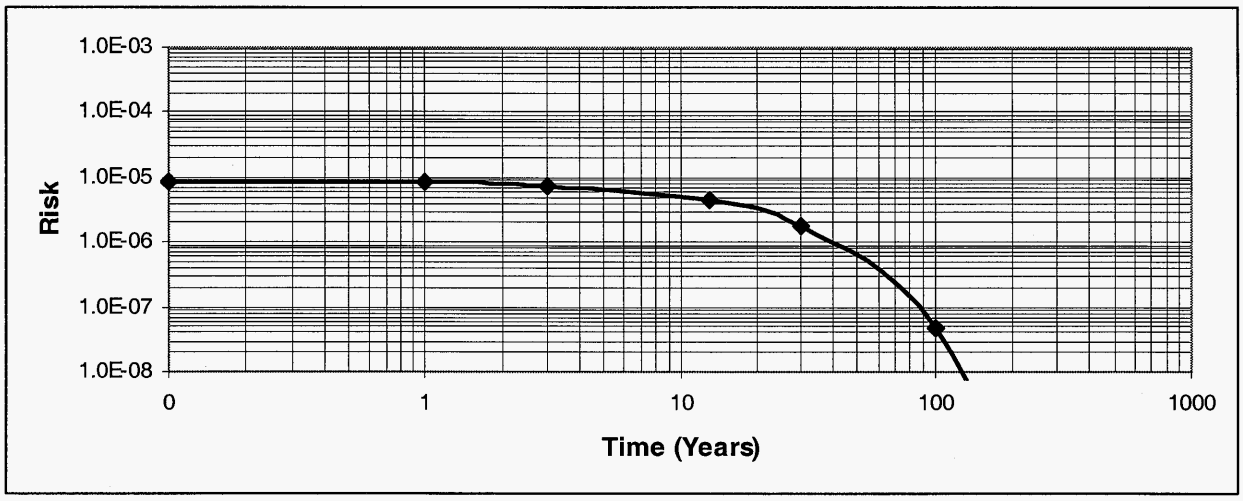


Figure 11. Radionuclide Excess Lifetime Cancer Risk for the 116-K-2 Overburden Material.



7.0 STATEMENT OF PROTECTIVENESS

This CVP demonstrates that remedial action at the 116-K-2 waste site has achieved the RAOs and corresponding RAGs established in the ROD (EPA 1995) and the RDR/RAWP (DOE-RL 2005b). The contaminated materials from this site have been excavated and disposed at the ERDF. The remaining soils at the site have been sampled, analyzed, and modeled, and the results do not preclude any future uses (as bounded by the rural-residential scenario), allow unrestricted use of shallow zone soils, and pose no threat to groundwater or the Columbia River. Institutional controls are required for the site to prevent drilling or excavation into deep zone soils.

8.0 REFERENCES

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APPENDIX A

SUMMARY OF VERIFICATION SOIL SAMPLING AND ANALYTICAL RESULTS

Table A-1. 116-K-2 (East End) Shallow Zone Cleanup Verification Data.

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Carbon-14			Cesium-137			Cobalt-60			Europium-152		
			mg/kg	Q	PQL	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
B7	J03JW8	8/18/2005	2.0E-01	U	2.0E-01	-1.04E+00	U	2.6E+00	1.67E-01		3.2E-02	3.0E-02	U	3.0E-02	1.1E-01	U	1.1E-01
Duplicate of J03JW8	J03JW9	8/18/2005	2.0E-01	U	2.0E-01	4.5E-02	U	2.8E+00	1.48E-01		3.0E-02	3.0E-02	U	3.0E-02	1.1E-01	U	1.1E-01
Split of J03JW8	J03JX1	8/18/2005	3.50E+00	UR	3.50E+00	-1.51E-01	U	8.02E-01	2.04E-01		1.50E-02	3.89E-06	U	1.54E-02	1.09E-01	U	4.86E-02
A1	J103C0	9/6/2005	2.0E-01	U	2.0E-01	-2.87E+00	U	4.4E+00	3.46E-01		2.8E-02	4.1E-02	U	4.1E-02	3.46E-01		7.5E-02
A2	J03JW3	8/18/2005	2.5E-01		2.0E-01	2.98E+00		2.9E+00	5.1E-02	U	5.1E-02	3.2E-02	U	3.2E-02	7.5E-02	U	7.5E-02
A3	J03W34	8/18/2005	2.2E-01		2.0E-01	-5.18E-01	U	1.8E+00	3.4E-02	U	3.4E-02	3.1E-02	U	3.1E-02	1.1E-01	U	1.1E-01
A4	J03JW5	8/18/2005	2.0E-01	U	2.0E-01	5.14E-01	U	2.6E+00	1.46E-01		3.4E-02	3.2E-02	U	3.2E-02	1.2E-01	U	1.2E-01
B5	J03JW6	7/6/2005	2.3E-01		2.0E-01	-8.08E-01	U	2.2E+00	1.45E+00		1.0E-01	3.5E-02	U	3.5E-02	1.7E-01	U	1.7E-01
B6	J03JW7	8/19/2005	2.0E-01	U	2.0E-01	-5.96E-01	U	2.6E+00	3.8E-02	U	3.8E-02	3.5E-02	U	3.5E-02	1.2E-01	U	1.2E-01
B8	J03JX0	7/7/2005	8.5E-01		2.0E-01	-1.92E-01	U	1.6E+00	3.2E-02	U	3.2E-02	2.8E-02	U	2.8E-02	1.0E-01	U	1.0E-01

Sampling Area	HEIS Number	Sample Date	Europium-154			Nickel-63			Plutonium-239/240			Strontium-90		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
B7	J03JW8	8/18/2005	1.0E-01	U	1.0E-01	1.09E+00	U	3.3E+00	0	U	3.1E-01	-6.3E-02	U	2.6E-01
Duplicate of J03JW8	J03JW9	8/18/2005	9.8E-02	U	9.8E-02	3.41E-01	U	3.2E+00	5.3E-02	U	4.1E-01	6.0E-02	U	2.8E-01
Split of J03JW8	J03JX1	8/18/2005	-7.73E-03	U	4.90E-02	4.55E+00	U	1.06E+01	2.82E-02	U	7.64E-02	8.63E-02	U	1.24E-01
A1	J103C0	9/6/2005	1.2E-01	U	1.2E-01	1.97E+00	U	4.3E+00	0	U	2.9E-01	1.94E-01		1.8E-01
A2	J03JW3	8/18/2005	1.1E-01	U	1.1E-01	3.56E-01	U	3.4E+00	0	U	2.7E-01	-5.1E-02	U	2.3E-01
A3	J03W34	8/18/2005	1.0E-01	U	1.0E-01	4.99E-01	U	3.3E+00	3.7E-02	U	2.8E-01	1.80E-01		1.8E-01
A4	J03JW5	8/18/2005	1.1E-01	U	1.1E-01	2.24E+00	U	3.3E+00	3.6E-02	U	2.7E-01	1.2E-02	U	2.4E-01
B5	J03JW6	7/6/2005	1.1E-01	U	1.1E-01	7.83E+00		3.7E+00	0	U	2.5E-01	1.02E-01	U	3.0E-01
B6	J03JW7	8/19/2005	1.1E-01	U	1.1E-01	8.75E-01	U	3.2E+00	0	U	3.0E-01	1.7E-02	U	2.3E-01
B8	J03JX0	7/7/2005	9.7E-02	U	9.7E-02	-1.25E+01	U	7.3E+00	0	U	3.5E-01	2.13E-01	U	2.3E-01

NOTE: The following acronyms and abbreviations apply to all tables in this appendix.
HEIS = Hanford Environmental Information system
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
R = rejected
U = undetected

Table A-2. 116-K-2 (East End) Deep Zone Cleanup Verification Data.

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Carbon-14			Cesium-137			Cobalt-60			Europium-152		
			mg/kg	Q	PQL	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
B6	J03D02	7/26/2005	8.7E+00		4.0E-01	2.00E+00		1.9E+00	1.83E+02		3.0E-01	4.12E+00		1.2E-01	8.92E+01		9.0E-01
Duplicate of J03D02	J03D03	7/26/2005	7.3E+00		4.0E-01	8.54E-01	U	2.1E+00	1.64E+02		3.3E-01	3.56E+00		1.5E-01	8.18E+01		8.9E-01
Split of J03D02	J03D04	7/26/2005	1.33E+01		3.50E+00	1.50E-01	U	8.06E-01	2.27E+02		1.10E-01	6.16E+00		4.29E-02	1.32E+02		3.66E-01
A1	J03CY7	7/7/2005	2.7E+00		2.0E-01	1.69E-01	U	1.5E+00	1.03E+02		2.8E-01	1.52E+00		9.5E-02	2.53E+01		7.9E-01
A2	J03CY8	7/25/2005	2.5E+00		4.1E-01	4.23E-01	U	1.7E+00	1.04E+02		2.6E-01	7.35E-01		7.8E-02	2.02E+01		1.0E-01
A3	J03CY9	7/7/2005	3.3E+00		2.0E-01	1.32E+00	U	1.4E+00	1.10E+02		3.3E-01	1.66E+00		1.1E-01	6.29E+01		1.1E+00
B4	J03D00	7/25/200	3.6E+00		4.0E-01	7.58E-01	U	1.7E+00	6.06E+01		1.7E-01	8.33E-01		5.5E-02	1.06E+01		5.9E-01
B5	J03D01	7/7/2005	3.3E+00		2.0E-01	1.33E+00	U	1.6E+00	6.18E+01		2.3E-01	1.79E+00		8.9E-02	5.46E+01		6.2E-01

Sampling Area	HEIS Number	Sample Date	Europium-154			Nickel-63			Plutonium-239/240			Strontium-90		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
B6	J03D02	7/26/2005	8.14E+00		4.5E-01	1.22E+03		9.5E+00	7.22E+00		2.3E-01	9.83E+00		3.2E-01
Duplicate of J03D02	J03D03	7/26/2005	5.90E+00		5.5E-01	1.45E+03		1.0E+01	1.02E+01		2.8E-01	8.80E+00		2.9E-01
Split of J03D02	J03D04	7/26/2005	1.15E+01		1.60E-01	2.18E+03		7.15E+00	1.31E+01		5.56E-02	1.30E+01		1.65E-01
A1	J03CY7	7/7/2005	2.75E+00		3.1E-01	2.48E+02		7.9E+00	1.58E+00		2.6E-01	2.96E+00		2.2E-01
A2	J03CY8	7/25/2005	2.04E+00		3.1E-01	2.27E+02		4.1E+00	2.56E+00		2.1E-01	2.60E+00		2.9E-01
A3	J03CY9	7/7/2005	5.28E+00		4.4E-01	8.22E+02		7.2E+00	7.38E+00		2.9E-01	6.65E+00		2.1E-01
B4	J03D00	7/25/200	7.70E-01		2.1E-01	3.38E+02		4.9E+00	2.30E+00		2.6E-01	4.84E+00		3.1E-01
B5	J03D01	7/7/2005	5.20E+00		3.6E-01	5.64E+02		7.4E+00	6.40E+00		3.3E-01	6.21E+00		2.9E-01

Table A-3. 116-K-2 (West End) Shallow Zone Cleanup Verification Data. (2 Pages)

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Carbon-14			Cesium-137			Cobalt-60			Europium-152		
			mg/kg	Q	PQL	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A3	J10DL0	11/2/2005	2.1E-01	U	2.1E-01	1.08E+00	U	3.6E+00	4.2E-02	U	4.2E-02	4.6E-02	U	4.6E-02	9.1E-02	U	9.1E-02
Duplicate of J10DL0	J10DM4	11/2/2005	2.1E-01	U	2.1E-01	-9.13E-01	U	3.6E+00	3.2E-02	U	3.2E-02	3.2E-02	U	3.2E-02	1.1E-01	U	1.1E-01
Split of J10DL0	J10F85	11/2/2005	3.50E-01	U	3.50E-01	2.62E-01	U	8.10E-01	1.21E-03	U	1.56E-02	9.70E-05	U	1.57E-02	7.88E-03	U	3.90E-02
A1	J10DK8	11/2/2005	2.1E-01	U	2.1E-01	1.82E+00	U	3.3E+00	4.4E-02	U	4.4E-02	4.1E-02	U	4.1E-02	1.2E-01	U	1.2E-01
A2	J10DK9	11/2/2005	2.1E-01	U	2.1E-01	1.45E+00		3.2E+00	4.4E-02	U	4.4E-02	3.8E-02	U	3.8E-02	8.9E-02	U	8.9E-02
A4	J10DL1	10/27/2005	2.1E-01	U	2.1E-01	-5.04E-01	U	3.6E+00	4.28E-01		4.1E-02	3.4E-02	U	3.4E-02	2.37E-01		8.6E-02
B5	J10DL2	10/27/2005	2.5E-01		2.0E-01	-1.16E+00	U	3.4E+00	2.08E+00		4.9E-02	3.4E-02	U	3.4E-02	8.16E-01		1.6E-01
B6	J10DL3	10/27/2005	2.9E-01		2.1E-01	-2.00E+00	U	3.6E+00	4.69E+00		6.6E-02	4.4E-02	U	4.4E-02	2.62E+00		1.4E-01
B7	J10DL4	10/27/2005	2.3E-01		2.1E-01	-2.63E+00	U	3.4E+00	4.0E-02	U	4.0E-02	4.2E-02	U	4.2E-02	1.3E-01	U	1.3E-01
B8	J10DL5	10/27/2005	2.5E-01		2.0E-01	-1.20E+00	U	2.2E+00	5.4E-02		4.4E-02	4.1E-02	U	4.1E-02	1.1E-01	U	1.1E-01
C9	J10DL6	11/2/2005	2.1E-01		2.1E-01	9.95E-01	U	3.5E+00	6.16E-01		4.8E-02	3.9E-02	U	3.9E-02	3.65E-01		1.1E-01
C10	J10DL7	10/26/2005	2.1E-01	U	2.1E-01	-2.52E+00	U	3.6E+00	3.6E-02	U	3.6E-02	3.4E-02	U	3.4E-02	1.2E-01	U	1.2E-01
C1	J10DL8	10/26/2005	2.3E-01		2.0E-01	-1.52E+00	U	3.5E+00	1.17E+00		5.8E-02	6.8E-02	U	6.8E-02	9.36E-01		1.1E-01
C2	J10DL9	10/26/2005	3.1E-01		2.1E-01	-2.51E+00	U	3.7E+00	2.52E-01		4.6E-02	4.7E-02	U	4.7E-02	1.5E-01	U	1.5E-01
D3	J10DM0	10/25/2005	2.2E-01		2.0E-01	1.80E+00	U	3.3E+00	4.3E-02	U	4.3E-02	4.9E-02	U	4.9E-02	1.5E-01	U	1.5E-01
D4	J10DM1	10/25/2005	2.0E-01	U	2.0E-01	-5.00E-01		3.5E+00	9.0E-02		4.8E-02	4.5E-02	U	4.5E-02	1.2E-01	U	1.2E-01
D5	J10DM2	10/25/2005	2.4E-01		2.0E-01	7.42E-01	U	3.1E+00	4.4E-02		3.9E-02	4.9E-02	U	4.9E-02	1.1E-01	U	1.1E-01
D6	J10DM3	10/25/2005	3.0E-01		2.0E-01	1.63E+00	U	3.4E+00	3.4E-02	U	3.4E-02	3.1E-02	U	3.1E-02	1.2E-01	U	1.2E-01

Table A-3. 116-K-2 (West End) Shallow Zone Cleanup Verification Data. (2 Pages)

Sampling Area	HEIS Number	Sample Date	Europium-154			Nickel-63			Plutonium-239/240			Strontium-90		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A3	J10DL0	11/2/2005	1.5E-01	U	1.5E-01	-5.04E-01	U	3.8E+00	0	U	3.2E-01	9.0E-02	U	1.5E-01
Duplicate of J10DL0	J10DM4	11/2/2005	1.1E-01	U	1.1E-01	-1.83E+00	U	3.9E+00	0	U	2.8E-01	1.36E-01	U	1.1E-01
Split of J10DL0	J10F85	11/2/2005	6.80E-03	U	5.04E-02	6.59E+00	U	9.34E+00	0.00E+00	U	5.18E-02	6.11E-02	U	1.29E-01
A1	J10DK8	11/2/2005	1.4E-01	U	1.4E-01	-1.04E+00	U	3.7E+00	0	U	3.1E-01	1.54E-01		1.4E-01
A2	J10DK9	11/2/2005	1.4E-01	U	1.4E-01	-1.11E+00	U	3.7E+00	3.5E-02	U	2.7E-01	1.24E-01	U	1.4E-01
A4	J10DL1	10/27/2005	1.1E-01	U	1.1E-01	-3.94E-01	U	3.6E+00	0	U	1.3E-01	3.74E-01		1.1E-01
B5	J10DL2	10/27/2005	1.3E-01	U	1.3E-01	2.07E+00	U	3.6E+00	0	U	2.5E-01	2.85E-01		1.3E-01
B6	J10DL3	10/27/2005	2.95E-01		1.5E-01	4.22E+00		3.4E+00	3.6E-02	U	2.7E-01	2.71E-01		2.95E-01
B7	J10DL4	10/27/2005	1.5E-01	U	1.5E-01	2.10E+00	U	3.8E+00	0	U	2.6E-01	9.9E-02	U	1.5E-01
B8	J10DL5	10/27/2005	1.3E-01	U	1.3E-01	1.27E+00	U	3.5E+00	0	U	3.6E-01	1.57E-01	U	1.3E-01
C9	J10DL6	11/2/2005	1.3E-01	U	1.3E-01	2.25E-01	U	3.7E+00	0	U	2.3E-01	2.40E-01		1.3E-01
C10	J10DL7	10/26/2005	1.3E-01	U	1.3E-01	7.6E-02	U	3.2E+00	0	U	1.8E-01	-3.5E-02	U	1.3E-01
C1	J10DL8	10/26/2005	2.99E-01		1.6E-01	5.03E+00		3.5E+00	0	U	2.4E-01	3.6E-02	U	2.99E-01
C2	J10DL9	10/26/2005	1.5E-01	U	1.5E-01	1.87E+00	U	3.2E+00	0	U	2.4E-01	2.E-03	U	1.5E-01
D3	J10DM0	10/25/2005	1.5E-01	U	1.5E-01	9.08E-01	U	3.6E+00	0	U	2.9E-01	3.20E-01		1.5E-01
D4	J10DM1	10/25/2005	1.4E-01	U	1.4E-01	3.50E-01	U	4.3E+00	1.13E-01	U	2.2E-01	1.09E-01	U	1.4E-01
D5	J10DM2	10/25/2005	1.7E-01	U	1.7E-01	1.14E+00	U	4.3E+00	0	U	2.6E-01	1.16E-01	U	1.7E-01
D6	J10DM3	10/25/2005	1.1E-01	U	1.1E-01	1.18E+00	U	4.1E+00	0	U	3.4E-01	1.00E-01	U	1.1E-01

Table A-4. 116-K-2 (West End) Deep Zone Cleanup Verification Data. (2 Pages)

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Carbon-14			Cesium-137			Cobalt-60			Europium-152		
			mg/kg	Q	PQL	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
D10	J10CW7	10/18/2005	9.7E-01		2.1E-01	1.08E+00	U	2.4E+00	2.18E+02		4.0E-01	6.68E+00		1.5E-01	1.94E+02		1.1E+00
Duplicate of J10CW7	J10CX6	10/18/2005	2.0E+00		2.0E-01	1.71E+00	U	2.4E+00	1.09E+02		3.0E-01	3.45E+00		1.3E-01	1.02E+02		8.6E-01
Split of J10CW7	J10CX7	10/18/2005	7.50E-01		3.50E-01	5.59E-01	U	8.01E-01	1.22E+02		1.13E-01	4.30E+00		5.10E-02	1.13E+02		3.11E-01
A1	J10CV8	10/11/2005	2.1E+00		2.0E-01	4.87E-01	U	4.2E+00	3.77E+01		2.4E-01	4.71E+00		1.1E-01	4.65E+01		6.4E-01
A2	J10CV9	10/11/2005	1.2E+00		2.0E-01	-1.24E+00		4.3E+00	1.57E+01		1.9E-01	1.78E+00		8.7E-02	1.68E+01		6.4E-01
A3	J10CW0	10/11/2005	2.0E+00		2.1E-01	-2.19E+00		4.0E+00	1.13E+02		3.9E-01	4.85E+00		1.5E-01	9.00E+01		1.0E+00
B4	J10CW1	10/12/2005	9.3E-01		2.0E-01	-7.82E-01		2.5E+00	9.48E-01		4.4E-02	7.7E-02	U	7.7E-02	1.42E+00		1.3E-01
B5	J10CW2	10/12/2005	1.2E+00		2.0E-01	5.52E-01		2.2E+00	2.71E+01		1.9E-01	1.54E+00		9.3E-02	1.93E+01		3.3E-01
B6	J10CW3	10/12/2005	2.2E+00		2.0E-01	1.56E+00		2.2E+00	8.87E+01		2.1E-01	7.53E+00		9.6E-02	3.70E+01		6.5E-01
C7	J10CW4	10/17/2005	3.6E+00		2.0E-01	4.62E+00		2.3E+00	1.11E+02		3.4E-01	9.62E+00		1.8E-01	1.24E+02		8.8E-01
C8	J10CW5	10/17/2005	2.0E-01	U	2.0E-01	-5.13E-01	U	2.4E+00	1.21E+00		4.3E-02	4.40E-02		3.1E-02	1.15E+00		9.9E-02
C9	J10CW6	10/17/2005	1.7E+00		2.1E-01	1.33E+00	U	2.3E+00	2.2E-02	U	2.2E-01	3.7E-02	U	3.7E-02	6.0E-02	U	6.0E-02
D1	J10CW8	10/18/2005	1.1E+00		2.1E-01	8.21E-01	U	2.4E+00	4.64E+01		2.4E-01	2.01E+00		1.2E-01	6.93E+01		5.0E-01
D2	J10CW9	10/18/2005	4.6E+00		2.0E-01	1.48E+00	U	2.3E+00	2.61E+02		2.7E-01	6.80E+00		1.5E-01	1.51E+02		1.2E+00
E3	J10CX0	10/18/2005	2.2E+00		2.0E-01	2.34E-01	U	2.3E+00	1.73E+02		4.1E-01	4.38E+00		1.5E-01	5.56E+01		1.1E+00
E4	J10CX1	10/18/2005	1.0E+00		2.0E-01	4.7E-02	U	2.3E+00	1.12E+00		4.0E-02	3.6E-02	U	3.6E-02	9.15E-01		1.4E-01
E5	J10CX2	10/24/2005	1.7E+00		2.0E-01	1.02E+00	U	3.5E+00	4.63E+01		1.4E-01	6.15E-01		7.6E-02	1.79E+01		5.7E-01
F6	J10CX3	10/24/2005	4.3E+00		2.0E-01	3.66E+00	U	5.0E+00	2.32E+02		5.7E-01	5.09E+00		2.1E-01	1.61E+02		1.5E+00
F7	J10CX4	10/24/2005	1.7E+00		2.0E-01	1.48E+00	U	3.1E+00	4.12E+01		1.6E-01	6.18E-01		7.1E-02	2.41E+01		3.5E-01
F8	J10CX5	10/24/2005	2.3E+00		2.0E-01	8.19E-01		3.2E+00	1.63E+02		1.7E-01	3.87E-01		5.3E-02	1.52E+01		4.7E-01

Table A-4. 116-K-2 (West End) Deep Zone Cleanup Verification Data. (2 Pages)

Sampling Area	HEIS Number	Sample Date	Europium-154			Nickel-63			Plutonium-239/240			Strontium-90		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
D10	J10CW7	10/18/2005	1.80E+01		5.8E-01	4.80E+02		4.0E+00	4.33E+00		2.8E-01	3.27E+00		2.6E-01
Duplicate of J10CW7	J10CX6	10/18/2005	1.00E+01		5.2E-01	5.30E+02		3.9E+00	5.47E+00		1.8E-01	5.38E+00		2.3E-01
Split of J10CW7	J10CX7	10/18/2005	1.09E+01		1.91E-01	5.28E+02		5.73E+00	7.33E+00		1.25E-01	4.30E+00		1.39E-01
A1	J10CV8	10/11/2005	4.75E+00		4.1E-01	3.93E+02		5.6E+00	2.67E+00		3.2E-01	2.48E+00		2.2E-01
A2	J10CV9	10/11/2005	1.59E+00		3.2E-01	1.92E+02		4.1E+00	4.62E-01		2.7E-01	4.27E+00		2.1E-01
A3	J10CW0	10/11/2005	9.45E+00		5.5E-01	5.88E+02		6.7E+00	3.81E+00		2.9E-01	3.93E+00		2.2E-01
B4	J10CW1	10/12/2005	1.2E-01	U	1.2E-01	2.16E+01		3.5E+00	0	U	3.7E-01	8.24E-01		2.9E-01
B5	J10CW2	10/12/2005	2.21E+00		3.2E-01	2.43E+02		4.4E+00	1.43E+00		2.8E-01	2.19E+00		2.8E-01
B6	J10CW3	10/12/2005	3.45E+00		3.0E-01	7.39E+02		7.5E+00	1.71E+00		4.2E-01	1.88E+00		2.8E-01
C7	J10CW4	10/17/2005	1.03E+01		6.2E-01	1.57E+03		4.4E+00	1.34E+01		2.6E-01	2.01E+01		3.1E-01
C8	J10CW5	10/17/2005	1.4E-01	U	1.4E-01	9.10E+00		4.2E+00	8.8E-02	U	3.4E-01	1.44E+00		2.8E-01
C9	J10CW6	10/17/2005	7.3E-02	U	7.3E-02	4.49E+02		3.9E+00	3.82E+00		3.3E-01	2.79E+00		2.5E-01
D1	J10CW8	10/18/2005	5.67E+00		4.6E-01	5.15E+02		3.6E+00	2.56E+00		3.8E-01	1.14E+00		2.5E-01
D2	J10CW9	10/18/2005	1.48E+01		5.6E-01	1.11E+03		3.8E+00	7.28E+00		3.3E-01	6.62E+00		2.7E-01
E3	J10CX0	10/18/2005	5.07E+00		5.3E-01	6.69E+02		3.4E+00	2.60E+00		1.9E-01	5.68E+00		2.4E-01
E4	J10CX1	10/18/2005	1.2E-01	U	1.2E-01	6.88E+00		3.7E+00	1.71E-01		3.3E-01	4.57E+00		2.5E-01
E5	J10CX2	10/24/2005	1.66E+00		3.0E-01	1.56E+02		5.1E+00	1.10E+00		3.5E-01	4.24E+00		2.0E-01
F6	J10CX3	10/24/2005	1.57E+01		8.2E-01	1.17E+03		9.8E+00	1.11E+01		3.3E-01	8.41E+00		2.0E-01
F7	J10CX4	10/24/2005	2.38E+00		2.7E-01	1.36E+02		3.7E+00	1.11E+00		3.7E-01	2.81E+00		2.3E-01
F8	J10CX5	10/24/2005	1.30E+00		2.1E-01	8.89E+01		4.0E+00	6.50E-01		4.1E-01	4.82E+00		2.7E-01

Table A-1. 116-K-2 Overburden Cleanup Verification Data.

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Carbon-14			Cesium-137			Cobalt-60			Europium-152		
			mg/kg	Q	PQL	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
B8	J10M07	11/15/2005	3.0E-01		2.2E-01	-1.37E+00	U	2.4E+00	4.3E-02	U	4.3E-02	4.7E-02	U	4.7E-02	9.7E-02	U	9.7E-02
Duplicate of J10M07	J10M08	11/15/2005	2.6E-01		2.2E-01	-6.04E-01	U	2.4E+00	3.2E-02	U	3.2E-02	2.9E-02	U	2.9E-02	1.2E-01	U	1.2E-01
Split of J10M07	J10M09	11/15/2005	3.50E-01	U	3.50E-01	-7.93E-02	U	7.92E-01	6.76E-03	U	1.99E-02	-3.73E-04	U	1.97E-02	4.84E-03	U	4.61E-02
A1	J10M00	11/14/2005	2.1E-01	U	2.1E-01	-1.06E+00	U	2.4E+00	1.01E-01		3.9E-02	3.8E-02	U	3.8E-02	2.57E-01		8.0E-02
A2	J10M01	11/14/2005	2.6E-01		2.2E-01	-3.78E-01	U	2.2E+00	2.6E-02	U	2.6E-02	2.6E-02	U	2.6E-02	8.1E-02	U	8.1E-02
A3	J10M02	11/14/2005	2.1E-01	U	2.1E-01	-1.08E+00	U	2.4E+00	1.30E-01		4.9E-02	3.9E-02	U	3.9E-02	1.64E-01		7.8E-02
A4	J10M03	11/14/2005	2.2E-01	U	2.2E-01	-2.58E-01	U	2.3E+00	4.1E-02	U	4.1E-02	3.9E-02	U	3.9E-02	1.1E-01	U	1.1E-01
B5	J10M04	11/14/2005	2.7E-01		2.2E-01	2.13E+00	U	2.2E+00	1.08E-01		3.8E-02	3.8E-02	U	3.8E-02	2.34E-01		8.0E-02
B6	J10M05	11/14/2005	3.4E-01		2.1E-01	1.74E+00	U	2.3E+00	3.0E-02	U	3.0E-02	3.2E-02	U	3.2E-02	9.6E-02	U	9.6E-02
B7	J10M06	11/14/2005	2.7E-01		2.2E-01	-5.45E-01	U	2.4E+00	4.4E-02	U	4.4E-02	4.7E-02	U	4.7E-02	1.3E-01	U	1.3E-01

Sampling Area	HEIS Number	Sample Date	Europium-154			Nickel-63			Plutonium-239/240			Strontium-90		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
B8	J10M07	11/15/2005	1.6E-01	U	1.6E-01	1.15E-01	U	3.2E+00	0	U	2.9E-01	-3.1E-02	U	2.6E-01
Duplicate of J10M07	J10M08	11/15/2005	1.1E-01	U	1.1E-01	8.42E-01	U	3.4E+00	1.20E-01	U	4.6E-01	-6.8E-02	U	2.2E-01
Split of J10M07	J10M09	11/15/2005	-1.90E-02	U	6.46E-02	-1.46E+00	U	6.89E+00	0.00E+00	U	4.17E-02	-3.37E-02	U	9.76E-02
A1	J10M00	11/14/2005	1.2E-01	U	1.2E-01	9.24E-01	U	4.5E+00	0	U	3.4E-01	-3.2E-02	U	2.3E-01
A2	J10M01	11/14/2005	8.3E-02	U	8.3E-02	4.49E-01	U	2.9E+00	0	U	2.6E-01	8.3E-02	U	2.6E-01
A3	J10M02	11/14/2005	1.3E-01	U	1.3E-01	7.06E-01	U	4.5E+00	3.1E-02	U	2.4E-01	1.70E-01	U	1.8E-01
A4	J10M03	11/14/2005	1.4E-01	U	1.4E-01	-5.94E-01	U	2.9E+00	0	U	3.1E-01	-3.1E-02	U	2.7E-01
B5	J10M04	11/14/2005	1.2E-01	U	1.2E-01	9.75E-01	U	2.9E+00	0	U	2.1E-01	-7.E-03	U	2.4E-01
B6	J10M05	11/14/2005	1.1E-01	U	1.1E-01	-5.54E-01	U	3.3E+00	0	U	2.1E-01	-3.E-03	U	2.0E-01
B7	J10M06	11/14/2005	1.5E-01	U	1.5E-01	2.99E-01	U	3.6E+00	4.4E-02	U	3.4E-01	2.5E-02	U	2.7E-01

APPENDIX B

DATA QUALITY ASSESSMENT

B1.0 DATA QUALITY ASSESSMENT FOR THE 116-K-2 WASTE SITE

B1.1 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 (BHI 2005a, 2005b, 2005c) to verify sample location, date, and time. It also involves the 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 WCH-EE-01, *Environmental Investigations Procedures*. Specific data quality objectives for the site are found in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2005a). 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 100 Area* (RDR/RAWP) (DOE-RL 2005b).

Prior to performing statistical tests, the field logbooks (BHI 2005a, 2005b, 2005c), sample designs (Appendix C), and sample analytical data are evaluated. A portion of the cleanup verification sample analytical data are validated for compliance requirements (DOE-RL 2005a). Data 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. This evaluation also examines the available laboratory data to determine if an analyte is present or absent in a sample and the degree of overall uncertainty associated with that determination. Data validation is done in accordance with validation procedures (BHI 2000a, 2000b) as part of data evaluation. After data evaluation and validation, the appropriate statistical analyses are performed on the adjusted raw analytical data (Appendix C) to determine statistical values for each contaminant. The cleanup verification sample analytical data are stored in the Hanford Environmental Information System and are summarized in Appendix A.

For the 116-K-2 site, 66 samples in 18 sample delivery groups (SDGs) have been evaluated in the following sections.

B1.2 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 SDG, or 1 in 20, 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 contamination of the analytes of interest) carried through the complete analytical process. The method blank is used to evaluate false-positive results in samples due to contamination during handling at the laboratory.

- Analytical Accuracy. For most analyses, a known quantity of representative analytes of interest (matrix spike/matrix spike duplicate [MS/MSD]) is added to a separate aliquot of a sample from the analytical batch. The recovery percentage of the added MS is 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 (e.g., laboratory control spike or blank spike sample).

- Analytical Precision. Separate aliquots removed from the same sample container (replicate samples) are analyzed for each analytical batch. The replicate sample results (evaluated as relative percent differences [RPDs]) are used to assess analytical precision.

- 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.

B1.3 DATA VALIDATION

After sampling was completed, all of the fixed-base laboratory data from SDG H3328 were validated by a third-party validator to Level C per WCH-EE-01, Procedure 2.5, "Data Package Validation Process." Level C validation procedures are specified in *Data Validation Procedure for Radiochemical Analysis* (BHI 2000b) and *Data Validation Procedure for Chemical Analysis* (BHI 2000a).

Use of Level C validation procedures was included in the review of the following items, as appropriate, for each analytical method:

- Sample holding times
- Method blanks

- MS/MSD recovery
- Surrogate recovery
- Sample replicates
- Associated batch laboratory control sample results
- Data package completeness
- Achievement of required (or contractual) detection limits (RDLs).

Data flagged by the validator as estimated (i.e., "J") indicate that the associated concentration is an estimate, but that the data may be used for decision-making purposes. Data flagged as below detection limits (i.e., "U") indicate the contaminant was analyzed for but not detected, and the concentration is below the minimum detectable activity (MDA) for radionuclides or the practical quantitation limit (PQL) (i.e., reporting limit) for nonradionuclides. For nonradionuclides, nondetects are reported at the PQL. For radionuclides, nondetects report the actual value obtained from analysis (positive or negative but less than the MDA) except for limited analyses where no value can be calculated. In these cases, the MDA is reported. This situation is applicable for sample results that are below detection limits. All other validated results are considered to be 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 2005a). 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%). Comparison of the RDL with the respective MDA or PQL is discussed in Section B1.4.

The validated SDG H3328 contains six samples (J03JW3, J03W34, J03JW5, J03JW7, J03JW8, and J03JW9). A summary of deficiencies noted during validation follows.

- **Radionuclides.** The validation DQA noted no major deficiencies.

Sample number J03W34, in SDG 3328, had errors in the quantitation of carbon-14 and nickel-63. The sample was rerun for those two results only. The validator qualified the carbon-14 and nickel-63 results with a “J” as estimated values. Data qualified with a “J” are useable for decision-making purposes.

- **Nonradionuclides.** The validation DQA noted no major or minor deficiencies.

B1.4 LABORATORY DATA EVALUATION

The following paragraphs include the results of the data evaluation of 18 verification sample SDGs.

The context for assessing the data includes evaluating the sample data using the statistical methodology of the SAP (DOE-RL 2005a) (included in the calculation briefs in Appendix C) and a comparison of analytical results to the parameters as specified in the SAP. This section summarizes the results of the comparison and presents an evaluation of the affected data.

MAJOR DEFICIENCIES

Any data anomaly that causes final data to be qualified as rejected is considered a major deficiency. The project has identified one major deficiency in the 116-K-2 data set. The hexavalent chromium result for sample J03JX1 has been qualified, by the project, with an "R" as rejected data. Sample J03JX1 is the only sample in SDG W04740. The sample was non-detect for hexavalent chromium, the MDLs were not met, and the associated MS(s) had zero recovery. J03JX1 was a split sample, sent to a separate laboratory from the rest of the data. The primary sample and its duplicate are not affected by the J03JX1 result. No other major deficiencies were found in the 116-K-2 data set.

MINOR DEFICIENCIES

Sample Holding Times. All of the method-specific holding times were met for all samples in the 116-K-2 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. In the radionuclide analyses, low-level positive results were observed in several SDGs. Most radiological analytical techniques are counting methods. Due to the nature of this type of analysis, positive, but insignificant, results are not uncommon in the method blank and are not considered contamination.

Nonradionuclides. No analytes were reported in the nonradiological method blanks associated with 116-K-2.

MS/MSDs Recoveries. Recovery of spiked analytes in the MS/MSD pair is used to evaluate method efficiency and the effect of the matrix on an environmental sample.

Radionuclides. All MS/MSD recoveries for radionuclide analytes were within acceptance criteria.

Nonradionuclides. In SDG J00004, the MS/MSD pair for hexavalent chromium had low recoveries (49% and 60%, respectively). The laboratory control sample had good recovery, indicating that the analytical instrumentation was in good operating condition. It is not uncommon to see reactive species, such as hexavalent chromium, react with the sample media and give a low response in the MS/MSD pair. This conclusion is

supported by the similarly low recovery in both the MS and the MSD. Low recoveries in the MS/MSD pair may be cause to consider the data estimated. However, the data remain usable for decision-making purposes.

RDL Comparison. Reported analytical detection levels for nondetected analytes were compared to the RDLs specified in the SAP (DOE-RL 2005a). When detected results were obtained, evaluation of detection limits was not performed. The data validation and supplemental data evaluation noted any analyses in which the detection limit (MDA or PQL) was above the SAP RDLs for nondetected analytes.

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

Nonradionuclides. All of the reported method detection limits are less than applicable remedial action goals (RAGs), and the data are of sufficient quality for decision-making purposes.

Precision and Accuracy Evaluation. Analytical accuracy and precision were evaluated by examination of the RPD of the main and duplicate samples. Only the contaminants of concern (COCs) detected at five times the detection limit (or greater) are used for data analysis with respect to accuracy and precision.

Radionuclides. In SDG H3256, the RPD for the duplicate analysis of sample J03D01 for uranium-233/234 is slightly above acceptance criteria at 35.0%. In SDG K0010, the RPD for the duplicate analysis of sample J103C0 for nickel-63 is 93%. In SDG J00004, the RPD for the duplicate analysis of plutonium-238 is slightly above acceptance criteria at 35.5%.

Nonradionuclides. The RPD for the duplicate analysis of sample J03JW2 for hexavalent chromium in SDG 3250 is above acceptance criteria at 44.3%. The RPD for the duplicate analysis of sample J03JX0 for hexavalent chromium in SDG 3256 is above criteria at 39.5%.

Duplicates are produced using field-collected materials. The natural heterogeneity of these materials adds to elevated RPDs, such as those listed above. This variability is expected and does not indicate a problem with the analytical system. RPDs of analytes detected at low concentrations (less than five times the detection limit) are also not considered to be indicative of the analytical system performance. The data are useable for decision-making purposes.

B1.5 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 (BHI 2005b, 2005c) are summarized in Table B-1. All main and QA/QC sample results are presented in Appendix A.

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

Sample Area	Main Sample	Duplicate	Split
B7 (East Shallow Zone)	J03JW8	J03JW9	J03JX1
B6 (East Deep Zone)	J03D02	J03D03	J03D04
A3 (West Shallow Zone)	J10DL0	J10DM4	J10F85
D10 (West Deep Zone)	J10CW7	J10CX6	J10CX7
B8 (Overburden)	J10M07	J10M08	J10M09

Field duplicate samples were 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 compared. The 95% upper confidence limit (UCL) calculation briefs in Appendix C provide details on duplicate pair evaluation and RPD calculation. The data are suitable for the intended purpose of cleanup verification.

Split samples were 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. Environmental Protection Agency 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 C provide details on split pair RPD calculation. These results are typical of the heterogeneity found in the sample matrices and do not indicate a problem with either of the laboratory's analytical systems.

B1.6 SUITABILITY OF DATA

The DQA for the 116-K-2 site determined that the data are of the right type, quality, and quantity to support site cleanup verification decisions within specified error tolerances. The evaluation verified that the sample design was sufficient for the purpose of clean

site verification. All analytical data, except the hexavalent chromium result in sample J03JX1, were found to be acceptable for decision-making purposes.

B2.0 REFERENCES

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APPENDIX C

RESRAD INPUT PARAMETERS AND CALCULATION BRIEF EXCERPTS

RESRAD INPUT PARAMETERS FOR THE 116-K-2 (EAST END) SHALLOW ZONE

Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-SZ-swc.RAD

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Part I: Mixture Sums and Single Radionuclide Guidelines

1RESRAD, Version 6.3 T« Limit = 180 days 10/10/2005 09:35 Page 2
Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-SZ-swc.RAD

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

0 Menu	Parameter	Current Value	Base Case*	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	C-14	2.090E-06	2.090E-06	DCF2(1)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(2)
B-1	Eu-152	2.210E-04	2.210E-04	DCF2(3)
B-1	Gd-152	2.430E-01	2.430E-01	DCF2(5)
B-1	Ni-63	6.290E-06	6.290E-06	DCF2(6)
B-1	Sr-90+D	1.308E-03	1.300E-03	DCF2(7)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	C-14	2.090E-06	2.090E-06	DCF3(1)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(2)
D-1	Eu-152	6.480E-06	6.480E-06	DCF3(3)
D-1	Gd-152	1.610E-04	1.610E-04	DCF3(5)
D-1	Ni-63	5.770E-07	5.770E-07	DCF3(6)
D-1	Sr-90+D	1.528E-04	1.420E-04	DCF3(7)
D-34	Food transfer factors:			
D-34	C-14 , plant/soil concentration ratio, dimensionless	5.500E+00	5.500E+00	RTF(1,1)
D-34	C-14 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.100E-02	3.100E-02	RTF(1,2)
D-34	C-14 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.200E-02	1.200E-02	RTF(1,3)
D-34				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(2,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(2,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(2,3)
D-34				
D-34	Eu-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(3,1)
D-34	Eu-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(3,2)
D-34	Eu-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-05	5.000E-05	RTF(3,3)
D-34				
D-34	Gd-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(5,1)
D-34	Gd-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(5,2)
D-34	Gd-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(5,3)
D-34				
D-34	Ni-63 , plant/soil concentration ratio, dimensionless	5.000E-02	5.000E-02	RTF(6,1)
D-34	Ni-63 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(6,2)
D-34	Ni-63 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-02	2.000E-02	RTF(6,3)
D-34				
D-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(7,1)
D-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(7,2)
D-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(7,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	C-14 , fish	5.000E+04	5.000E+04	BIOFAC(1,1)
D-5	C-14 , crustacea and mollusks	9.100E+03	9.100E+03	BIOFAC(1,2)
D-5				
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(2,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5				
D-5	Eu-152 , fish	5.000E+01	5.000E+01	BIOFAC(3,1)
D-5	Eu-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(3,2)

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

Menu	Parameter	Current Value	Base Case*	Parameter Name
D-5	Gd-152 , fish	2.500E+01	2.500E+01	BIOFAC(5,1)
D-5	Gd-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(5,2)
D-5				
D-5	Ni-63 , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Ni-63 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(6,2)
D-5				
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(7,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(7,2)

*Base Case means Default.Lib w/o Associate Nuclide contributions.

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Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.779E+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)	2.920E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+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)	1.300E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): C-14	7.000E-01	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Cs-137	5.600E-01	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Eu-152	1.530E-01	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Ni-63	3.560E+00	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.430E-01	0.000E+00	---	S1(7)
R012	Concentration in groundwater (pCi/L): C-14	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Eu-152	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Ni-63	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W1(7)
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	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.050E+00	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)	1.600E-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
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	1.500E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.530E+03	1.000E+02	---	HCSZ

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Saturated zone hydraulic gradient	1.250E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	4.600E+00	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	1.040E+01	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.500E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	1.500E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for C-14				
R016	Contaminated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	5.000E+01	4.600E+03	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	4.600E+03	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	5.000E+01	4.600E+03	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.166E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Ni-63				
R016	Contaminated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.605E-04	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.322E-04	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)

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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
R016	Distribution coefficients for daughter Gd-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.316E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
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	8.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	6.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.000E-01	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)	1.100E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	2.700E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	1.000E+02	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	3.600E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	1.970E+01	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	7.300E+01	3.650E+01	---	SOIL

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.890E+00	FMEAT
R018	Contamination fraction of milk	-1	-1	0.890E+00	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	2.000E-05	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	3.000E-02	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	2.000E-02	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	9.800E-01	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	3.000E-01	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	7.000E-07	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	1.000E-10	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	8.000E-01	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	2.000E-01	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	8.894E+01	0.000E+00	---	CO2F

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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	32	---	---	NPTS
TITL	Maximum number of integration points for dose	1	---	---	LYMAX
TITL	Maximum number of integration points for risk	5	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
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:	17794.00 square meters	C-14	7.000E-01
Thickness:	4.60 meters	Cs-137	5.600E-01
Cover Depth:	0.00 meters	Eu-152	1.530E-01
		Ni-63	3.560E+00
		Sr-90	1.430E-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	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	4.624E+00	3.130E+00	2.489E+00	1.830E+00	1.139E+00	2.008E-01	3.657E-03	9.730E-06
M(t):	3.082E-01	2.087E-01	1.659E-01	1.220E-01	7.595E-02	1.339E-02	2.438E-04	6.487E-07

0Maximum TDOSE(t): 4.624E+00 mrem/yr at t = 0.000E+00 years

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	6.299E-06	0.0000	3.167E-04	0.0001	0.000E+00	0.0000	1.183E+00	0.2559	4.110E-01	0.0889	3.329E-01	0.0720	8.544E-05	0.0000
Cs-137	1.225E+00	0.2648	7.655E-07	0.0000	0.000E+00	0.0000	6.311E-02	0.0137	8.664E-02	0.0187	5.381E-02	0.0116	1.635E-03	0.0004
Eu-152	6.911E-01	0.1495	1.449E-06	0.0000	0.000E+00	0.0000	1.397E-04	0.0000	4.257E-05	0.0000	2.813E-06	0.0000	5.790E-05	0.0000
Ni-63	0.000E+00	0.0000	9.596E-07	0.0000	0.000E+00	0.0000	5.788E-03	0.0013	1.283E-03	0.0003	1.188E-02	0.0026	1.200E-04	0.0000
Sr-90	2.264E-03	0.0005	8.018E-06	0.0000	0.000E+00	0.0000	3.694E-01	0.0799	1.170E-01	0.0253	6.610E-02	0.0143	1.276E-03	0.0003
Total	1.918E+00	0.4148	3.278E-04	0.0001	0.000E+00	0.0000	1.621E+00	0.3507	6.160E-01	0.1332	4.647E-01	0.1005	3.175E-03	0.0007

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.927E+00	0.4168
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.430E+00	0.3092
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.914E-01	0.1495
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.907E-02	0.0041
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.560E-01	0.1203
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.624E+00	1.0000

*Sum of all water independent and dependent pathways.

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	1.488E-06	0.0000	7.479E-05	0.0000	0.000E+00	0.0000	2.953E-01	0.0943	1.255E-01	0.0401	9.427E-02	0.0301	2.018E-05	0.0000
Cs-137	1.196E+00	0.3822	7.479E-07	0.0000	0.000E+00	0.0000	6.166E-02	0.0197	8.465E-02	0.0270	5.257E-02	0.0168	1.598E-03	0.0005
Eu-152	6.561E-01	0.2096	1.375E-06	0.0000	0.000E+00	0.0000	1.326E-04	0.0000	4.041E-05	0.0000	2.670E-06	0.0000	5.496E-05	0.0000
Ni-63	0.000E+00	0.0000	9.523E-07	0.0000	0.000E+00	0.0000	5.744E-03	0.0018	1.273E-03	0.0004	1.179E-02	0.0038	1.191E-04	0.0000
Sr-90	2.209E-03	0.0007	7.826E-06	0.0000	0.000E+00	0.0000	3.605E-01	0.1152	1.142E-01	0.0365	6.452E-02	0.0206	1.246E-03	0.0004
Total	1.855E+00	0.5925	8.569E-05	0.0000	0.000E+00	0.0000	7.234E-01	0.2311	3.257E-01	0.1041	2.232E-01	0.0713	3.037E-03	0.0010

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.152E-01	0.1646
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.397E+00	0.4463
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.563E-01	0.2097
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.893E-02	0.0060
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.427E-01	0.1734
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.130E+00	1.0000

*Sum of all water independent and dependent pathways.

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	8.285E-08	0.0000	4.165E-06	0.0000	0.000E+00	0.0000	1.644E-02	0.0066	6.990E-03	0.0028	5.250E-03	0.0021	1.124E-06	0.0000
Cs-137	1.142E+00	0.4587	7.138E-07	0.0000	0.000E+00	0.0000	5.885E-02	0.0236	8.079E-02	0.0325	5.018E-02	0.0202	1.525E-03	0.0006
Eu-152	5.912E-01	0.2375	1.239E-06	0.0000	0.000E+00	0.0000	1.195E-04	0.0000	3.641E-05	0.0000	2.406E-06	0.0000	4.953E-05	0.0000
Ni-63	0.000E+00	0.0000	9.380E-07	0.0000	0.000E+00	0.0000	5.658E-03	0.0023	1.254E-03	0.0005	1.161E-02	0.0047	1.173E-04	0.0000
Sr-90	2.105E-03	0.0008	7.456E-06	0.0000	0.000E+00	0.0000	3.435E-01	0.1380	1.088E-01	0.0437	6.147E-02	0.0247	1.187E-03	0.0005
Total	1.735E+00	0.6971	1.451E-05	0.0000	0.000E+00	0.0000	4.246E-01	0.1706	1.979E-01	0.0795	1.285E-01	0.0516	2.879E-03	0.0012

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
0 Water Dependent Pathways

0 Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.869E-02	0.0115
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.333E+00	0.5356
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.914E-01	0.2376
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.864E-02	0.0075
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.171E-01	0.2077
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.489E+00	1.0000

0*Sum of all water independent and dependent pathways.

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.300E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	4.271E-14	0.0000	2.147E-12	0.0000	0.000E+00	0.0000	8.479E-09	0.0000	3.607E-09	0.0000	2.708E-09	0.0000	5.792E-13	0.0000
Cs-137	9.043E-01	0.4941	5.653E-07	0.0000	0.000E+00	0.0000	4.661E-02	0.0255	6.398E-02	0.0350	3.974E-02	0.0217	1.208E-03	0.0007
Eu-152	3.513E-01	0.1919	7.365E-07	0.0000	0.000E+00	0.0000	7.102E-05	0.0000	2.164E-05	0.0000	1.430E-06	0.0000	2.943E-05	0.0000
Ni-63	0.000E+00	0.0000	8.695E-07	0.0000	0.000E+00	0.0000	5.244E-03	0.0029	1.163E-03	0.0006	1.077E-02	0.0059	1.087E-04	0.0001
Sr-90	1.652E-03	0.0009	5.851E-06	0.0000	0.000E+00	0.0000	2.696E-01	0.1473	8.540E-02	0.0467	4.824E-02	0.0264	9.312E-04	0.0005
Total	1.257E+00	0.6869	8.022E-06	0.0000	0.000E+00	0.0000	3.215E-01	0.1756	1.506E-01	0.0823	9.874E-02	0.0539	2.277E-03	0.0012

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t ■ 1.300E+01 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.480E-08	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.056E+00	0.5769
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.514E-01	0.1920
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.728E-02	0.0094
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.058E-01	0.2217
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.830E+00	1.0000

0*Sum of all water independent and dependent pathways.

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	7.553E-25	0.0000	3.797E-23	0.0000	0.000E+00	0.0000	1.500E-19	0.0000	6.392E-20	0.0000	4.796E-20	0.0000	1.024E-23	0.0000
Cs-137	6.083E-01	0.5340	3.803E-07	0.0000	0.000E+00	0.0000	3.135E-02	0.0275	4.304E-02	0.0378	2.673E-02	0.0235	8.123E-04	0.0007
Eu-152	1.450E-01	0.1273	3.040E-07	0.0000	0.000E+00	0.0000	2.931E-05	0.0000	8.931E-06	0.0000	5.901E-07	0.0000	1.215E-05	0.0000
Ni-63	0.000E+00	0.0000	7.644E-07	0.0000	0.000E+00	0.0000	4.610E-03	0.0040	1.022E-03	0.0009	9.464E-03	0.0083	9.556E-05	0.0001
Sr-90	1.094E-03	0.0010	3.875E-06	0.0000	0.000E+00	0.0000	1.785E-01	0.1567	5.656E-02	0.0496	3.195E-02	0.0280	6.168E-04	0.0005
Total	7.544E-01	0.6622	5.324E-06	0.0000	0.000E+00	0.0000	2.145E-01	0.1883	1.006E-01	0.0883	6.815E-02	0.0598	1.537E-03	0.0013

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.619E-19	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.102E-01	0.6234
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.451E-01	0.1273
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.519E-02	0.0133
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.688E-01	0.2359
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.139E+00	1.0000

*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 180 days 10/10/2005 09:35 Page 15
Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-SZ-swc.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	1.189E-01	0.5920	7.432E-08	0.0000	0.000E+00	0.0000	6.127E-03	0.0305	8.412E-03	0.0419	5.225E-03	0.0260	1.588E-04	0.0008
Eu-152	3.792E-03	0.0189	7.951E-09	0.0000	0.000E+00	0.0000	7.666E-07	0.0000	2.336E-07	0.0000	1.543E-08	0.0000	3.177E-07	0.0000
Ni-63	0.000E+00	0.0000	4.496E-07	0.0000	0.000E+00	0.0000	2.712E-03	0.0135	6.012E-04	0.0030	5.567E-03	0.0277	5.621E-05	0.0003
Sr-90	2.006E-04	0.0010	7.105E-07	0.0000	0.000E+00	0.0000	3.273E-02	0.1630	1.037E-02	0.0516	5.857E-03	0.0292	1.131E-04	0.0006
Total	1.229E-01	0.6119	1.242E-06	0.0000	0.000E+00	0.0000	4.157E-02	0.2070	1.938E-02	0.0965	1.665E-02	0.0829	3.284E-04	0.0016

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.388E-01	0.6912
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.794E-03	0.0189
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.937E-03	0.0445
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.927E-02	0.2454
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.008E-01	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 180 days 10/10/2005 09:35 Page 16
Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-SZ-swc.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	1.121E-03	0.3064	7.005E-10	0.0000	0.000E+00	0.0000	5.776E-05	0.0158	7.929E-05	0.0217	4.925E-05	0.0135	1.496E-06	0.0004
Eu-152	1.142E-07	0.0000	2.395E-13	0.0000	0.000E+00	0.0000	2.308E-11	0.0000	7.033E-12	0.0000	4.647E-13	0.0000	9.566E-12	0.0000
Ni-63	0.000E+00	0.0000	9.872E-08	0.0000	0.000E+00	0.0000	5.954E-04	0.1628	1.320E-04	0.0361	1.222E-03	0.3342	1.234E-05	0.0034
Sr-90	1.575E-06	0.0004	5.578E-09	0.0000	0.000E+00	0.0000	2.570E-04	0.0703	8.141E-05	0.0223	4.599E-05	0.0126	8.878E-07	0.0002
Total	1.122E-03	0.3069	1.050E-07	0.0000	0.000E+00	0.0000	9.102E-04	0.2489	2.927E-04	0.0800	1.317E-03	0.3602	1.473E-05	0.0040

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
0 Water Dependent Pathways

0 Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.308E-03	0.3577
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.142E-07	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.962E-03	0.5365
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.869E-04	0.1058
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.657E-03	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-SZ-swc.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	9.111E-11	0.0000	5.696E-17	0.0000	0.000E+00	0.0000	4.696E-12	0.0000	6.446E-12	0.0000	4.004E-12	0.0000	1.217E-13	0.0000
Eu-152	1.710E-23	0.0000	5.414E-17	0.0000	0.000E+00	0.0000	1.180E-16	0.0000	3.594E-17	0.0000	9.499E-19	0.0000	4.889E-17	0.0000
Ni-63	0.000E+00	0.0000	4.896E-10	0.0001	0.000E+00	0.0000	2.953E-06	0.3035	6.546E-07	0.0673	6.061E-06	0.6229	6.120E-08	0.0063
Sr-90	6.753E-14	0.0000	2.392E-16	0.0000	0.000E+00	0.0000	1.102E-11	0.0000	3.492E-12	0.0000	1.972E-12	0.0000	3.807E-14	0.0000
Total	9.118E-11	0.0000	4.896E-10	0.0001	0.000E+00	0.0000	2.953E-06	0.3035	6.546E-07	0.0673	6.061E-06	0.6229	6.120E-08	0.0063

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
0 Water Dependent Pathways

0 Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.064E-10	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.579E-16	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.730E-06	1.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.659E-11	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.730E-06	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-SZ-swc.RAD

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

0 Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00	2.753E+00	7.360E-01	4.099E-02	2.114E-08	3.742E-19	0.000E+00	0.000E+00	0.000E+00
0Cs-137+D	Cs-137+D	1.000E+00	2.553E+00	2.494E+00	2.381E+00	1.885E+00	1.268E+00	2.479E-01	2.336E-03	1.900E-10
0Eu-152	Eu-152	7.208E-01	3.257E+00	3.092E+00	2.786E+00	1.656E+00	6.834E-01	1.787E-02	5.382E-07	8.061E-23
0Eu-152	Eu-152	2.792E-01	1.262E+00	1.198E+00	1.079E+00	6.413E-01	2.647E-01	6.923E-03	2.085E-07	3.122E-23
Eu-152	Gd-152	2.792E-01	0.000E+00	8.660E-17	2.469E-16	8.395E-16	1.349E-15	1.696E-15	1.701E-15	1.686E-15
Eu-152	äDSR(j)		1.262E+00	1.198E+00	1.079E+00	6.413E-01	2.647E-01	6.923E-03	2.085E-07	1.686E-15
0Ni-63	Ni-63	1.000E+00	5.357E-03	5.317E-03	5.237E-03	4.855E-03	4.268E-03	2.510E-03	5.511E-04	2.733E-06
0Sr-90+D	Sr-90+D	1.000E+00	3.888E+00	3.795E+00	3.616E+00	2.838E+00	1.879E+00	3.446E-01	2.705E-03	1.160E-10

The DSR includes contributions from associated (half-life ó 180 days) daughters.
0

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.500E+01 mrem/yr

0Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	5.448E+00	2.038E+01	3.660E+02	7.096E+08	*4.455E+12	*4.455E+12	*4.455E+12	*4.455E+12
Cs-137	5.875E+00	6.014E+00	6.301E+00	7.956E+00	1.183E+01	6.052E+01	6.420E+03	7.897E+10
Eu-152	3.319E+00	3.497E+00	3.880E+00	6.530E+00	1.582E+01	6.049E+02	2.009E+07	*1.765E+14
Ni-63	2.800E+03	2.821E+03	2.864E+03	3.090E+03	3.515E+03	5.975E+03	2.722E+04	5.488E+06
Sr-90	3.858E+00	3.952E+00	4.148E+00	5.286E+00	7.981E+00	4.353E+01	5.545E+03	1.293E+11

*At specific activity limit
0

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
C-14	7.000E-01	0.000E+00	2.753E+00	5.448E+00	2.753E+00	5.448E+00
Cs-137	5.600E-01	0.000E+00	2.553E+00	5.875E+00	2.553E+00	5.875E+00
Eu-152	1.530E-01	0.000E+00	4.519E+00	3.319E+00	4.519E+00	3.319E+00
Ni-63	3.560E+00	0.000E+00	5.357E-03	2.800E+03	5.357E-03	2.800E+03
Sr-90	1.430E-01	0.000E+00	3.888E+00	3.858E+00	3.888E+00	3.858E+00

1RESRAD, Version 6.3 T« Limit = 180 days 10/10/2005 09:35 Page 19
Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-SZ-swc.RAD

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t=	0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00		1.927E+00	5.152E-01	2.869E-02	1.480E-08	2.619E-19	0.000E+00	0.000E+00	0.000E+00
0Cs-137	Cs-137	1.000E+00		1.430E+00	1.397E+00	1.333E+00	1.056E+00	7.102E-01	1.388E-01	1.308E-03	1.064E-10
0Eu-152	Eu-152	7.208E-01		4.984E-01	4.731E-01	4.263E-01	2.533E-01	1.046E-01	2.735E-03	8.234E-08	1.233E-23
Eu-152	Eu-152	2.792E-01		1.930E-01	1.832E-01	1.651E-01	9.812E-02	4.050E-02	1.059E-03	3.189E-08	4.777E-24
Eu-152	äDOSE(j)			6.914E-01	6.563E-01	5.914E-01	3.514E-01	1.451E-01	3.794E-03	1.142E-07	1.711E-23
0Gd-152	Eu-152	2.792E-01		0.000E+00	1.325E-17	3.777E-17	1.284E-16	2.064E-16	2.595E-16	2.603E-16	2.579E-16
0Ni-63	Ni-63	1.000E+00		1.907E-02	1.893E-02	1.864E-02	1.728E-02	1.519E-02	8.937E-03	1.962E-03	9.730E-06
0Sr-90	Sr-90	1.000E+00		5.560E-01	5.427E-01	5.171E-01	4.058E-01	2.688E-01	4.927E-02	3.869E-04	1.659E-11

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t=	0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00		7.000E-01	1.653E-01	9.206E-03	4.746E-09	8.393E-20	0.000E+00	0.000E+00	0.000E+00
0Cs-137	Cs-137	1.000E+00		5.600E-01	5.471E-01	5.222E-01	4.135E-01	2.782E-01	5.437E-02	5.125E-04	4.167E-11
0Eu-152	Eu-152	7.208E-01		1.103E-01	1.047E-01	9.434E-02	5.606E-02	2.314E-02	6.051E-04	1.822E-08	2.729E-24
Eu-152	Eu-152	2.792E-01		4.272E-02	4.055E-02	3.654E-02	2.171E-02	8.962E-03	2.344E-04	7.058E-09	1.057E-24
Eu-152	äS(j):			1.530E-01	1.452E-01	1.309E-01	7.777E-02	3.210E-02	8.395E-04	2.528E-08	3.786E-24
0Gd-152	Eu-152	2.792E-01		0.000E+00	2.671E-16	7.615E-16	2.590E-15	4.161E-15	5.232E-15	5.248E-15	5.199E-15
0Ni-63	Ni-63	1.000E+00		3.560E+00	3.533E+00	3.480E+00	3.226E+00	2.836E+00	1.668E+00	3.662E-01	1.816E-03
0Sr-90	Sr-90	1.000E+00		1.430E-01	1.396E-01	1.330E-01	1.044E-01	6.912E-02	1.267E-02	9.948E-05	4.267E-12

THF(i) is the thread fraction of the parent nuclide.
0RESCALC.EXE execution time = 0.35 seconds

RESRAD INPUT PARAMETERS FOR THE 116-K-2 (EAST END) DEEP ZONE

Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-DZ-swc.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

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

Menu	Parameter	Current Value	Base Case*	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.724E+00	6.700E+00	DCF2(1)
B-1	C-14	2.090E-06	2.090E-06	DCF2(2)
B-1	Co-60	2.190E-04	2.190E-04	DCF2(3)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(4)
B-1	Eu-152	2.210E-04	2.210E-04	DCF2(5)
B-1	Eu-154	2.860E-04	2.860E-04	DCF2(7)
B-1	Gd-152	2.430E-01	2.430E-01	DCF2(8)
B-1	Ni-63	6.290E-06	6.290E-06	DCF2(9)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(10)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(11)
B-1	Pu-240	4.290E-01	4.290E-01	DCF2(12)
B-1	Ra-228+D	5.078E-03	4.770E-03	DCF2(14)
B-1	Sr-90+D	1.308E-03	1.300E-03	DCF2(15)
B-1	Th-228+D	3.454E-01	3.420E-01	DCF2(16)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(17)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(18)
B-1	U-236	1.250E-01	1.250E-01	DCF2(19)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.410E-02	DCF3(1)
D-1	C-14	2.090E-06	2.090E-06	DCF3(2)
D-1	Co-60	2.690E-05	2.690E-05	DCF3(3)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(4)
D-1	Eu-152	6.480E-06	6.480E-06	DCF3(5)
D-1	Eu-154	9.550E-06	9.550E-06	DCF3(7)
D-1	Gd-152	1.610E-04	1.610E-04	DCF3(8)
D-1	Ni-63	5.770E-07	5.770E-07	DCF3(9)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(10)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(11)
D-1	Pu-240	3.540E-03	3.540E-03	DCF3(12)
D-1	Ra-228+D	1.442E-03	1.440E-03	DCF3(14)
D-1	Sr-90+D	1.528E-04	1.420E-04	DCF3(15)
D-1	Th-228+D	8.086E-04	3.960E-04	DCF3(16)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(17)
D-1	U-235+D	2.673E-04	2.660E-04	DCF3(18)
D-1	U-236	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	C-14 , plant/soil concentration ratio, dimensionless	5.500E+00	5.500E+00	RTF(2,1)
D-34	C-14 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.100E-02	3.100E-02	RTF(2,2)
D-34	C-14 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.200E-02	1.200E-02	RTF(2,3)
D-34				
D-34	Co-60 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(3,1)
D-34	Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(3,2)
D-34	Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(3,3)

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

Menu	Parameter	Current Value	Base Case*	Parameter Name
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(4,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(4,3)
D-34				
D-34	Eu-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(5,1)
D-34	Eu-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(5,2)
D-34	Eu-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-05	5.000E-05	RTF(5,3)
D-34				
D-34	Eu-154 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	Eu-154 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(7,2)
D-34	Eu-154 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-05	5.000E-05	RTF(7,3)
D-34				
D-34	Gd-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	Gd-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(8,2)
D-34	Gd-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(8,3)
D-34				
D-34	Ni-63 , plant/soil concentration ratio, dimensionless	5.000E-02	5.000E-02	RTF(9,1)
D-34	Ni-63 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(9,2)
D-34	Ni-63 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-02	2.000E-02	RTF(9,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(10,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(10,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(10,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(11,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(11,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(11,3)
D-34				
D-34	Pu-240 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(12,1)
D-34	Pu-240 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(12,2)
D-34	Pu-240 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(12,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(14,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(14,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(14,3)
D-34				
D-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(15,1)
D-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(15,2)
D-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(15,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(16,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(16,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(16,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(17,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(17,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(17,3)
D-34				

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

Menu	Parameter	Current Value	Base Case*	Parameter Name
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(18,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(18,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(18,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(19,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(19,2)
D-34	U-236 , 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	C-14 , fish	5.000E+04	5.000E+04	BIOFAC(2,1)
D-5	C-14 , crustacea and mollusks	9.100E+03	9.100E+03	BIOFAC(2,2)
D-5				
D-5	Co-60 , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Co-60 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(3,2)
D-5				
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(4,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(4,2)
D-5				
D-5	Eu-152 , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Eu-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(5,2)
D-5				
D-5	Eu-154 , fish	5.000E+01	5.000E+01	BIOFAC(7,1)
D-5	Eu-154 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(7,2)
D-5				
D-5	Gd-152 , fish	2.500E+01	2.500E+01	BIOFAC(8,1)
D-5	Gd-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(8,2)
D-5				
D-5	Ni-63 , fish	1.000E+02	1.000E+02	BIOFAC(9,1)
D-5	Ni-63 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(9,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(10,2)
D-5				
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(11,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(11,2)
D-5				
D-5	Pu-240 , fish	3.000E+01	3.000E+01	BIOFAC(12,1)
D-5	Pu-240 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(12,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(14,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(14,2)
D-5				
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(15,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(15,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(16,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(16,2)

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

Menu	Parameter	Current Value	Base Case*	Parameter Name
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(17,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(17,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(18,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(18,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(19,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(19,2)

*Base Case means Default.Lib w/o Associate Nuclide contributions.

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Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
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Site-Specific Parameter Summary

Menu	Parameter		User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)		1.779E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)		7.300E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)		2.920E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)		1.500E+01	3.000E+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)		1.300E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)		3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)		1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)		3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)		1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)		not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)		not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g):	C-14	1.260E+00	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g):	Co-60	2.480E+00	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g):	Cs-137	1.300E+02	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g):	Eu-152	6.270E+01	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g):	Eu-154	5.400E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g):	Ni-63	8.800E+02	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g):	Pu-239	5.570E+00	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g):	Pu-240	1.330E+00	0.000E+00	---	S1(12)
R012	Initial principal radionuclide (pCi/g):	Sr-90	7.120E+00	0.000E+00	---	S1(15)
R012	Concentration in groundwater (pCi/L):	C-14	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L):	Co-60	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L):	Cs-137	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L):	Eu-152	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L):	Eu-154	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L):	Ni-63	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L):	Pu-239	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L):	Pu-240	not used	0.000E+00	---	W1(12)
R012	Concentration in groundwater (pCi/L):	Sr-90	not used	0.000E+00	---	W1(15)
R013	Cover depth (m)		4.600E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)		1.500E+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		4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity		2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)		2.500E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter		4.050E+00	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)		1.600E-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

Site-Specific Parameter Summary (continued)

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)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	1.500E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.530E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	1.250E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	4.600E+00	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	3.100E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.500E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	1.500E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for C-14				
R016	Contaminated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Co-60				
R016	Contaminated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.365E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	5.000E+01	4.600E+03	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	4.600E+03	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	5.000E+01	4.600E+03	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.365E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)

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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 Eu-154				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for Ni-63				
R016	Contaminated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.271E-04	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R016	Distribution coefficients for Pu-240				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCC(15)
R016	Unsaturated zone 1 (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCU(15,1)
R016	Saturated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.723E-04	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
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)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.400E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Gd-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.294E-06	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)

Site-Specific Parameter Summary (continued)

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(10)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.365E-04	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(14,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.758E-05	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(16,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for daughter Th-232				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(17)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(17,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for daughter U-235				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(18)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(18,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.220E-03	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)
R016	Distribution coefficients for daughter U-236				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(19)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(19,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.220E-03	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)
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	8.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	6.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.000E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	1.100E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	2.700E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	1.000E+02	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	3.600E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	1.970E+01	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	7.300E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.890E+00	FMEAT
R018	Contamination fraction of milk	-1	-1	0.890E+00	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI

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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
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	2.000E-05	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	3.000E-02	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	2.000E-02	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	9.800E-01	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	3.000E-01	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	7.000E-07	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	1.000E-10	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	8.000E-01	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	2.000E-01	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	8.894E+01	0.000E+00	---	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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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	32	---	---	NPTS
TITL	Maximum number of integration points for dose	1	---	---	LYMAX
TITL	Maximum number of integration points for risk	5	---	---	KYMAX

Summary of Pathway Selections

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

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Contaminated Zone Dimensions

Area:	17794.00 square meters
Thickness:	7.30 meters
Cover Depth:	4.60 meters

Initial Soil Concentrations, pCi/g

C-14	1.260E+00
Co-60	2.480E+00
Cs-137	1.300E+02
Eu-152	6.270E+01
Eu-154	5.400E+00
Ni-63	8.800E+02
Pu-239	5.570E+00
Pu-240	1.330E+00
Sr-90	7.120E+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)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	1.286E-22	1.156E-22	9.366E-23	3.490E-23	9.010E-24	4.210E-06	4.455E-04	9.891E-04
M(t):	8.574E-24	7.707E-24	6.244E-24	2.326E-24	6.007E-25	2.806E-07	2.970E-05	6.594E-05

0Maximum TDOSE(t): 9.891E-04 mrem/yr at t = 1.000E+03 years

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	1.069E-22	0.8308	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	9.524E-27	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	1.830E-23	0.1423	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	3.444E-24	0.0268	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.286E-22	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.069E-22	0.8308
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.524E-27	0.0001
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.830E-23	0.1423
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.444E-24	0.0268
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.286E-22	1.0000

*Sum of all water independent and dependent pathways.

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Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-DZ-swc.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	9.478E-23	0.8198	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	9.439E-27	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	1.760E-23	0.1522	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	3.223E-24	0.0279	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.156E-22	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.478E-23	0.8198
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.439E-27	0.0001
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.760E-23	0.1522
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.223E-24	0.0279
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.156E-22	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 180 days 10/10/2005 09:46 Page 16
Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-DZ-swc.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	7.456E-23	0.7961	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	9.271E-27	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	1.626E-23	0.1736	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	2.823E-24	0.0301	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.366E-23	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.456E-23	0.7961
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.271E-27	0.0001
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.626E-23	0.1736
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.823E-24	0.0301
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.366E-23	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 180 days 10/10/2005 09:46 Page 17
Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-DZ-swc.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.300E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	2.247E-23	0.6440	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	8.473E-27	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	1.096E-23	0.3141	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	1.454E-24	0.0417	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.490E-23	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.300E+01 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.247E-23	0.6440
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.473E-27	0.0002
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.096E-23	0.3141
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.454E-24	0.0417
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.490E-23	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 180 days 10/10/2005 09:46 Page 18
Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-DZ-swc.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	2.925E-24	0.3246	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	7.272E-27	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	5.607E-24	0.6223	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	4.706E-25	0.0522	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.010E-24	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.925E-24	0.3246
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.272E-27	0.0008
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.607E-24	0.6223
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.706E-25	0.0522
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.010E-24	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-DZ-swc.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
0 Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	6.606E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	3.876E-27	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	3.548E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	4.524E-27	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.638E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
0 Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.606E-28	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.876E-27	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.548E-25	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.524E-27	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	4.414E-07	0.1049	1.836E-09	0.0004	0.000E+00	0.0000	4.858E-08	0.0115	3.355E-09	0.0008	1.719E-08	0.0041	5.123E-07	0.1217
Pu-240	3.185E-06	0.7567	1.325E-08	0.0031	0.000E+00	0.0000	3.505E-07	0.0833	2.411E-08	0.0057	1.241E-07	0.0295	3.697E-06	0.8783
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.627E-06	0.8615	1.508E-08	0.0036	0.000E+00	0.0000	3.991E-07	0.0948	2.747E-08	0.0065	1.413E-07	0.0336	4.210E-06	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-DZ-swc.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	6.417E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	9.608E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.378E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
0 Water Dependent Pathways

0 Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.417E-28	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.608E-29	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	4.743E-05	0.1065	2.043E-07	0.0005	0.000E+00	0.0000	5.243E-06	0.0118	3.815E-07	0.0009	1.847E-06	0.0041	5.511E-05	0.1237
Pu-240	3.360E-04	0.7542	1.400E-06	0.0031	0.000E+00	0.0000	3.714E-05	0.0834	2.598E-06	0.0058	1.324E-05	0.0297	3.904E-04	0.8763
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.834E-04	0.8607	1.605E-06	0.0036	0.000E+00	0.0000	4.239E-05	0.0951	2.980E-06	0.0067	1.509E-05	0.0339	4.455E-04	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-DZ-swc.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	3.316E-27	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.316E-27	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	1.168E-04	0.1181	6.132E-07	0.0006	0.000E+00	0.0000	1.292E-05	0.0131	1.102E-06	0.0011	4.210E-06	0.0043	1.357E-04	0.1372
Pu-240	7.345E-04	0.7426	3.061E-06	0.0031	0.000E+00	0.0000	8.120E-05	0.0821	5.684E-06	0.0057	2.896E-05	0.0293	8.534E-04	0.8628
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	8.513E-04	0.8607	3.675E-06	0.0037	0.000E+00	0.0000	9.412E-05	0.0952	6.786E-06	0.0069	3.317E-05	0.0335	9.891E-04	1.0000

*Sum of all water independent and dependent pathways.

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Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-DZ-swc.RAD

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

0 Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Co-60	Co-60	1.000E+00	4.309E-23	3.822E-23	3.007E-23	9.061E-24	1.179E-24	2.664E-28	1.018E-38	0.000E+00
0Cs-137+D	Cs-137+D	1.000E+00	7.326E-29	7.261E-29	7.131E-29	6.518E-29	5.594E-29	2.981E-29	4.936E-30	9.119E-33
0Eu-152	Eu-152	7.208E-01	2.104E-25	2.023E-25	1.869E-25	1.260E-25	6.446E-26	4.079E-27	1.532E-30	1.575E-42
0Eu-152	Eu-152	2.792E-01	8.150E-26	7.835E-26	7.241E-26	4.881E-26	2.497E-26	1.580E-27	5.936E-31	6.110E-43
Eu-152	Gd-152	2.792E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Eu-152	äDSR(j)		8.150E-26	7.835E-26	7.241E-26	4.881E-26	2.497E-26	1.580E-27	5.936E-31	6.110E-43
0Eu-154	Eu-154	1.000E+00	6.379E-25	5.969E-25	5.227E-25	2.692E-25	8.715E-26	8.378E-28	1.445E-33	0.000E+00
0Ni-63	Ni-63	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Pu-239	Pu-239	1.000E+00	5.605E-45	5.605E-45	5.605E-45	7.006E-45	9.809E-45	4.204E-44	2.405E-42	3.298E-36
Pu-239	U-235+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.195E-08	9.774E-06	2.222E-05
Pu-239	Pa-231	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.027E-11	3.589E-08	5.286E-07
Pu-239	Ac-227+D	1.000E+00	0.000E+00	0.000E+00	1.121E-44	9.122E-43	1.247E-41	8.159E-12	8.392E-08	1.613E-06
Pu-239	äDSR(j)		5.605E-45	5.605E-45	1.682E-44	9.193E-43	1.248E-41	9.198E-08	9.894E-06	2.436E-05
0Pu-240	Pu-240	4.950E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Pu-240	Pu-240	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pu-240	U-236	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.780E-06	2.935E-04	6.416E-04
Pu-240	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.778E-16	1.494E-13	2.153E-12
Pu-240	Ra-228+D	1.000E+00	0.000E+00	1.401E-44	3.727E-43	2.622E-41	2.744E-40	1.812E-16	2.165E-13	3.385E-12
Pu-240	Th-228+D	1.000E+00	0.000E+00	1.636E-39	1.125E-37	2.042E-35	2.721E-34	3.077E-17	3.923E-14	6.304E-13
Pu-240	äDSR(j)		0.000E+00	1.636E-39	1.125E-37	2.042E-35	2.721E-34	2.780E-06	2.935E-04	6.416E-04
0Sr-90+D	Sr-90+D	1.000E+00	6.433E-38	6.393E-38	6.312E-38	5.922E-38	5.314E-38	3.401E-38	9.502E-39	1.096E-40

The DSR includes contributions from associated (half-life ó 180 days) daughters.

1RESRAD, Version 6.3 T« Limit = 180 days 10/10/2005 09:46 Page 23
Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-DZ-swc.RAD

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.500E+01 mrem/yr

0Nuclide

(i)	t= 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	*4.455E+12	*4.455E+12	*4.455E+12	*4.455E+12	*4.455E+12	*4.455E+12	*4.455E+12	*4.455E+12
Co-60	*1.132E+15	*1.132E+15	*1.132E+15	*1.132E+15	*1.132E+15	*1.132E+15	*1.132E+15	*1.132E+15
Cs-137	*8.704E+13	*8.704E+13	*8.704E+13	*8.704E+13	*8.704E+13	*8.704E+13	*8.704E+13	*8.704E+13
Eu-152	*1.765E+14	*1.765E+14	*1.765E+14	*1.765E+14	*1.765E+14	*1.765E+14	*1.765E+14	*1.765E+14
Eu-154	*2.639E+14	*2.639E+14	*2.639E+14	*2.639E+14	*2.639E+14	*2.639E+14	*2.639E+14	*2.639E+14
Ni-63	*5.917E+13	*5.917E+13	*5.917E+13	*5.917E+13	*5.917E+13	*5.917E+13	*5.917E+13	*5.917E+13
Pu-239	*6.214E+10	*6.214E+10	*6.214E+10	*6.214E+10	*6.214E+10	1.631E+08	1.516E+06	6.158E+05
Pu-240	*2.278E+11	*2.278E+11	*2.278E+11	*2.278E+11	*2.278E+11	5.396E+06	5.110E+04	2.338E+04
Sr-90	*1.365E+14	*1.365E+14	*1.365E+14	*1.365E+14	*1.365E+14	*1.365E+14	*1.365E+14	*1.365E+14

*At specific activity limit

0

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 1.000E+03 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
C-14	1.260E+00	0.000E+00	0.000E+00	*4.455E+12	0.000E+00	*4.455E+12
Co-60	2.480E+00	0.000E+00	4.309E-23	*1.132E+15	0.000E+00	*1.132E+15
Cs-137	1.300E+02	0.000E+00	7.326E-29	*8.704E+13	0.000E+00	*8.704E+13
Eu-152	6.270E+01	0.000E+00	2.919E-25	*1.765E+14	0.000E+00	*1.765E+14
Eu-154	5.400E+00	0.000E+00	6.379E-25	*2.639E+14	0.000E+00	*2.639E+14
Ni-63	8.800E+02	0.000E+00	0.000E+00	*5.917E+13	0.000E+00	*5.917E+13
Pu-239	5.570E+00	1.000E+03	2.436E-05	6.158E+05	2.436E-05	6.158E+05
Pu-240	1.330E+00	1.000E+03	6.416E-04	2.338E+04	6.416E-04	2.338E+04
Sr-90	7.120E+00	0.000E+00	0.000E+00	*1.365E+14	0.000E+00	*1.365E+14

*At specific activity limit

1RESRAD, Version 6.3 T« Limit = 180 days 10/10/2005 09:46 Page 24
Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-DZ-swc.RAD

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Co-60	Co-60	1.000E+00	1.069E-22	9.478E-23	7.456E-23	2.247E-23	2.925E-24	6.606E-28	0.000E+00	0.000E+00
0Cs-137	Cs-137	1.000E+00	9.524E-27	9.439E-27	9.271E-27	8.473E-27	7.272E-27	3.876E-27	6.417E-28	0.000E+00
0Eu-152	Eu-152	7.208E-01	1.319E-23	1.268E-23	1.172E-23	7.901E-24	4.042E-24	2.557E-25	9.608E-29	0.000E+00
Eu-152	Eu-152	2.792E-01	5.110E-24	4.913E-24	4.540E-24	3.061E-24	1.566E-24	9.905E-26	0.000E+00	0.000E+00
Eu-152	äDOSE(j)		1.830E-23	1.760E-23	1.626E-23	1.096E-23	5.607E-24	3.548E-25	9.608E-29	0.000E+00
0Gd-152	Eu-152	2.792E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Eu-154	Eu-154	1.000E+00	3.444E-24	3.223E-24	2.823E-24	1.454E-24	4.706E-25	4.524E-27	0.000E+00	0.000E+00
0Ni-63	Ni-63	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Pu-239	Pu-239	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0U-235	Pu-239	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.122E-07	5.444E-05	1.237E-04
0Pa-231	Pu-239	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.129E-10	1.999E-07	2.945E-06
0Ac-227	Pu-239	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.545E-11	4.675E-07	8.986E-06
0Pu-240	Pu-240	4.950E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pu-240	Pu-240	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pu-240	äDOSE(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0U-236	Pu-240	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.697E-06	3.904E-04	8.534E-04
0Th-232	Pu-240	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.364E-16	1.988E-13	2.863E-12
0Ra-228	Pu-240	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.410E-16	2.879E-13	4.502E-12
0Th-228	Pu-240	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.093E-17	5.218E-14	8.384E-13
0Sr-90	Sr-90	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

THF(i) is the thread fraction of the parent nuclide.

1RESRAD, Version 6.3 T« Limit = 180 days 10/10/2005 09:46 Page 25
Summary : 116-K-2 Trench (East End) Cleanup Verification RESRAD Calculation
File : 116-K-2-DZ-swc.RAD

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00	1.260E+00	1.260E+00	1.259E+00	1.257E+00	1.254E+00	1.241E+00	1.203E+00	1.079E+00
0Co-60	Co-60	1.000E+00	2.480E+00	2.174E+00	1.671E+00	4.480E-01	4.779E-02	4.758E-06	1.752E-17	0.000E+00
0Cs-137	Cs-137	1.000E+00	1.300E+02	1.270E+02	1.212E+02	9.610E+01	6.473E+01	1.272E+01	1.219E-01	1.048E-08
0Eu-152	Eu-152	7.208E-01	4.519E+01	4.290E+01	3.866E+01	2.298E+01	9.487E+00	2.485E-01	7.512E-06	1.141E-21
Eu-152	Eu-152	2.792E-01	1.751E+01	1.662E+01	1.498E+01	8.900E+00	3.675E+00	9.625E-02	2.910E-06	4.420E-22
Eu-152	äS(j):		6.270E+01	5.952E+01	5.364E+01	3.188E+01	1.316E+01	3.447E-01	1.042E-05	1.583E-21
0Gd-152	Eu-152	2.792E-01	0.000E+00	1.095E-13	3.121E-13	1.061E-12	1.706E-12	2.146E-12	2.154E-12	2.142E-12
0Eu-154	Eu-154	1.000E+00	5.400E+00	4.991E+00	4.263E+00	1.939E+00	5.078E-01	2.042E-03	2.921E-10	3.233E-34
0Ni-63	Ni-63	1.000E+00	8.800E+02	8.735E+02	8.606E+02	7.988E+02	7.038E+02	4.179E+02	9.423E+01	5.130E-01
0Pu-239	Pu-239	1.000E+00	5.570E+00	5.570E+00	5.569E+00	5.565E+00	5.559E+00	5.535E+00	5.466E+00	5.230E+00
0U-235	Pu-239	1.000E+00	0.000E+00	5.477E-09	1.638E-08	6.981E-08	1.567E-07	4.675E-07	1.044E-06	1.562E-06
0Pa-231	Pu-239	1.000E+00	0.000E+00	5.797E-14	5.205E-13	9.663E-12	5.048E-11	5.188E-10	3.789E-09	2.316E-08
0Ac-227	Pu-239	1.000E+00	0.000E+00	6.104E-16	1.619E-14	1.209E-12	1.293E-11	2.946E-10	3.131E-09	2.201E-08
0Pu-240	Pu-240	4.950E-08	6.584E-08	6.583E-08	6.581E-08	6.572E-08	6.556E-08	6.492E-08	6.312E-08	5.722E-08
Pu-240	Pu-240	1.000E+00	1.330E+00	1.330E+00	1.329E+00	1.328E+00	1.324E+00	1.311E+00	1.275E+00	1.156E+00
Pu-240	äS(j):		1.330E+00	1.330E+00	1.329E+00	1.328E+00	1.324E+00	1.311E+00	1.275E+00	1.156E+00
0U-236	Pu-240	1.000E+00	0.000E+00	3.931E-08	1.175E-07	5.008E-07	1.123E-06	3.341E-06	7.392E-06	1.060E-05
0Th-232	Pu-240	1.000E+00	0.000E+00	9.701E-19	8.711E-18	1.617E-16	8.451E-16	8.696E-15	6.373E-14	3.949E-13
0Ra-228	Pu-240	1.000E+00	0.000E+00	3.784E-20	9.623E-19	5.972E-17	5.058E-16	7.424E-15	6.072E-14	3.903E-13
0Th-228	Pu-240	1.000E+00	0.000E+00	3.212E-21	2.169E-19	3.579E-17	4.063E-16	7.013E-15	5.974E-14	3.889E-13
0Sr-90	Sr-90	1.000E+00	7.120E+00	6.951E+00	6.624E+00	5.207E+00	3.458E+00	6.411E-01	5.197E-03	2.493E-10

THF(i) is the thread fraction of the parent nuclide.
0RESCALC.EXE execution time = 0.80 seconds

RESRAD INPUT PARAMETERS FOR THE 116-K-2 (WEST END) SHALLOW ZONE

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 11:50 Page 1
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Shallow_Zone_West.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 11:50 Page 2
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Shallow_Zone_West.RAD

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

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	C-14	2.090E-06	2.090E-06	DCF2(1)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(2)
B-1	Eu-152	2.210E-04	2.210E-04	DCF2(3)
B-1	Eu-154	2.860E-04	2.860E-04	DCF2(5)
B-1	Gd-152	2.430E-01	2.430E-01	DCF2(6)
B-1	Ni-63	6.290E-06	6.290E-06	DCF2(7)
B-1	Sr-90+D	1.310E-03	1.310E-03	DCF2(8)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	C-14	2.090E-06	2.090E-06	DCF3(1)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(2)
D-1	Eu-152	6.480E-06	6.480E-06	DCF3(3)
D-1	Eu-154	9.550E-06	9.550E-06	DCF3(5)
D-1	Gd-152	1.610E-04	1.610E-04	DCF3(6)
D-1	Ni-63	5.770E-07	5.770E-07	DCF3(7)
D-1	Sr-90+D	1.530E-04	1.530E-04	DCF3(8)
D-34	Food transfer factors:			
D-34	C-14 , plant/soil concentration ratio, dimensionless	5.500E+00	5.500E+00	RTF(1,1)
D-34	C-14 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.100E-02	3.100E-02	RTF(1,2)
D-34	C-14 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.200E-02	1.200E-02	RTF(1,3)
D-34				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(2,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(2,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(2,3)
D-34				
D-34	Eu-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(3,1)
D-34	Eu-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(3,2)
D-34	Eu-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(3,3)
D-34				
D-34	Eu-154 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(5,1)
D-34	Eu-154 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(5,2)
D-34	Eu-154 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(5,3)
D-34				
D-34	Gd-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	Gd-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(6,2)
D-34	Gd-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(6,3)
D-34				
D-34	Ni-63 , plant/soil concentration ratio, dimensionless	5.000E-02	5.000E-02	RTF(7,1)
D-34	Ni-63 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(7,2)
D-34	Ni-63 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-02	2.000E-02	RTF(7,3)
D-34				
D-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(8,1)
D-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(8,2)
D-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(8,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	C-14 , fish	5.000E+04	5.000E+04	BIOFAC(1,1)
D-5	C-14 , crustacea and mollusks	9.100E+03	9.100E+03	BIOFAC(1,2)

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

Menu	Parameter	Current Value	Default	Parameter Name
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(2,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5				
D-5	Eu-152 , fish	5.000E+01	5.000E+01	BIOFAC(3,1)
D-5	Eu-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(3,2)
D-5				
D-5	Eu-154 , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Eu-154 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(5,2)
D-5				
D-5	Gd-152 , fish	2.500E+01	2.500E+01	BIOFAC(6,1)
D-5	Gd-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(6,2)
D-5				
D-5	Ni-63 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Ni-63 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(7,2)
D-5				
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(8,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(8,2)

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Shallow_Zone_West.RAD

Site-Specific Parameter Summary

Menu	Parameter		User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)		3.774E+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)		3.190E+02	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)		1.300E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)		3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)		1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)		3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)		1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)		not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)		not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g):	C-14	2.900E-01	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g):	Cs-137	1.100E+00	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g):	Eu-152	6.260E-01	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g):	Eu-154	1.290E-01	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g):	Ni-63	1.770E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g):	Sr-90	2.010E-01	0.000E+00	---	S1(8)
R012	Concentration in groundwater (pCi/L):	C-14	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L):	Cs-137	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L):	Eu-152	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L):	Eu-154	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L):	Ni-63	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L):	Sr-90	not used	0.000E+00	---	W1(8)
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		4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity		2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)		2.500E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter		4.050E+00	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)		1.600E-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
R013	Watershed area for nearby stream or pond (m**2)		1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations		1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)		1.600E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity		4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity		2.500E-01	2.000E-01	---	EPSZ

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Saturated zone field capacity	1.500E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.530E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	1.250E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	4.600E+00	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	1.040E+01	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.500E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	1.500E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for C-14				
R016	Contaminated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.166E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Eu-154				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)

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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 Ni-63				
R016	Contaminated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.605E-04	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.322E-04	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for daughter Gd-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.316E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
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	8.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	6.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.000E-01	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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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	1.100E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	2.700E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	1.000E+02	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	3.600E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	1.970E+01	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	7.300E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.100E+01	FMEAT
R018	Contamination fraction of milk	-1	-1	0.100E+01	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	2.000E-05	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	3.000E-02	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	2.000E-02	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	9.800E-01	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	3.000E-01	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	7.000E-07	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	1.000E-10	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	8.000E-01	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	2.000E-01	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	8.894E+01	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)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	33	---	---	KYMAX

Summary of Pathway Selections

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

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Shallow_Zone_West.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	37742.00 square meters	C-14	2.900E-01
Thickness:	4.60 meters	Cs-137	1.100E+00
Cover Depth:	0.00 meters	Eu-152	6.260E-01
		Eu-154	1.290E-01
		Ni-63	1.770E+00
		Sr-90	2.010E-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	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	7.767E+00	6.959E+00	6.287E+00	4.331E+00	2.450E+00	3.673E-01	4.214E-03	5.232E-06
M(t):	5.178E-01	4.639E-01	4.192E-01	2.888E-01	1.633E-01	2.449E-02	2.809E-04	3.488E-07

0Maximum TDOSE(t): 7.767E+00 mrem/yr at t = 0.000E+00 years

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Shallow_Zone_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	1.384E-06	0.0000	1.011E-04	0.0000	0.000E+00	0.0000	3.917E-01	0.0504	1.789E-01	0.0230	1.365E-01	0.0176	1.874E-05	0.0000
Cs-137	2.407E+00	0.3099	1.605E-06	0.0000	0.000E+00	0.0000	1.225E-01	0.0158	1.891E-01	0.0243	1.174E-01	0.0151	3.175E-03	0.0004
Eu-152	2.783E+00	0.3583	6.239E-06	0.0000	0.000E+00	0.0000	5.570E-04	0.0001	1.908E-04	0.0000	5.042E-06	0.0000	2.308E-04	0.0000
Eu-154	6.207E-01	0.0799	1.642E-06	0.0000	0.000E+00	0.0000	1.669E-04	0.0000	5.717E-05	0.0000	1.511E-06	0.0000	6.918E-05	0.0000
Ni-63	0.000E+00	0.0000	5.133E-07	0.0000	0.000E+00	0.0000	2.867E-03	0.0004	7.143E-04	0.0001	6.614E-03	0.0009	5.942E-05	0.0000
Sr-90	3.180E-03	0.0004	1.204E-05	0.0000	0.000E+00	0.0000	5.136E-01	0.0661	1.829E-01	0.0235	1.033E-01	0.0133	1.774E-03	0.0002
Total	5.814E+00	0.7486	1.232E-04	0.0000	0.000E+00	0.0000	1.031E+00	0.1328	5.519E-01	0.0711	3.639E-01	0.0468	5.327E-03	0.0007

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.072E-01	0.0911
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.839E+00	0.3656
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.784E+00	0.3585
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.210E-01	0.0800
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.025E-02	0.0013
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.048E-01	0.1036
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.767E+00	1.0000

*Sum of all water independent and dependent pathways.

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Shallow_Zone_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	3.268E-07	0.0000	2.388E-05	0.0000	0.000E+00	0.0000	9.376E-02	0.0135	4.478E-02	0.0064	3.363E-02	0.0048	4.425E-06	0.0000
Cs-137	2.352E+00	0.3379	1.568E-06	0.0000	0.000E+00	0.0000	1.197E-01	0.0172	1.847E-01	0.0265	1.147E-01	0.0165	3.102E-03	0.0004
Eu-152	2.642E+00	0.3797	5.922E-06	0.0000	0.000E+00	0.0000	5.288E-04	0.0001	1.811E-04	0.0000	4.786E-06	0.0000	2.191E-04	0.0000
Eu-154	5.737E-01	0.0824	1.517E-06	0.0000	0.000E+00	0.0000	1.543E-04	0.0000	5.284E-05	0.0000	1.396E-06	0.0000	6.394E-05	0.0000
Ni-63	0.000E+00	0.0000	5.094E-07	0.0000	0.000E+00	0.0000	2.845E-03	0.0004	7.089E-04	0.0001	6.564E-03	0.0009	5.897E-05	0.0000
Sr-90	3.104E-03	0.0004	1.175E-05	0.0000	0.000E+00	0.0000	5.013E-01	0.0720	1.785E-01	0.0257	1.008E-01	0.0145	1.732E-03	0.0002
Total	5.570E+00	0.8005	4.515E-05	0.0000	0.000E+00	0.0000	7.183E-01	0.1032	4.090E-01	0.0588	2.558E-01	0.0368	5.180E-03	0.0007

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.722E-01	0.0247
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.774E+00	0.3986
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.643E+00	0.3798
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.739E-01	0.0825
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.018E-02	0.0015
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.855E-01	0.1129
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.959E+00	1.0000

*Sum of all water independent and dependent pathways.

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File : 116-K-2_Shallow_Zone_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	1.819E-08	0.0000	1.329E-06	0.0000	0.000E+00	0.0000	5.218E-03	0.0008	2.493E-03	0.0004	1.872E-03	0.0003	2.463E-07	0.0000
Cs-137	2.244E+00	0.3570	1.497E-06	0.0000	0.000E+00	0.0000	1.143E-01	0.0182	1.763E-01	0.0280	1.095E-01	0.0174	2.960E-03	0.0005
Eu-152	2.381E+00	0.3787	5.337E-06	0.0000	0.000E+00	0.0000	4.765E-04	0.0001	1.632E-04	0.0000	4.313E-06	0.0000	1.975E-04	0.0000
Eu-154	4.900E-01	0.0779	1.296E-06	0.0000	0.000E+00	0.0000	1.318E-04	0.0000	4.513E-05	0.0000	1.193E-06	0.0000	5.461E-05	0.0000
Ni-63	0.000E+00	0.0000	5.017E-07	0.0000	0.000E+00	0.0000	2.802E-03	0.0004	6.983E-04	0.0001	6.465E-03	0.0010	5.808E-05	0.0000
Sr-90	2.957E-03	0.0005	1.119E-05	0.0000	0.000E+00	0.0000	4.776E-01	0.0760	1.701E-01	0.0271	9.607E-02	0.0153	1.650E-03	0.0003
Total	5.118E+00	0.8140	2.116E-05	0.0000	0.000E+00	0.0000	6.005E-01	0.0955	3.498E-01	0.0556	2.139E-01	0.0340	4.921E-03	0.0008

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.585E-03	0.0015
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.647E+00	0.4211
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.382E+00	0.3788
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.902E-01	0.0780
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.002E-02	0.0016
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.484E-01	0.1190
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.287E+00	1.0000

*Sum of all water independent and dependent pathways.

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.300E+01 years
Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	9.352E-15	0.0000	6.835E-13	0.0000	0.000E+00	0.0000	2.684E-09	0.0000	1.283E-09	0.0000	9.633E-10	0.0000	1.266E-13	0.0000
Cs-137	1.778E+00	0.4104	1.185E-06	0.0000	0.000E+00	0.0000	9.049E-02	0.0209	1.396E-01	0.0322	8.672E-02	0.0200	2.345E-03	0.0005
Eu-152	1.415E+00	0.3266	3.171E-06	0.0000	0.000E+00	0.0000	2.831E-04	0.0001	9.696E-05	0.0000	2.563E-06	0.0000	1.173E-04	0.0000
Eu-154	2.228E-01	0.0514	5.893E-07	0.0000	0.000E+00	0.0000	5.992E-05	0.0000	2.052E-05	0.0000	5.423E-07	0.0000	2.483E-05	0.0000
Ni-63	0.000E+00	0.0000	4.651E-07	0.0000	0.000E+00	0.0000	2.598E-03	0.0006	6.473E-04	0.0001	5.993E-03	0.0014	5.384E-05	0.0000
Sr-90	2.321E-03	0.0005	8.785E-06	0.0000	0.000E+00	0.0000	3.748E-01	0.0865	1.335E-01	0.0308	7.539E-02	0.0174	1.295E-03	0.0003
Total	3.417E+00	0.7890	1.420E-05	0.0000	0.000E+00	0.0000	4.683E-01	0.1081	2.739E-01	0.0632	1.681E-01	0.0388	3.835E-03	0.0009

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.300E+01 years
Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.932E-09	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.097E+00	0.4841
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.415E+00	0.3267
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.229E-01	0.0515
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.293E-03	0.0021
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.873E-01	0.1356
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.331E+00	1.0000

*Sum of all water independent and dependent pathways.

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Shallow_Zone_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	1.647E-25	0.0000	1.204E-23	0.0000	0.000E+00	0.0000	4.729E-20	0.0000	2.265E-20	0.0000	1.699E-20	0.0000	2.230E-24	0.0000
Cs-137	1.196E+00	0.4880	7.974E-07	0.0000	0.000E+00	0.0000	6.087E-02	0.0248	9.393E-02	0.0383	5.834E-02	0.0238	1.577E-03	0.0006
Eu-152	5.839E-01	0.2383	1.309E-06	0.0000	0.000E+00	0.0000	1.169E-04	0.0000	4.002E-05	0.0000	1.058E-06	0.0000	4.843E-05	0.0000
Eu-154	5.834E-02	0.0238	1.543E-07	0.0000	0.000E+00	0.0000	1.569E-05	0.0000	5.373E-06	0.0000	1.420E-07	0.0000	6.502E-06	0.0000
Ni-63	0.000E+00	0.0000	4.089E-07	0.0000	0.000E+00	0.0000	2.284E-03	0.0009	5.690E-04	0.0002	5.269E-03	0.0022	4.733E-05	0.0000
Sr-90	1.537E-03	0.0006	5.819E-06	0.0000	0.000E+00	0.0000	2.483E-01	0.1013	8.840E-02	0.0361	4.993E-02	0.0204	8.576E-04	0.0004
Total	1.840E+00	0.7508	8.488E-06	0.0000	0.000E+00	0.0000	3.115E-01	0.1272	1.829E-01	0.0747	1.135E-01	0.0463	2.537E-03	0.0010

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.695E-20	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.410E+00	0.5757
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.841E-01	0.2384
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.837E-02	0.0238
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.169E-03	0.0033
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.890E-01	0.1588
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.450E+00	1.0000

*Sum of all water independent and dependent pathways.

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	2.337E-01	0.6363	1.558E-07	0.0000	0.000E+00	0.0000	1.190E-02	0.0324	1.836E-02	0.0500	1.140E-02	0.0310	3.082E-04	0.0008
Eu-152	1.527E-02	0.0416	3.423E-08	0.0000	0.000E+00	0.0000	3.057E-06	0.0000	1.047E-06	0.0000	2.766E-08	0.0000	1.267E-06	0.0000
Eu-154	2.343E-04	0.0006	6.197E-10	0.0000	0.000E+00	0.0000	6.301E-08	0.0000	2.158E-08	0.0000	5.703E-10	0.0000	2.611E-08	0.0000
Ni-63	0.000E+00	0.0000	2.405E-07	0.0000	0.000E+00	0.0000	1.343E-03	0.0037	3.347E-04	0.0009	3.099E-03	0.0084	2.784E-05	0.0001
Sr-90	2.818E-04	0.0008	1.067E-06	0.0000	0.000E+00	0.0000	4.551E-02	0.1239	1.621E-02	0.0441	9.154E-03	0.0249	1.572E-04	0.0004
Total	2.495E-01	0.6793	1.498E-06	0.0000	0.000E+00	0.0000	5.876E-02	0.1600	3.490E-02	0.0950	2.365E-02	0.0644	4.946E-04	0.0013

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.757E-01	0.7505
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.528E-02	0.0416
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.344E-04	0.0006
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.805E-03	0.0131
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.131E-02	0.1942
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.673E-01	1.0000

*Sum of all water independent and dependent pathways.

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
0 Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	2.203E-03	0.5228	1.469E-09	0.0000	0.000E+00	0.0000	1.121E-04	0.0266	1.730E-04	0.0411	1.075E-04	0.0255	2.905E-06	0.0007
Eu-152	4.598E-07	0.0001	1.031E-12	0.0000	0.000E+00	0.0000	9.203E-11	0.0000	3.152E-11	0.0000	8.330E-13	0.0000	3.814E-11	0.0000
Eu-154	3.338E-11	0.0000	8.828E-17	0.0000	0.000E+00	0.0000	8.977E-15	0.0000	3.074E-15	0.0000	8.125E-17	0.0000	3.720E-15	0.0000
Ni-63	0.000E+00	0.0000	5.280E-08	0.0000	0.000E+00	0.0000	2.949E-04	0.0700	7.349E-05	0.0174	6.804E-04	0.1615	6.113E-06	0.0015
Sr-90	2.212E-06	0.0005	8.376E-09	0.0000	0.000E+00	0.0000	3.573E-04	0.0848	1.272E-04	0.0302	7.187E-05	0.0171	1.234E-06	0.0003
Total	2.205E-03	0.5234	6.265E-08	0.0000	0.000E+00	0.0000	7.644E-04	0.1814	3.738E-04	0.0887	8.598E-04	0.2040	1.025E-05	0.0024

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
0 Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.598E-03	0.6166
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.600E-07	0.0001
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.339E-11	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.055E-03	0.2504
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.599E-04	0.1329
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.214E-03	1.0000

0*Sum of all water independent and dependent pathways.

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	1.791E-10	0.0000	1.194E-16	0.0000	0.000E+00	0.0000	9.117E-12	0.0000	1.407E-11	0.0000	8.738E-12	0.0000	2.362E-13	0.0000
Eu-152	6.888E-23	0.0000	2.392E-16	0.0000	0.000E+00	0.0000	4.827E-16	0.0000	1.653E-16	0.0000	4.368E-18	0.0000	2.000E-16	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	2.619E-10	0.0001	0.000E+00	0.0000	1.463E-06	0.2795	3.644E-07	0.0697	3.374E-06	0.6449	3.031E-08	0.0058
Sr-90	9.487E-14	0.0000	3.592E-16	0.0000	0.000E+00	0.0000	1.532E-11	0.0000	5.457E-12	0.0000	3.082E-12	0.0000	5.294E-14	0.0000
Total	1.792E-10	0.0000	2.619E-10	0.0001	0.000E+00	0.0000	1.463E-06	0.2795	3.645E-07	0.0697	3.374E-06	0.6449	3.031E-08	0.0058

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
0 Water Dependent Pathways

0 Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.113E-10	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.092E-15	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.232E-06	1.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.401E-11	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.232E-06	1.0000

0*Sum of all water independent and dependent pathways.

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Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

0Parent (i)	Product (j)	Branch Fraction*	t= 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
			DSR(j,t) (mrem/yr)/(pCi/g)							
C-14	C-14	1.000E+00		2.439E+00	5.938E-01	3.305E-02	1.701E-08	2.998E-19	0.000E+00	0.000E+00	0.000E+00
0Cs-137	Cs-137	1.000E+00		2.581E+00	2.522E+00	2.407E+00	1.906E+00	1.282E+00	2.506E-01	2.362E-03	1.920E-10
0Eu-152	Eu-152	7.208E-01		3.206E+00	3.043E+00	2.742E+00	1.629E+00	6.726E-01	1.759E-02	5.297E-07	7.934E-23
0Eu-152	Eu-152	2.792E-01		1.242E+00	1.179E+00	1.062E+00	6.312E-01	2.605E-01	6.814E-03	2.052E-07	3.073E-23
Eu-152	Gd-152	2.792E-01		4.519E-17	1.325E-16	2.940E-16	8.914E-16	1.405E-15	1.755E-15	1.760E-15	1.744E-15
Eu-152	äDSR(j)			1.242E+00	1.179E+00	1.062E+00	6.312E-01	2.605E-01	6.814E-03	2.052E-07	1.744E-15
0Eu-154	Eu-154	1.000E+00		4.814E+00	4.449E+00	3.800E+00	1.728E+00	4.524E-01	1.817E-03	2.589E-10	2.825E-34
0Ni-63	Ni-63	1.000E+00		5.794E-03	5.750E-03	5.663E-03	5.250E-03	4.615E-03	2.715E-03	5.960E-04	2.956E-06
0Sr-90	Sr-90	1.000E+00		4.004E+00	3.908E+00	3.723E+00	2.922E+00	1.935E+00	3.548E-01	2.786E-03	1.195E-10

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ó 0.5 yr) daughters.
0

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.500E+01 mrem/yr

0Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	6.151E+00	2.526E+01	4.538E+02	8.820E+08	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12
Cs-137	5.811E+00	5.948E+00	6.232E+00	7.869E+00	1.170E+01	5.986E+01	6.350E+03	7.811E+10
Eu-152	3.373E+00	3.553E+00	3.943E+00	6.635E+00	1.608E+01	6.146E+02	2.041E+07	*1.765E+14
Eu-154	3.116E+00	3.371E+00	3.947E+00	8.681E+00	3.315E+01	8.255E+03	5.795E+10	*2.639E+14
Ni-63	2.589E+03	2.609E+03	2.649E+03	2.857E+03	3.250E+03	5.525E+03	2.517E+04	5.075E+06
Sr-90	3.746E+00	3.838E+00	4.029E+00	5.134E+00	7.751E+00	4.228E+01	5.385E+03	1.256E+11

*At specific activity limit

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Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
C-14	2.900E-01	0.000E+00	2.439E+00	6.151E+00	2.439E+00	6.151E+00
Cs-137	1.100E+00	0.000E+00	2.581E+00	5.811E+00	2.581E+00	5.811E+00
Eu-152	6.260E-01	0.000E+00	4.448E+00	3.373E+00	4.448E+00	3.373E+00
Eu-154	1.290E-01	0.000E+00	4.814E+00	3.116E+00	4.814E+00	3.116E+00
Ni-63	1.770E+00	0.000E+00	5.794E-03	2.589E+03	5.794E-03	2.589E+03
Sr-90	2.010E-01	0.000E+00	4.004E+00	3.746E+00	4.004E+00	3.746E+00

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Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00	7.072E-01	1.722E-01	9.585E-03	4.932E-09	8.695E-20	0.000E+00	0.000E+00	0.000E+00
0Cs-137	Cs-137	1.000E+00	2.839E+00	2.774E+00	2.647E+00	2.097E+00	1.410E+00	2.757E-01	2.598E-03	2.113E-10
0Eu-152	Eu-152	7.208E-01	2.007E+00	1.905E+00	1.717E+00	1.020E+00	4.210E-01	1.101E-02	3.316E-07	4.967E-23
Eu-152	Eu-152	2.792E-01	7.773E-01	7.379E-01	6.650E-01	3.951E-01	1.631E-01	4.265E-03	1.284E-07	1.924E-23
Eu-152	äDOSE(j)		2.784E+00	2.643E+00	2.382E+00	1.415E+00	5.841E-01	1.528E-02	4.600E-07	6.890E-23
0Gd-152	Eu-152	2.792E-01	2.829E-17	8.294E-17	1.841E-16	5.580E-16	8.795E-16	1.099E-15	1.102E-15	1.092E-15
0Eu-154	Eu-154	1.000E+00	6.210E-01	5.739E-01	4.902E-01	2.229E-01	5.837E-02	2.344E-04	3.339E-11	0.000E+00
0Ni-63	Ni-63	1.000E+00	1.025E-02	1.018E-02	1.002E-02	9.293E-03	8.169E-03	4.805E-03	1.055E-03	5.232E-06
0Sr-90	Sr-90	1.000E+00	8.048E-01	7.855E-01	7.484E-01	5.873E-01	3.890E-01	7.131E-02	5.599E-04	2.401E-11

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00	2.900E-01	6.850E-02	3.814E-03	1.966E-09	3.477E-20	0.000E+00	0.000E+00	0.000E+00
0Cs-137	Cs-137	1.000E+00	1.100E+00	1.075E+00	1.026E+00	8.123E-01	5.464E-01	1.068E-01	1.007E-03	8.184E-11
0Eu-152	Eu-152	7.208E-01	4.512E-01	4.283E-01	3.860E-01	2.294E-01	9.467E-02	2.476E-03	7.455E-08	1.117E-23
Eu-152	Eu-152	2.792E-01	1.748E-01	1.659E-01	1.495E-01	8.884E-02	3.667E-02	9.591E-04	2.888E-08	4.325E-24
Eu-152	äS(j):		6.260E-01	5.942E-01	5.355E-01	3.182E-01	1.313E-01	3.435E-03	1.034E-07	1.549E-23
0Gd-152	Eu-152	2.792E-01	0.000E+00	1.093E-15	3.116E-15	1.060E-14	1.702E-14	2.141E-14	2.147E-14	2.127E-14
0Eu-154	Eu-154	1.000E+00	1.290E-01	1.192E-01	1.018E-01	4.630E-02	1.212E-02	4.869E-05	6.936E-12	7.570E-36
0Ni-63	Ni-63	1.000E+00	1.770E+00	1.757E+00	1.730E+00	1.604E+00	1.410E+00	8.294E-01	1.821E-01	9.030E-04
0Sr-90	Sr-90	1.000E+00	2.010E-01	1.962E-01	1.869E-01	1.467E-01	9.715E-02	1.781E-02	1.398E-04	5.997E-12

BRF(i) is the branch fraction of the parent nuclide.
0RESCALC.EXE execution time = 0.60 seconds

RESRAD INPUT PARAMETERS FOR THE 116-K-2 (WEST END) DEEP ZONE

Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

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

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	C-14	2.090E-06	2.090E-06	DCF2(2)
B-1	Co-60	2.190E-04	2.190E-04	DCF2(3)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(4)
B-1	Eu-152	2.210E-04	2.210E-04	DCF2(5)
B-1	Eu-154	2.860E-04	2.860E-04	DCF2(7)
B-1	Gd-152	2.430E-01	2.430E-01	DCF2(8)
B-1	Ni-63	6.290E-06	6.290E-06	DCF2(9)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(10)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(11)
B-1	Pu-240	4.290E-01	4.290E-01	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-232	1.640E+00	1.640E+00	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)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	C-14	2.090E-06	2.090E-06	DCF3(2)
D-1	Co-60	2.690E-05	2.690E-05	DCF3(3)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(4)
D-1	Eu-152	6.480E-06	6.480E-06	DCF3(5)
D-1	Eu-154	9.550E-06	9.550E-06	DCF3(7)
D-1	Gd-152	1.610E-04	1.610E-04	DCF3(8)
D-1	Ni-63	5.770E-07	5.770E-07	DCF3(9)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(10)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(11)
D-1	Pu-240	3.540E-03	3.540E-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-232	2.730E-03	2.730E-03	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-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	C-14 , plant/soil concentration ratio, dimensionless	5.500E+00	5.500E+00	RTF(2,1)
D-34	C-14 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.100E-02	3.100E-02	RTF(2,2)
D-34	C-14 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.200E-02	1.200E-02	RTF(2,3)
D-34				
D-34	Co-60 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(3,1)
D-34	Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(3,2)
D-34	Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(3,3)

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

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

Menu	Parameter	Current Value	Default	Parameter Name
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(4,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(4,3)
D-34				
D-34	Eu-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(5,1)
D-34	Eu-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(5,2)
D-34	Eu-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(5,3)
D-34				
D-34	Eu-154 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	Eu-154 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(7,2)
D-34	Eu-154 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(7,3)
D-34				
D-34	Gd-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	Gd-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(8,2)
D-34	Gd-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(8,3)
D-34				
D-34	Ni-63 , plant/soil concentration ratio, dimensionless	5.000E-02	5.000E-02	RTF(9,1)
D-34	Ni-63 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(9,2)
D-34	Ni-63 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-02	2.000E-02	RTF(9,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(10,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(10,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(10,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(11,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(11,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(11,3)
D-34				
D-34	Pu-240 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(12,1)
D-34	Pu-240 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(12,2)
D-34	Pu-240 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	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				
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-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				

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File : 116-K-2_Deep_Zone_West.RAD

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

0 Menu	Parameter	Current Value	Default	Parameter Name
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-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	C-14 , fish	5.000E+04	5.000E+04	BIOFAC(2,1)
D-5	C-14 , crustacea and mollusks	9.100E+03	9.100E+03	BIOFAC(2,2)
D-5				
D-5	Co-60 , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Co-60 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(3,2)
D-5				
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(4,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(4,2)
D-5				
D-5	Eu-152 , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Eu-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(5,2)
D-5				
D-5	Eu-154 , fish	5.000E+01	5.000E+01	BIOFAC(7,1)
D-5	Eu-154 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(7,2)
D-5				
D-5	Gd-152 , fish	2.500E+01	2.500E+01	BIOFAC(8,1)
D-5	Gd-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(8,2)
D-5				
D-5	Ni-63 , fish	1.000E+02	1.000E+02	BIOFAC(9,1)
D-5	Ni-63 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(9,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(10,2)
D-5				
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(11,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(11,2)
D-5				
D-5	Pu-240 , fish	3.000E+01	3.000E+01	BIOFAC(12,1)
D-5	Pu-240 , crustacea and mollusks	1.000E+02	1.000E+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)

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

Menu	Parameter	Current Value	Default	Parameter Name
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-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)

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Site-Specific Parameter Summary

Menu	Parameter		User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)		3.774E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)		7.300E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)		3.190E+02	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)		1.300E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)		3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)		1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)		3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)		1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)		not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)		not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g):	C-14	1.440E+00	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g):	Co-60	4.230E+00	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g):	Cs-137	1.170E+02	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g):	Eu-152	7.600E+01	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g):	Eu-154	7.200E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g):	Ni-63	6.500E+02	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g):	Pu-239	3.800E+00	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g):	Pu-240	9.000E-01	0.000E+00	---	S1(12)
R012	Initial principal radionuclide (pCi/g):	Sr-90	6.300E+00	0.000E+00	---	S1(14)
R012	Concentration in groundwater (pCi/L):	C-14	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L):	Co-60	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L):	Cs-137	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L):	Eu-152	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L):	Eu-154	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L):	Ni-63	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L):	Pu-239	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L):	Pu-240	not used	0.000E+00	---	W1(12)
R012	Concentration in groundwater (pCi/L):	Sr-90	not used	0.000E+00	---	W1(14)
R013	Cover depth (m)		4.600E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)		1.500E+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		4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity		2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)		2.500E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter		4.050E+00	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)		1.600E-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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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)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	1.500E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.530E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	1.250E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	4.600E+00	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	3.100E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.500E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	1.500E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for C-14				
R016	Contaminated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Co-60				
R016	Contaminated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.365E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.365E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Eu-154				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for Ni-63				
R016	Contaminated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.271E-04	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R016	Distribution coefficients for Pu-240				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCU(14,1)
R016	Saturated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.723E-04	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Gd-152				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)

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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)	2.500E+01	5.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	2.500E+01	5.000E+01	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	2.500E+01	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.723E-04	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.758E-05	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	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(15,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for daughter Th-232				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(16,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-05	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for daughter U-235				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(17)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(17,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.220E-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)	2.000E+00	5.000E+01	---	DCNUCC(18)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(18,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.220E-03	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	8.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	6.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.000E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	1.100E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	2.700E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	1.000E+02	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	3.600E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	1.970E+01	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	7.300E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.100E+01	FMEAT
R018	Contamination fraction of milk	-1	-1	0.100E+01	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI

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Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	2.000E-05	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	3.000E-02	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	2.000E-02	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	9.800E-01	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	3.000E-01	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	7.000E-07	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	1.000E-10	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	8.000E-01	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	2.000E-01	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	8.894E+01	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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	33	---	---	KYMAX

Summary of Pathway Selections

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

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	37742.00 square meters	C-14	1.440E+00
Thickness:	7.30 meters	Co-60	4.230E+00
Cover Depth:	4.60 meters	Cs-137	1.170E+02
		Eu-152	7.600E+01
		Eu-154	7.200E+00
		Ni-63	6.500E+02
		Pu-239	3.800E+00
		Pu-240	9.000E-01
		Sr-90	6.300E+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)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	1.700E-22	1.528E-22	1.239E-22	4.607E-23	1.168E-23	3.063E-06	3.257E-04	7.340E-04
M(t):	1.133E-23	1.019E-23	8.257E-24	3.071E-24	7.789E-25	2.042E-07	2.172E-05	4.893E-05

0Maximum TDOSE(t): 7.340E-04 mrem/yr at t = 1.000E+03 years

1RESRAD, Version 6.3 T< Limit = 0.5 year 12/15/2005 11:12 Page 14
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
0 Water Independent Pathways (Inhalation excludes radon)

0	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	1.395E-22	0.8207	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	8.532E-27	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	2.177E-23	0.1281	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	8.706E-24	0.0512	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.700E-22	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
0 Water Dependent Pathways

0	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.395E-22	0.8207
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.532E-27	0.0001
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.177E-23	0.1281
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.706E-24	0.0512
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.700E-22	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	1.238E-22	0.8097	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	8.455E-27	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	2.093E-23	0.1369	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	8.145E-24	0.0533	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.528E-22	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
0 Water Dependent Pathways

0 Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.238E-22	0.8097
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.455E-27	0.0001
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.093E-23	0.1369
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.145E-24	0.0533
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.528E-22	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	9.737E-23	0.7862	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	8.305E-27	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	1.934E-23	0.1562	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	7.131E-24	0.0576	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.239E-22	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
0 Water Dependent Pathways

0 Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.737E-23	0.7862
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.305E-27	0.0001
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.934E-23	0.1562
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.131E-24	0.0576
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.239E-22	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.300E+01 years
0 Water Independent Pathways (Inhalation excludes radon)

0	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	2.936E-23	0.6372	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	7.591E-27	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	1.304E-23	0.2830	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	3.667E-24	0.0796	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.607E-23	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.300E+01 years
0 Water Dependent Pathways

0	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.936E-23	0.6372
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.591E-27	0.0002
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.304E-23	0.2830
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.667E-24	0.0796
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.607E-23	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 11:12 Page 18
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
0 Water Independent Pathways (Inhalation excludes radon)

0	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	3.824E-24	0.3273	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	6.515E-27	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	6.669E-24	0.5708	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	1.184E-24	0.1013	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.168E-23	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
0 Water Dependent Pathways

0	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.824E-24	0.3273
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.515E-27	0.0006
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.669E-24	0.5708
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.184E-24	0.1013
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.168E-23	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 11:12 Page 19
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
0 Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	8.664E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	3.472E-27	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	4.220E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	1.126E-26	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.376E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
0 Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.664E-28	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.472E-27	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.220E-25	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.126E-26	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	3.204E-07	0.1046	2.588E-09	0.0008	0.000E+00	0.0000	3.527E-08	0.0115	2.748E-09	0.0009	1.403E-08	0.0046	3.750E-07	0.1225
Pu-240	2.296E-06	0.7497	1.854E-08	0.0061	0.000E+00	0.0000	2.527E-07	0.0825	1.955E-08	0.0064	1.006E-07	0.0328	2.687E-06	0.8775
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.616E-06	0.8544	2.113E-08	0.0069	0.000E+00	0.0000	2.880E-07	0.0940	2.230E-08	0.0073	1.146E-07	0.0374	3.063E-06	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T< Limit = 0.5 year 12/15/2005 11:12 Page 20
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
0 Water Independent Pathways (Inhalation excludes radon)

0	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	5.749E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	1.143E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	6.891E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
0 Water Dependent Pathways

0	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.749E-28	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.143E-28	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	3.446E-05	0.1058	2.802E-07	0.0009	0.000E+00	0.0000	3.810E-06	0.0117	3.286E-07	0.0010	1.515E-06	0.0046	4.040E-05	0.1240
Pu-240	2.435E-04	0.7477	1.971E-06	0.0061	0.000E+00	0.0000	2.692E-05	0.0826	2.117E-06	0.0065	1.079E-05	0.0331	2.853E-04	0.8760
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.780E-04	0.8535	2.251E-06	0.0069	0.000E+00	0.0000	3.073E-05	0.0943	2.445E-06	0.0075	1.230E-05	0.0378	3.257E-04	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 11:12 Page 21
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio- Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	4.392E-30	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.392E-30	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
0 Water Dependent Pathways

0 Radio- Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	8.353E-05	0.1138	7.002E-07	0.0010	0.000E+00	0.0000	9.237E-06	0.0126	1.165E-06	0.0016	3.512E-06	0.0048	9.815E-05	0.1337
Pu-240	5.427E-04	0.7394	4.392E-06	0.0060	0.000E+00	0.0000	5.999E-05	0.0817	4.720E-06	0.0064	2.405E-05	0.0328	6.358E-04	0.8663
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	6.262E-04	0.8532	5.092E-06	0.0069	0.000E+00	0.0000	6.923E-05	0.0943	5.885E-06	0.0080	2.756E-05	0.0375	7.340E-04	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 11:12 Page 22
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

0Parent (i)	Product (j)	Branch Fraction*	t=	DSR(j,t) (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Co-60	Co-60	1.000E+00		3.298E-23	2.926E-23	2.302E-23	6.941E-24	9.041E-25	2.048E-28	7.899E-39	0.000E+00
0Cs-137	Cs-137	1.000E+00		7.292E-29	7.227E-29	7.098E-29	6.488E-29	5.568E-29	2.967E-29	4.913E-30	9.077E-33
0Eu-152	Eu-152	7.208E-01		2.065E-25	1.985E-25	1.834E-25	1.237E-25	6.325E-26	4.002E-27	1.504E-30	1.546E-42
0Eu-152	Eu-152	2.792E-01		7.997E-26	7.688E-26	7.105E-26	4.790E-26	2.450E-26	1.550E-27	5.824E-31	5.998E-43
Eu-152	Gd-152	2.792E-01		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Eu-152	äDSR(j)			7.997E-26	7.688E-26	7.105E-26	4.790E-26	2.450E-26	1.550E-27	5.824E-31	5.998E-43
0Eu-154	Eu-154	1.000E+00		1.209E-24	1.131E-24	9.904E-25	5.093E-25	1.645E-25	1.564E-27	2.619E-33	0.000E+00
0Ni-63	Ni-63	1.000E+00		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Pu-239	Pu-239	1.000E+00		5.605E-45	5.605E-45	5.605E-45	7.006E-45	9.809E-45	4.204E-44	2.430E-42	3.330E-36
Pu-239	U-235	1.000E+00		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.865E-08	1.054E-05	2.442E-05
Pu-239	Pa-231	1.000E+00		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.585E-11	7.969E-08	1.217E-06
Pu-239	Ac-227	1.000E+00		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.487E-13	9.167E-09	1.878E-07
Pu-239	äDSR(j)			5.605E-45	5.605E-45	5.605E-45	7.006E-45	9.809E-45	9.869E-08	1.063E-05	2.583E-05
0Pu-240	Pu-240	1.000E+00		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pu-240	U-236	1.000E+00		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.986E-06	3.170E-04	7.065E-04
Pu-240	Th-232	1.000E+00		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.510E-16	1.595E-13	2.391E-12
Pu-240	Ra-228	1.000E+00		0.000E+00	2.803E-45	1.962E-44	9.543E-43	9.515E-42	1.306E-16	2.291E-13	3.723E-12
Pu-240	Th-228	1.000E+00		1.065E-43	3.087E-42	6.710E-41	7.620E-39	9.708E-38	2.096E-17	4.184E-14	6.996E-13
Pu-240	äDSR(j)			1.065E-43	3.090E-42	6.712E-41	7.621E-39	9.709E-38	2.986E-06	3.170E-04	7.065E-04
0Sr-90	Sr-90	1.000E+00		1.660E-38	1.650E-38	1.630E-38	1.534E-38	1.384E-38	9.043E-39	2.683E-39	3.816E-41

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ó 0.5 yr) daughters.

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 11:12 Page 23
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.500E+01 mrem/yr

0Nuclide

(i)	t= 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12
Co-60	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15
Cs-137	*8.701E+13	*8.701E+13	*8.701E+13	*8.701E+13	*8.701E+13	*8.701E+13	*8.701E+13	*8.701E+13
Eu-152	*1.765E+14	*1.765E+14	*1.765E+14	*1.765E+14	*1.765E+14	*1.765E+14	*1.765E+14	*1.765E+14
Eu-154	*2.639E+14	*2.639E+14	*2.639E+14	*2.639E+14	*2.639E+14	*2.639E+14	*2.639E+14	*2.639E+14
Ni-63	*5.916E+13	*5.916E+13	*5.916E+13	*5.916E+13	*5.916E+13	*5.916E+13	*5.916E+13	*5.916E+13
Pu-239	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	1.520E+08	1.411E+06	5.808E+05
Pu-240	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	5.023E+06	4.731E+04	2.123E+04
Sr-90	*1.365E+14	*1.365E+14	*1.365E+14	*1.365E+14	*1.365E+14	*1.365E+14	*1.365E+14	*1.365E+14

*At specific activity limit

0

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 1.000E+03 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
C-14	1.440E+00	0.000E+00	0.000E+00	*4.454E+12	0.000E+00	*4.454E+12
Co-60	4.230E+00	0.000E+00	3.298E-23	*1.131E+15	0.000E+00	*1.131E+15
Cs-137	1.170E+02	0.000E+00	7.292E-29	*8.701E+13	0.000E+00	*8.701E+13
Eu-152	7.600E+01	0.000E+00	2.864E-25	*1.765E+14	0.000E+00	*1.765E+14
Eu-154	7.200E+00	0.000E+00	1.209E-24	*2.639E+14	0.000E+00	*2.639E+14
Ni-63	6.500E+02	0.000E+00	0.000E+00	*5.916E+13	0.000E+00	*5.916E+13
Pu-239	3.800E+00	1.000E+03	2.583E-05	5.808E+05	2.583E-05	5.808E+05
Pu-240	9.000E-01	1.000E+03	7.065E-04	2.123E+04	7.065E-04	2.123E+04
Sr-90	6.300E+00	0.000E+00	0.000E+00	*1.365E+14	0.000E+00	*1.365E+14

*At specific activity limit

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 11:12 Page 24
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr							
		t=	0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Co-60	Co-60	1.000E+00	1.395E-22	1.238E-22	9.737E-23	2.936E-23	3.824E-24	8.664E-28	0.000E+00	0.000E+00
0Cs-137	Cs-137	1.000E+00	8.532E-27	8.455E-27	8.305E-27	7.591E-27	6.515E-27	3.472E-27	5.749E-28	0.000E+00
0Eu-152	Eu-152	7.208E-01	1.569E-23	1.508E-23	1.394E-23	9.398E-24	4.807E-24	3.042E-25	1.143E-28	0.000E+00
Eu-152	Eu-152	2.792E-01	6.078E-24	5.843E-24	5.400E-24	3.640E-24	1.862E-24	1.178E-25	0.000E+00	0.000E+00
Eu-152	äDOSE(j)		2.177E-23	2.093E-23	1.934E-23	1.304E-23	6.669E-24	4.220E-25	1.143E-28	0.000E+00
0Gd-152	Eu-152	2.792E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Eu-154	Eu-154	1.000E+00	8.706E-24	8.145E-24	7.131E-24	3.667E-24	1.184E-24	1.126E-26	0.000E+00	0.000E+00
0Ni-63	Ni-63	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Pu-239	Pu-239	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0U-235	Pu-239	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.749E-07	4.006E-05	9.281E-05
0Pa-231	Pu-239	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.742E-10	3.028E-07	4.626E-06
0Ac-227	Pu-239	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.605E-12	3.483E-08	7.138E-07
0Pu-240	Pu-240	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0U-236	Pu-240	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.687E-06	2.853E-04	6.358E-04
0Th-232	Pu-240	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.359E-16	1.436E-13	2.152E-12
0Ra-228	Pu-240	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.175E-16	2.062E-13	3.351E-12
0Th-228	Pu-240	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.887E-17	3.766E-14	6.297E-13
0Sr-90	Sr-90	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

BRF(i) is the branch fraction of the parent nuclide.

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Deep_Zone_West.RAD

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g							
		t=	0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00	1.440E+00	1.440E+00	1.439E+00	1.437E+00	1.433E+00	1.418E+00	1.375E+00	1.233E+00
0Co-60	Co-60	1.000E+00	4.230E+00	3.708E+00	2.850E+00	7.641E-01	8.152E-02	8.116E-06	2.988E-17	0.000E+00
0Cs-137	Cs-137	1.000E+00	1.170E+02	1.143E+02	1.091E+02	8.649E+01	5.826E+01	1.145E+01	1.097E-01	9.431E-09
0Eu-152	Eu-152	7.208E-01	5.478E+01	5.200E+01	4.686E+01	2.785E+01	1.150E+01	3.012E-01	9.106E-06	1.383E-21
Eu-152	Eu-152	2.792E-01	2.122E+01	2.014E+01	1.815E+01	1.079E+01	4.454E+00	1.167E-01	3.527E-06	5.358E-22
Eu-152	äS(j):		7.600E+01	7.215E+01	6.502E+01	3.864E+01	1.595E+01	4.179E-01	1.263E-05	1.919E-21
0Gd-152	Eu-152	2.792E-01	0.000E+00	1.327E-13	3.782E-13	1.286E-12	2.067E-12	2.596E-12	2.592E-12	2.531E-12
0Eu-154	Eu-154	1.000E+00	7.200E+00	6.654E+00	5.684E+00	2.585E+00	6.771E-01	2.723E-03	3.895E-10	4.311E-34
0Ni-63	Ni-63	1.000E+00	6.500E+02	6.452E+02	6.356E+02	5.900E+02	5.199E+02	3.087E+02	6.960E+01	3.789E-01
0Pu-239	Pu-239	1.000E+00	3.800E+00	3.800E+00	3.799E+00	3.797E+00	3.793E+00	3.776E+00	3.729E+00	3.568E+00
0U-235	Pu-239	1.000E+00	0.000E+00	3.736E-09	1.117E-08	4.763E-08	1.069E-07	3.189E-07	7.121E-07	1.066E-06
0Pa-231	Pu-239	1.000E+00	0.000E+00	3.955E-14	3.551E-13	6.588E-12	3.439E-11	3.523E-10	2.548E-09	1.499E-08
0Ac-227	Pu-239	1.000E+00	0.000E+00	4.164E-16	1.105E-14	8.250E-13	8.829E-12	2.012E-10	2.125E-09	1.440E-08
0Pu-240	Pu-240	1.000E+00	9.000E-01	8.999E-01	8.996E-01	8.984E-01	8.962E-01	8.875E-01	8.629E-01	7.822E-01
0U-236	Pu-240	1.000E+00	0.000E+00	2.660E-08	7.953E-08	3.389E-07	7.603E-07	2.261E-06	5.002E-06	7.173E-06
0Th-232	Pu-240	1.000E+00	0.000E+00	6.565E-19	5.895E-18	1.094E-16	5.719E-16	5.885E-15	4.312E-14	2.672E-13
0Ra-228	Pu-240	1.000E+00	0.000E+00	2.561E-20	6.512E-19	4.041E-17	3.423E-16	5.024E-15	4.109E-14	2.641E-13
0Th-228	Pu-240	1.000E+00	0.000E+00	2.174E-21	1.468E-19	2.422E-17	2.749E-16	4.745E-15	4.042E-14	2.632E-13
0Sr-90	Sr-90	1.000E+00	6.300E+00	6.150E+00	5.861E+00	4.607E+00	3.060E+00	5.672E-01	4.598E-03	2.205E-10

BRF(i) is the branch fraction of the parent nuclide.
0RESCALC.EXE execution time = 2.30 seconds

RESRAD INPUT PARAMETERS FOR THE 116-K-2 OVERBURDEN

Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Overburden_West.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

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

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Eu-152	2.210E-04	2.210E-04	DCF2(1)
B-1	Gd-152	2.430E-01	2.430E-01	DCF2(3)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Eu-152	6.480E-06	6.480E-06	DCF3(1)
D-1	Gd-152	1.610E-04	1.610E-04	DCF3(3)
D-34	Food transfer factors:			
D-34	Eu-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Eu-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(1,2)
D-34	Eu-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Gd-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(3,1)
D-34	Gd-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(3,2)
D-34	Gd-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(3,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Eu-152 , fish	5.000E+01	5.000E+01	BIOFAC(1,1)
D-5	Eu-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Gd-152 , fish	2.500E+01	2.500E+01	BIOFAC(3,1)
D-5	Gd-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(3,2)

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Overburden_West.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)	8.676E+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)	1.220E+02	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)	1.300E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Eu-152	1.700E-01	0.000E+00	---	S1(1)
R012	Concentration in groundwater (pCi/L): Eu-152	not used	0.000E+00	---	W1(1)
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	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.050E+00	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)	1.600E-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
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	1.500E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.530E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	1.250E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	4.600E+00	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS

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Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Unsat. zone 1, thickness (m)	1.040E+01	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.500E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	1.500E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Gd-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.316E-05	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
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	8.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	6.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.000E-01	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)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	1.100E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	2.700E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	1.000E+02	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	3.600E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	1.970E+01	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	7.300E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.434E+00	FMEAT
R018	Contamination fraction of milk	-1	-1	0.434E+00	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	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)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	33	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
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:	8676.00 square meters	Eu-152	1.700E-01
Thickness:	4.60 meters		
Cover Depth:	0.00 meters		

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	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	7.396E-01	7.021E-01	6.326E-01	3.759E-01	1.552E-01	4.058E-03	1.222E-07	2.612E-16
M(t):	4.930E-02	4.680E-02	4.218E-02	2.506E-02	1.034E-02	2.705E-04	8.146E-09	1.742E-17

0Maximum TDOSE(t): 7.396E-01 mrem/yr at t = 0.000E+00 years

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Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	7.393E-01	0.9997	1.457E-06	0.0000	0.000E+00	0.0000	1.513E-04	0.0002	2.247E-05	0.0000	5.939E-07	0.0000	6.269E-05	0.0001
Total	7.393E-01	0.9997	1.457E-06	0.0000	0.000E+00	0.0000	1.513E-04	0.0002	2.247E-05	0.0000	5.939E-07	0.0000	6.269E-05	0.0001

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.396E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.396E-01	1.0000

*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 13:25 Page 10
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Overburden_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	7.018E-01	0.9997	1.383E-06	0.0000	0.000E+00	0.0000	1.436E-04	0.0002	2.133E-05	0.0000	5.638E-07	0.0000	5.951E-05	0.0001
Total	7.018E-01	0.9997	1.383E-06	0.0000	0.000E+00	0.0000	1.436E-04	0.0002	2.133E-05	0.0000	5.638E-07	0.0000	5.951E-05	0.0001

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.021E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.021E-01	1.0000

*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 13:25 Page 11
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Overburden_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	6.324E-01	0.9997	1.246E-06	0.0000	0.000E+00	0.0000	1.294E-04	0.0002	1.922E-05	0.0000	5.080E-07	0.0000	5.362E-05	0.0001
Total	6.324E-01	0.9997	1.246E-06	0.0000	0.000E+00	0.0000	1.294E-04	0.0002	1.922E-05	0.0000	5.080E-07	0.0000	5.362E-05	0.0001

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
0 Water Dependent Pathways

0 Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.326E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.326E-01	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 13:25 Page 12
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Overburden_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.300E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	3.758E-01	0.9997	7.404E-07	0.0000	0.000E+00	0.0000	7.689E-05	0.0002	1.142E-05	0.0000	3.019E-07	0.0000	3.186E-05	0.0001
Total	3.758E-01	0.9997	7.404E-07	0.0000	0.000E+00	0.0000	7.689E-05	0.0002	1.142E-05	0.0000	3.019E-07	0.0000	3.186E-05	0.0001

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.300E+01 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.759E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.759E-01	1.0000

*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 13:25 Page 13
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Overburden_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	1.551E-01	0.9997	3.056E-07	0.0000	0.000E+00	0.0000	3.174E-05	0.0002	4.714E-06	0.0000	1.246E-07	0.0000	1.315E-05	0.0001
Total	1.551E-01	0.9997	3.056E-07	0.0000	0.000E+00	0.0000	3.174E-05	0.0002	4.714E-06	0.0000	1.246E-07	0.0000	1.315E-05	0.0001

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.552E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.552E-01	1.0000

*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T< Limit = 0.5 year 12/15/2005 13:25 Page 14
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Overburden_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	4.057E-03	0.9997	7.993E-09	0.0000	0.000E+00	0.0000	8.300E-07	0.0002	1.233E-07	0.0000	3.259E-09	0.0000	3.440E-07	0.0001
Total	4.057E-03	0.9997	7.993E-09	0.0000	0.000E+00	0.0000	8.300E-07	0.0002	1.233E-07	0.0000	3.259E-09	0.0000	3.440E-07	0.0001

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
0 Water Dependent Pathways

0 Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.058E-03	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.058E-03	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 13:25 Page 15
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Overburden_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio- Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Eu-152	1.222E-07	0.9997	2.407E-13	0.0000	0.000E+00	0.0000	2.499E-11	0.0002	3.713E-12	0.0000	9.812E-14	0.0000	1.036E-11	0.0001
Total	1.222E-07	0.9997	2.407E-13	0.0000	0.000E+00	0.0000	2.499E-11	0.0002	3.713E-12	0.0000	9.812E-14	0.0000	1.036E-11	0.0001

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years
0 Water Dependent Pathways

0 Radio- Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.222E-07	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.222E-07	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 13:25 Page 16
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Overburden_West.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	1.830E-23	0.0000	5.586E-17	0.2138	0.000E+00	0.0000	1.311E-16	0.5017	1.947E-17	0.0745	5.146E-19	0.0020	5.432E-17	0.2079
Total	1.830E-23	0.0000	5.586E-17	0.2138	0.000E+00	0.0000	1.311E-16	0.5017	1.947E-17	0.0745	5.146E-19	0.0020	5.432E-17	0.2079

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years
0 Water Dependent Pathways

0 Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.612E-16	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.612E-16	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 13:25 Page 17
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Overburden_West.RAD

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

0Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Eu-152	Eu-152	7.208E-01	3.136E+00	2.977E+00	2.682E+00	1.594E+00	6.579E-01	1.721E-02	5.181E-07	7.760E-23
0Eu-152	Eu-152	2.792E-01	1.215E+00	1.153E+00	1.039E+00	6.174E-01	2.548E-01	6.665E-03	2.007E-07	3.006E-23
Eu-152	Gd-152	2.792E-01	3.982E-17	1.168E-16	2.591E-16	7.856E-16	1.238E-15	1.547E-15	1.551E-15	1.537E-15
Eu-152	äDSR(j)		1.215E+00	1.153E+00	1.039E+00	6.174E-01	2.548E-01	6.665E-03	2.007E-07	1.537E-15

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ó 0.5 yr) daughters.
0

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.500E+01 mrem/yr

0Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Eu-152	3.448E+00	3.632E+00	4.031E+00	6.783E+00	1.643E+01	6.284E+02	2.087E+07	*1.765E+14

*At specific activity limit
0

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Eu-152	1.700E-01	0.000E+00	4.350E+00	3.448E+00	4.350E+00	3.448E+00

1RESRAD, Version 6.3 T« Limit = 0.5 year 12/15/2005 13:25 Page 18
Summary : 116-K-2 Trench (West End) Cleanup Verification RESRAD Calculation
File : 116-K-2_Overburden_West.RAD

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr							
		t=	0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Eu-152	Eu-152	7.208E-01	5.331E-01	5.060E-01	4.560E-01	2.710E-01	1.118E-01	2.925E-03	8.808E-08	1.319E-23
Eu-152	Eu-152	2.792E-01	2.065E-01	1.960E-01	1.766E-01	1.050E-01	4.332E-02	1.133E-03	3.412E-08	5.110E-24
Eu-152	äDOSE(j)		7.396E-01	7.021E-01	6.326E-01	3.759E-01	1.552E-01	4.058E-03	1.222E-07	1.830E-23
0Gd-152	Eu-152	2.792E-01	6.769E-18	1.985E-17	4.405E-17	1.335E-16	2.105E-16	2.629E-16	2.636E-16	2.612E-16

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g							
		t=	0.000E+00	1.000E+00	3.000E+00	1.300E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Eu-152	Eu-152	7.208E-01	1.225E-01	1.163E-01	1.048E-01	6.228E-02	2.571E-02	6.724E-04	2.025E-08	3.033E-24
Eu-152	Eu-152	2.792E-01	4.746E-02	4.506E-02	4.060E-02	2.413E-02	9.958E-03	2.604E-04	7.842E-09	1.175E-24
Eu-152	äS(j):		1.700E-01	1.614E-01	1.454E-01	8.641E-02	3.567E-02	9.328E-04	2.809E-08	4.207E-24
0Gd-152	Eu-152	2.792E-01	0.000E+00	2.968E-16	8.461E-16	2.877E-15	4.623E-15	5.814E-15	5.831E-15	5.777E-15

BRF(i) is the branch fraction of the parent nuclide.
0RESCALC.EXE execution time = 0.29 seconds

CALCULATION BRIEF EXCERPTS

DISCLAIMER FOR CALCULATIONS

The attached calculations have been generated for a specific purpose and task. Use of these calculations by persons who do not have access to all pertinent facts may lead to incorrect conclusions and/or results. Before applying these calculations to your work, the underlying basis, rationale, and other pertinent information relevant to these calculations must be thoroughly reviewed with appropriate Washington Closure Hanford officials or other authorized personnel. Washington Closure Hanford is not responsible for the use of a calculation not under its direct control.

CALCULATION BRIEFS

The following calculation briefs have been prepared in accordance with WCH-DE-01, *Design Engineering Procedures Manual*, EDPI-4.37-01, "Project Calculations," Washington Closure Hanford, Richland, Washington.

116-K-2 (East End) Trench Shallow & Deep Zone Sampling Plan, Calculation No. 0100K-CA-V0057, Rev. 0, Washington Closure Hanford, Richland, Washington.

116-K-2 Mile Long Trench Variance Calculation, Calculation No. 0100K-CA-V0055, Rev. 0, Washington Closure Hanford, Richland, Washington.

116-K-2 Trench (East End) Cleanup Verification 95% UCL Calculations, Calculation No. 0100K-CA-V0056, Rev. 1, Washington Closure Hanford, Richland, Washington.

116-K-2 Trench (East End) RESRAD Calculation, Calculation No. 0100K-CA-V0058, Rev. 0, Washington Closure Hanford, Richland, Washington.

116-K-2 (West End) Trench Shallow, Deep Zone and Overburden Sampling Plan, Calculation No. 0100K-CA-V0062, Rev. 0, Washington Closure Hanford, Richland, Washington.

116-K-2 Mile Long Trench Variance Calculation (Phase 2, West), Calculation No. 0100K-CA-V0064, Rev. 0, Washington Closure Hanford, Richland, Washington.

116-K-2 Overburden Variance Calculation, Calculation No. 0100K-CA-V0065, Rev. 0, Washington Closure Hanford, Richland, Washington.

116-K-2 Trench (West End) Cleanup Verification 95% UCL Calculations, Calculation No. 0100K-CA-V0061, Rev. 0, Washington Closure Hanford, Richland, Washington.

116-K-2 Trench (West End) RESRAD Calculation, Calculation No. 0100K-CA-V0063, Rev. 0, Washington Closure Hanford, Richland, Washington.

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

CALCULATION COVER SHEET

Project Title:	116-K-2 (East End) Trench Sample Design	**Job No.**	14655
Area	100-K		
Discipline	Environmental Engineering	**Calc. No.**	0100K-CA-V0057
Subject	116-K-2 (East End) Trench Shallow & Deep Zone Sampling Plan		
Computer Program	Excel	**Program No.**	Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These documents should be used in 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 = 2 Shts Total = 7 Shts	G. Cruz 10/05/05	C.A. Bentz 10/05/05	R.T. Coffman 10/13/05	S.W. Callison 10-13-05	10-13-05

SUMMARY OF REVISIONS	

*Obtain Calc. No. from DIS

DE01437.03 (12/09/2004)

Washington Closure Hanford

CALCULATION SHEET

Originator G. Cruz **Date** 10/5/2005 **Calc. No.** 0100K-CA-V0057 **Rev. No.** 0

Project 116-K-2 (East End) Trench Sample Design **Job No.** 14655 **Checked** CAB **Date** 10/5/05

Subject 116-K-2 (East End) Trench Shallow & Deep Zone Sampling Plan **Sheet No.** 1 of 2

Problem:	Calculate and display required sampling nodes in concurrence with 100 Area SAP DOE/RL-96-22 Rev. 3 for verification and closure.			
Given:	-SAP (DOE/RL-96-22 Rev. 3) and IG (0100X-IG-G0001 Rev. 5) requirements			
	-Shallow Sampling Area (Surface area of each zone determined from CAD program, Attachment 3, Sht 1 of 2, CAD file 1K:100505A, 116-K-2 (East End) Trench Shallow Zone Sampling Plan)			
	-Deep Zone Sampling Area (Surface area of each zone determined from CAD program, Attachment 3, Sht 2 of 2, CAD file 1K:100505B, 116-K-2 (East End) Trench Deep Zone Sampling Plan)			
SAP and IG Requirements:				
Shallow Zone	-Develop a 16 node sampling grid for the sampling area			
	-Use appendix A of the IG to determine which six of the sixteen will be sampled to collect variance and clean up verification samples			
Overburden:	-Develop a 16 node sampling grid for the sampling area			
	-Use appendix A of the IG to determine which six of the sixteen will be sampled to collect variance and clean up verification samples			
Deep Zone:	-Develop a 16 node sampling grid for the sampling area			
	-Use appendix A of the IG to determine which four of the sixteen will be sampled to collect variance/verification samples			
Determination of Shallow Zone Sampling Grid:				
Shallow Zone Sampling Grid Area determined from Table 5-1, IG Attachment 2, Number of Decision Subunits Based on Area (Converted to Sq Meters)				
Total Area:		8653.26	m^2	
Area of Decision Subunits (total area 2 subunits)		4326.63	m^2	
Decision Subunit divided into 4 Sampling Areas:		1081.65	m^2	
Sampling Areas divided into a 16 node grid (node numbers 1-16):		67.60	m^2	
Nodes to be Sampled (as determined from Attachment 1, Table A-1, Sample Grid Point Lookup Table)	See Attachment 3, Sht 1 of 2, 116-K-2 (East End) Trench Shallow Zone Sampling Plan, for Sample Location Table			

Washington Closure Hanford

CALCULATION SHEET

Originator G. Cruz **Date** 10/5/2005 **Calc. No.** 0100K-CA-V0057 **Rev. No.** 0

Project 116-K-2 (East End) Trench Sample Design **Job No.** 14655 **Checked** AB **Date** 10/5/05

Subject 116-K-2 (East End) Trench Shallow & Deep Zone Sampling Plan **Sheet No.** 2 of 2

Determination of Deep Zone Sampling Grid:

Deep Zone Sampling Grid Area determined from Table 5-1, IG

Attachment 2, Number of Decision Subunits Based on Area (Converted to Sq Meters)

Total Area:	9140.52	m^2
Area of Decision Subunits (total area 2 subunits)	4570.26	m^2
Decision Subunits divided into 3 Sampling Areas:	1523.42	m^2
Sampling Areas divided into a 16 node grid (node numbers 1-16):	95.21	m^2

Nodes to be Sampled (as determined from Attachment 1, Table A-1, Sample Grid Point Lookup Table)

See Attachment 3, Sht 1 of 2, 116-K-2 (East End) Trench Deep Zone Sampling Plan, for Sample Location Table

Washington Closure Hanford

Originator	G. Cruz	**Date**	10/5/2005	**Calc. No.** 0100K-CA-V0057	**Rev. No.** 0		
Project	116-K-2 (East End) Trench Sample Design	**Job No.**	14655	**Checked** CAB	**Date**	10/5/05	
Subject	116-K-2 (East End) Trench Shallow & Deep Zone Sampling Plan			**Sheet No** 1 of 1			

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
Variance/Verification	3	6	1	4	5	1	3	3	4	16
Variance/Verification	4	7	11	3	15	15	5	13	10	10
Variance/Verification	16	3	2	7	7	10	11	4	3	14
Variance/Verification	10	15	4	12	1	13	4	8	16	4
Variance	2	14	5	9	13	12	8	2	14	8
Variance	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 northwestern-most node, then number consecutively left to right.

Washington Closure Hanford

Originator G. Cruz Date 10/5/2005 Calc. No. 0100K-CA-V0057 Rev. No. 0

Project 116-K-2 (East End) Trench Sample Design Job No. 14655 Checked CAB Date 10/5/05

Subject 116-K-2 (East End) Trench Shallow & Deep Zone Sampling Plan Sheet No. 1 of 1

ATTACHMENT 2

Number of Decision Subunits Based on Area.

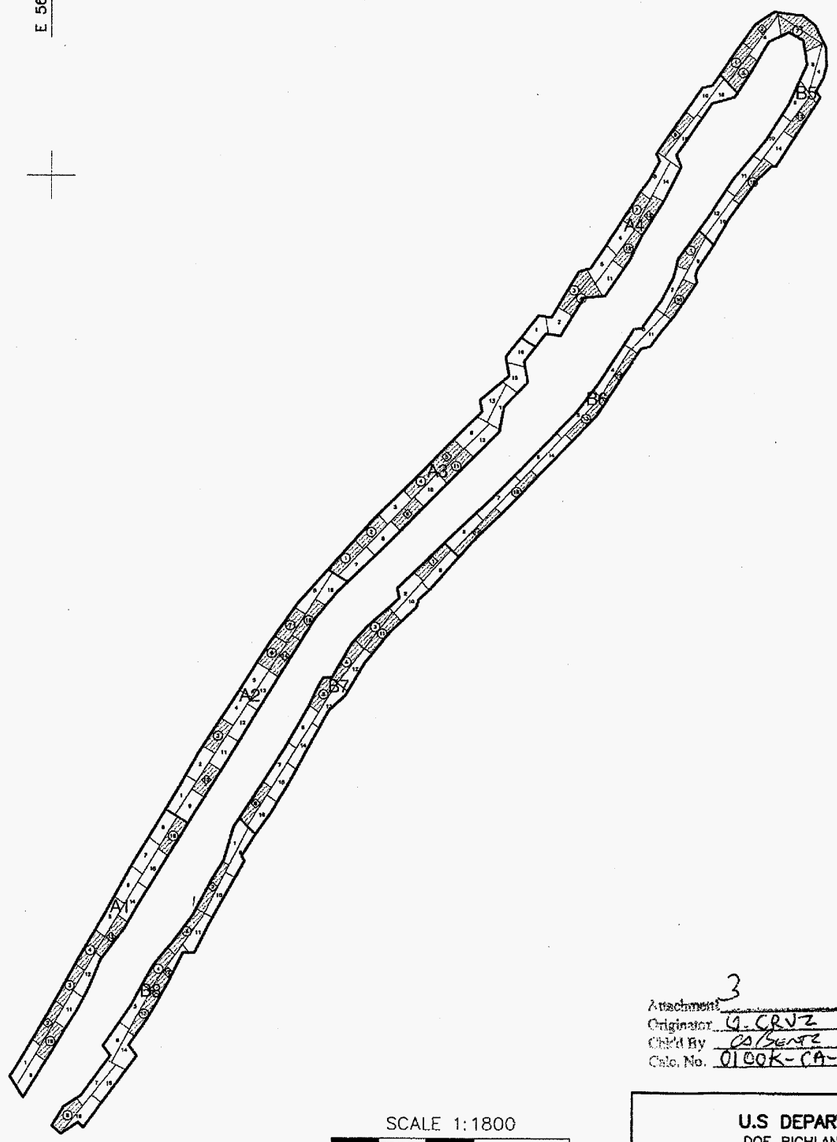
Area of Primary Decision Unit (m2)	Number of Subunits
<1,394	1
>1,394 to <2,326	2
>2,326 to <3,256	3
>3,256 to <4,186	4
>4,186 to <9,303	2
>9,303 to <13,024	3
>13,024 to <16,745	4
>16,745 to <20,466	5
>20,466	ROUNDa (Area/3,720)

a ROUND is an integer rounding function.

1K:100505A

E 569900

N 148150



SCALE 1:1800

18 0 18 36 72 meters

NOTES

1. SHALLOW ZONE NODE AREAS ARE APPROXIMATELY 67.60 SQUARE METERS.
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. AREAS B5, B6, B7 AND B8 WITHIN DECISION SUBUNIT 2.

LEGEND

VARIANCE AND VERIFICATION SAMPLING NODE

VERIFICATION SAMPLING NODE

SAMPLE LOCATION TABLE

DECISION SUBUNIT	SAMPLING AREA	SAMPLE NODE	NORTHING	EASTING
1	A1	S-A1-2	147824.98	569899.86
		S-A1-3	147839.32	569908.22
		S-A1-4	147852.78	569916.02
		S-A1-10	147818.13	569900.82
		S-A1-13	147857.85	569923.98
		S-A1-16	147896.67	569947.35
	A2	S-A2-3	147935.33	569964.27
		S-A2-6	147967.15	569984.49
		S-A2-7	147977.80	569991.42
		S-A2-10	147918.36	569959.93
		S-A2-14	147966.03	569989.47
		S-A2-15	147979.68	569998.38
	A3	S-A3-1	148003.49	570012.27
		S-A3-2	148013.49	570021.97
		S-A3-4	148032.90	570040.79
		S-A3-5	148042.34	570050.60
		S-A3-9	148020.40	570035.79
		S-A3-11	148038.81	570054.15
	A4	S-A4-3	148106.68	570098.06
		S-A4-4	148103.61	570100.78
		S-A4-7	148137.78	570121.78
		S-A4-9	148166.44	570136.48
		S-A4-12	148123.03	570118.54
		S-A4-13	148135.61	570126.50
2	B5	S-B5-1	148194.20	570159.35
		S-B5-2	148207.07	570169.20
		S-B5-5	148190.24	570162.13
		S-B5-7	148206.41	570182.42
		S-B5-13	148173.77	570183.60
		S-B5-15	148148.60	570165.94
	B6	S-B6-1	148122.25	570142.52
		S-B6-10	148103.20	570138.40
		S-B6-12	148073.90	570115.32
		S-B6-13	148057.20	570102.80
		S-B6-15	148028.92	570076.64
		S-B6-16	148013.45	570062.07
	B7	S-B7-1	148002.39	570045.64
		S-B7-3	147977.27	570023.63
		S-B7-4	147963.77	570012.80
		S-B7-5	147951.43	570004.11
		S-B7-8	147909.32	569978.47
		S-B7-11	147974.70	570026.33
	B8	S-B8-2	147877.17	569962.42
		S-B8-3	147860.15	569952.58
		S-B8-4	147845.79	569941.96
		S-B8-8	147790.06	569907.54
		S-B8-12	147844.53	569945.56
		S-B8-13	147828.82	569936.55

Attachment 3 Sheet No. 1 of 2
Originator G. CRUZ Date 10/05/05
Chkd By CA/SENTZ Date 10/05/05
Calc. No. 0100K-CA-V0057 Rev. No. 0

ATTACHMENT 3

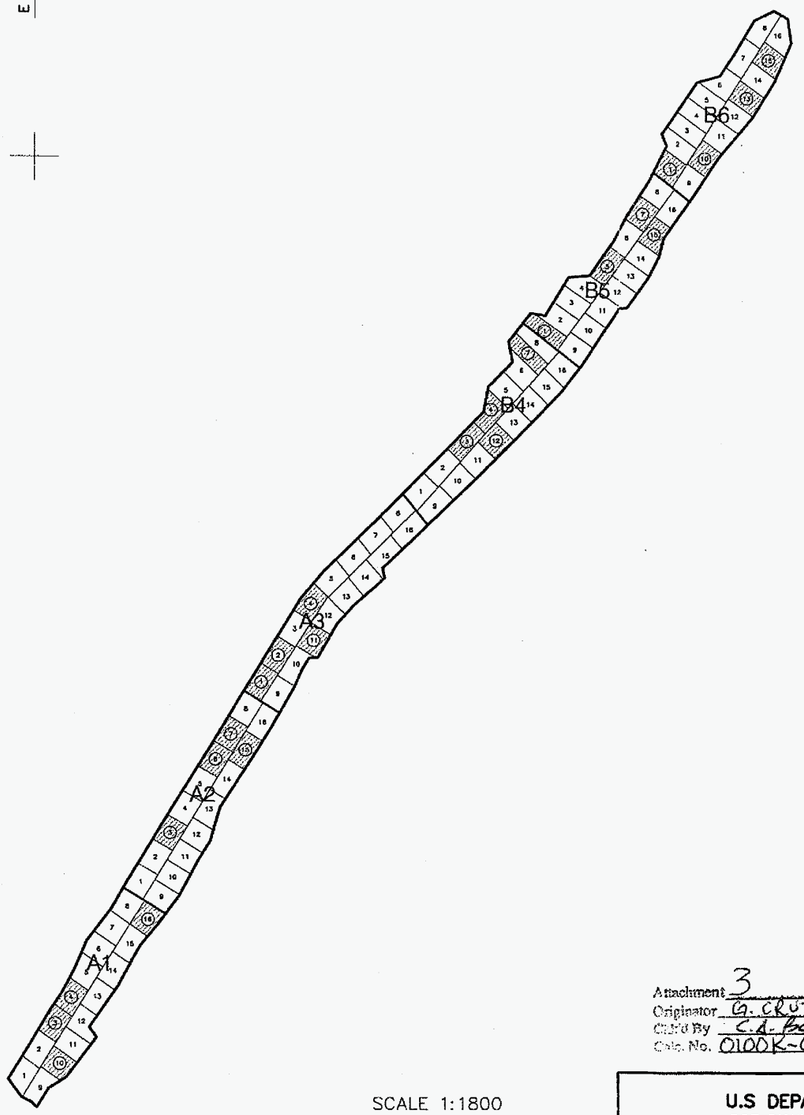
U.S DEPARTMENT OF ENERGY
DOE RICHLAND OPERATIONS OFFICE
RIVER CORRIDOR CLOSURE CONTRACT

100 K AREA
116-K-2 (EAST END) TRENCH
SHALLOW ZONE SAMPLING PLAN

1K:100505B

E 569900

N 148150



SCALE 1:1800

18 0 18 36 72 meters

NOTES

1. DEEP ZONE NODE AREAS ARE APPROXIMATELY 95.21 SQUARE METERS.
2. SAMPLES ARE TAKEN FROM THE APPROXIMATE CENTER OF EACH NODE.
3. THE DEEP ZONE CONSISTS OF SAMPLING AREAS A1, A2, AND A3 WITHIN DECISION SUBUNIT 1. AREAS B4, B5, AND B6 WITHIN DECISION SUBUNIT 2.

LEGEND

VARIANCE AND VERIFICATION SAMPLING NODE

VERIFICATION SAMPLING NODE

SAMPLE LOCATION TABLE

DECISION SUBUNIT	SAMPLING AREA	SAMPLE NODE	NORTHING	EASTING
1	A1	D-A1-3	147818.01	569908.35
		D-A1-4	147827.85	569914.38
		D-A1-10	147802.83	569910.11
		D-A1-16	147857.45	569943.10
	A2	D-A2-3	147890.67	569951.45
		D-A2-6	147918.98	569968.53
		D-A2-7	147928.59	569974.34
		D-A2-15	147922.49	569979.86
	A3	D-A3-1	147948.60	569985.79
		D-A3-2	147958.87	569992.26
		D-A3-4	147978.57	570004.64
		A3-11	147964.54	570005.75
2	B4	B4-3	148040.53	570063.71
		D-B4-4	148052.75	570072.75
		D-B4-7	148074.54	570086.48
		D-B4-12	148040.87	570074.74
	B5	D-B5-1	148083.09	570092.70
		D-B5-5	148108.11	570116.38
		D-B5-7	148128.17	570129.74
		D-B5-15	148120.26	570134.23
	B6	D-B6-1	148145.36	570140.07
		D-B6-10	148149.47	570153.28
		D-B6-13	148172.41	570168.90
		D-B6-15	148186.90	570177.16

Attachment 3 Sheet No. 2 of 2
Originator G. CRUZ Date 10/05/05
Checked By C.A. PEARZ Date 10/05/05
Calc. No. 0100K-CA-V0057 Rev. No. 0

ATTACHMENT 3

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

100 K AREA
116-K-2 (EAST END) TRENCH
DEEP ZONE SAMPLING PLAN

CALCULATION COVER SHEET

Project Title:	100-K Remedial Action	**Job No.**	**14655**
Area	100-K		
Discipline	Environmental	***Calc. No.**	0100K-CA-V0055
Subject	116-K-2 Mile Long Trench Variance Calculation		
Computer Program	Excel	**Program No.**	Excel 2003

Committed Calculation **X** **Preliminary** **Superseded**

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover - 1 Summary - 1 Calculations - 1 Total - 3	R. T. Coffman R.T. Coffman 10/13/05	S. W. Callison SW Calle 10-13-05	M. A. Buckmaster 10/13/05	M. A. Buckmaster	10/13/05

SUMMARY OF REVISIONS

Scanned	Rev.	Date	Bar Code No.

* Obtain Calc. No. from DIS.

CALCULATION SHEET

Washington Closure Hanford

Originator	R. T. Coffman	Date	10/11/2005	Calc. No.	0100K-CA-V0055	Rev. No.	0
Project	100-K Remedial Action	Job No.	14655	Checked	S. W. Callison SWC	Date	10-13-05
Subject	116-K-2 Mile Long Trench Variance Calculation					Sheet No.	1 of 2

Conclusion:
The required number of samples calculated (1, 2, and 3 samples) for each decision sub-unit is less than the default number (4 samples) specified in the DOE/RL-96-22, Rev 4. Therefore, the default number of samples will be collected from each shallow zone decision sub-unit.

Problem:
Calculate the number of close out samples required for 116-K-2 Mile Long Trench Shallow Unit verification sampling as required in "100 Area Remedial Action Sampling and Analysis Plan" (DOE/RL-96-22, Rev 4) and "Instruction Guide for the Remediation of 100 Areas Waste Sites" (0100X-IG-G0001, Rev 5).

Given:
1) Sample locations for the 116-K-2 Mile Long Trench Shallow Decision Unit are identified on the 116-K-2 Mile Long Trench Shallow Sample Design, Calculation number 0100K-CA-V0057, Rev. 0.
2) Lookup values from DOE/RL-96-22, Rev 4.
3) Sample Design requirements from DOE/RL-96-22, Rev 4 and 0100X-IG-G0001, Rev 5.
4) Field sampling information from sampling logbook EL-1572-3.

Solution:
Calculation methodology is described in Appendix A of DOE/RL-96-22, Rev 4. Data from attached worksheets are used to calculate the required number of closeout samples. Variance calculation is based on the same three isotopes used to develop the statistical approach in DOE/RL-96-22, Rev 4. The statistical design is based on the premise that these isotopes are the predominant components of the contamination and are representative of the contamination distribution.

Sheet No.	Contents	Topic
1	Calc. Summary	Summary of Calc Brief
2	Shallow Zone	Required Number of Samples Calculation

CALCULATION SHEET

Washington Closure Hanford

Originator	R. T. Coffman	Date	10/11/2005	Calc. No.	0100K-CA-V0055	Rev. No.	0
Project	100-K Remedial Action	Job No.	14655	Checked	S. W. Callison SWC	Date	10-13-05
Subject	116-K-2 Mile Long Trench Variance Calculation					Sheet No.	2 of 2

Statistical Evaluation of Analytical Data

The required number of samples resulting from the calculation is highlighted at the bottom of the page.
Each value is reflective of the specific analyte evaluated.
The highest value of the three evaluations is used to determine the required number of samples as compared against the default of four.
Sample locations are from Calculation 0100K-CA-V0057.
Mean, Standard Deviation, *t*, and Number of Samples formulas are from DOE/RL-96-22, Appendix A.

Decision Unit: 116-K-2 Trench Shallow Zone
Samples values from GEA analysis
Sample Areas **A & B**

Sample #	Sample Date	Location	Constituent: Cobalt-60 pCi/g	Q	Cesium-137 pCi/g	Q	Europium-152 pCi/g	Q
Look-up Value (HT) ==========>			1.4		6.2		3.3	
J03CR9	7/6/2005	S-A1-2	0.063	U	0.343		0.615	
*J103C1	09/06/05	S-A1-3	0.481		0.302		0.332	
J03CT1	7/6/2005	S-A1-4	0.062	U	0.22		0.328	
*J03W02	8/2/05	S-A1-10	0.11	U	0.071	U	0.24	U
J03CT3	7/6/2005	S-A1-13	0.078	U	1.17		3.54	
J03CT4	7/6/2005	S-A1-16	0.051	U	0.35		0.321	
J03CT5	7/19/2005	S-A2-3	0.029	U	0.0527	U	0.11	U
J03CT6	7/19/2005	S-A2-6	0.035	U	0.036	U	0.12	U
J03CT7	7/19/2005	S-A2-7	0.046	U	0.228		0.753	
J03CT8	7/19/2005	S-A2-10	0.099	U	0.425		1.21	
J03CT9	7/19/2005	S-A2-14	0.095	U	0.269		0.566	
*J03W03	8/2/05	S-A2-15	0.64		0.667		2.3	U
*J03W04	8/2/05	S-A3-1	0.14	U	0.18		0.773	
J03CV2	7/6/2005	S-A3-2	0.042	U	0.051	U	0.17	U
J03CV3	7/6/2005	S-A3-4	0.056	U	0.082	U	0.14	U
J03CV4	7/6/2005	S-A3-5	0.06	U	0.061	U	0.19	U
*J03W05	8/2/05	S-A3-9	0.53		0.153		0.23	U
*J03W06	8/2/05	S-A3-11	0.441		0.45		1.13	
J03CV7	7/20/2005	S-A4-3	0.058	U	0.062	U	0.2	U
J03CV8	7/20/2005	S-A4-4	0.066	U	0.316		0.252	
J03CV9	7/20/2005	S-A4-7	0.198		2.61		6.22	
J03CW0	7/20/2005	S-A4-9	0.046	U	0.056	U	0.17	U
J03CW1	7/20/2005	S-A4-12	0.074	U	0.284		1.2	
J03CW2	7/20/2005	S-A4-13	0.092	U	0.14	U	0.27	U
J03CW3	7/6/2005	S-B5-1	0.083	U	0.928		1.78	
J03CW4	7/6/2005	S-B5-2	0.083	U	0.1	U	0.19	U
J03CW5	7/6/2005	S-B5-5	0.124		6.4		2.54	
J03CW6	7/6/2005	S-B5-7	0.058	U	0.065	U	0.22	U
J03CW7	7/6/2005	S-B5-13	0.061	U	0.052	U	0.13	U
J03CW8	7/6/2005	S-B5-15	0.065	U	0.067	U	0.22	U
J03CW9	7/20/2005	S-B6-1	0.048	U	0.045	U	0.17	U
J03CX0	7/20/2005	S-B6-10	0.053	U	0.066	U	0.15	U
J03CX1	7/20/2005	S-B6-12	0.059	U	0.063	U	0.18	U
J03CX2	7/20/2005	S-B6-13	0.062	U	0.077	U	0.14	U
J03CX3	7/20/2005	S-B6-15	0.052	U	0.053	U	0.18	U
J03CX4	7/20/2005	S-B6-16	0.06	U	0.067	U	0.19	U
J03CX5	7/20/2005	S-B7-1	0.066	U	0.087	U	0.21	U
*J03W07	8/2/2005	S-B7-3	0.231		0.104		0.17	U
J03CX7	7/20/2005	S-B7-4	0.072	U	0.126		0.23	U
J03CX8	7/20/2005	S-B7-5	0.083	U	0.149		0.352	
J03CX9	7/20/2005	S-B7-8	0.05	U	0.402		0.2	U
J03CY0	7/20/2005	S-B7-11	0.078	U	0.071	U	0.22	U
J03CY1	7/7/2005	S-B8-2	0.075	U	0.078	U	0.2	U
J03CY2	7/7/2005	S-B8-3	0.057	U	0.064	U	0.22	U
J03CY3	7/7/2005	S-B8-4	0.064	U	0.048	U	0.12	U
J03CY4	7/7/2005	S-B8-8	0.16	U	15.4		7.83	
J03CY5	7/7/2005	S-B8-12	0.1	U	0.079	U	0.2	U
J03CY6	7/7/2005	S-B8-13	0.057	U	0.062	U	0.21	U
Mean (LV) ==========>			0.11		0.69		0.78	
Standard Deviation (S) ==========>			0.13		2.38		1.50	
α (5%) ==========>			1.645		1.645		1.645	
β (20%) ==========>			0.842		0.842		0.842	
Number of Samples ==========>			**1**		**2**		**3**	

* Denotes sample node replacement sample and data, following additional remediation.

Shallow Zone

CALCULATION COVER SHEET

Project Title:	100-K Area Field Remediation	**Job No.**	14655
Area	100-K		
Discipline	Environmental	***Calc. No.**	0100K-CA-V0056
Subject	116-K-2 Trench (East End) Cleanup Verification 95% UCL Calculations		
Computer Program	Excel	**Program No.**	Excel 2003

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

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 5 Total = 6	*Approved* *10/13/2005* J. M. Capron	*Approved* *10/13/2005* T. M. Blakley	*Approved* *10/13/2005* L. M. Dittmer	*Approved* *10/17/2005* S. W. Callison	*10/17/2005*
1	Cover = 1 Sheets = 5 Total = 6	1/30/06 J. M. Capron	1/31/06 T. M. Blakley	1/31/06 L. M. Dittmer	2-6-06 S. W. Callison	2-6-06

SUMMARY OF REVISIONS

1	Replaced cover page for convenience. Revised Page 5, Lines 6 ("R" flag added to hexavalent chromium result) and 36 ("R" flag added to acronym list).

* Obtain calc no. from DIS

DE01437.03 (12/09/2004)

Washington Closure Hanford **CALCULATION SHEET**

Originator J. M. Capron **Date** 10/13/05 **Calc. No.** 0100K-CA-V0056 **Rev. No.** 0
Project 100-K Area Field Remediation **Job No.** 14655 **Checked** T. M. Blakley **Date** 10/13/05
Subject 116-K-2 Trench (East End) Cleanup Verification 95% UCL Calculations **Sheet No.** 1 of 5

Purpose:
Calculate the 95% upper confidence limit (UCL) to evaluate compliance with cleanup standards for the subject site. Also, calculate the carcinogenic risk for applicable nonradionuclide analytes, perform the *Washington Administrative Code* (WAC) 173-340 (Model Toxics Control Act [MTCA]) 3-part test, if required, and calculate the relative percent difference (RPD) for each contaminant of concern (COC).

Table of Contents:

Given/References:
1) Sample Results
2) All lookup values and remedial action goals (RAGs) are taken from DOE-RL (2005b) and Ecology (1996).
3) DOE-RL, 2005a, *100 Area Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) DOE-RL, 2005b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
5) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington State Department of Ecology, Olympia, Washington.
6) 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 State Department of Ecology, Olympia, Washington.
7) Ecology, 1996, *Model Toxics Control Act Cleanup Levels and Risk Calculations (CLARC II)*, Publication #94-145, Washington State Department of Ecology, Olympia, Washington.
8) 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.
9) WAC 173-340, 1996, "Model Toxics Control Act--Cleanup," *Washington Administrative Code*.

Solution:
Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2005b). Use data from 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 in the primary-duplicate and primary-split sample pairs.

Calculation Description:
The subject calculations were performed on data from soil verification samples from the northeast portion of the 116-K-2 waste site; calculations for the remainder of the waste site will be documented separately. 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 2005b) is documented by this calculation. Split and duplicate RPD results are used in evaluation of data quality and are presented in the cleanup verification package (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 minimal 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.

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 test for distribution is performed. For nonradionuclide data sets of ten or greater, distributional testing is done using Ecology's MTCAStat software (Ecology 1993).

The hazard quotient (for shallow zone nonradionuclide COCs) is determined by dividing the statistical value (derived in this calculation) by the WAC 173-340 non-carcinogenic 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^{-5}.

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 non-radionuclide COC,
2) greater than 10% of the raw data exceed the most stringent cleanup limit for each non-radionuclide COC,
3) the maximum value of the raw data set exceeds two times the most stringent cleanup limit for each non-radionuclide COC.

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 pre-determined for each analytical method, listed in Table II-1 of the SAP (DOE-RL 2005a). The RPD calculations use the following formula: $RPD = [\,|M-S|/((M+S)/2)]*100$

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

For quality assurance/quality control (QA/QC) split and duplicate RPD calculations, a value less than +/- 30% indicates the data compare favorably. For regulatory splits, a threshold of 35% is used (EPA 1994). If the RPD is greater than 30% (or 35% for regulatory split data), further investigation regarding the usability of the data is performed. Additional discussion as necessary is provided in the data quality assessment section of the applicable 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.

Washington Closure Hanford **CALCULATION SHEET**

Originator J. M. Capron **Date** 10/13/05 **Calc. No.** 0100K-CA-V0056 **Rev. No.** 0
Project 100-K Area Field Remediation **Job No.** 14655 **Checked** T. M. Blakley **Date** 10/13/05
Subject 116-K-2 Trench (East End) Cleanup Verification 95% UCL Calculations **Sheet No.** 2 of 5

Summary (continued)

Results:

The results presented in the summary tables that follow are for use in RESidual RADioactivity dose/risk analysis and the CVP for this site.

Results Summary - Shallow Zone			
Analyte	Result	Qualifier	Units
Hexavalent Chromium	3.9E-01		mg/kg
Carbon-14	7.0E-01		pCi/g
Cesium-137	5.6E-01		pCi/g
Cobalt-60	1.8E-02	U	pCi/g
Europium-152	1.53E-01		pCi/g
Europium-154	5.6E-02	U	pCi/g
Nickel-63	3.56E+00		pCi/g
Plutonium-239/240	2.3E-02	U	pCi/g
Strontium-90	1.43E-01		pCi/g

WAC 173-340 Evaluation (Shallow Zone)

3-Part Test:

95% UCL > Cleanup Limit?	NO
> 10% above Cleanup Limit?	NO
Any sample > 2x Cleanup Limit?	NO

Risk Estimate:

Nonrad noncarcinogenic index sum:	1.6E-03
Nonrad carcinogenic risk:	1.9E-07

Results Summary - Deep Zone			
Analyte	Result	Qualifier	Units
Hexavalent Chromium	5.3E+00		mg/kg
Carbon-14	1.26E+00		pCi/g
Cesium-137	1.30E+02		pCi/g
Cobalt-60	2.48E+00		pCi/g
Europium-152	6.27E+01		pCi/g
Europium-154	5.4E+00		pCi/g
Nickel-63	8.8E+02		pCi/g
Plutonium-239/240	6.9E+00		pCi/g
Strontium-90	7.12E+00		pCi/g

WAC 173-340 Evaluation (Deep Zone)

3-Part Test:

95% UCL > Cleanup Limit?	YES
> 10% above Cleanup Limit?	YES
Any sample > 2x Cleanup Limit?	YES

Because of the "yes" answers to the MTCA 3-part test for hexavalent chromium, a detailed assessment will be performed for this contaminant within the CVP.

Relative Percent Difference (RPD) Results (Shallow Zone)* QA/QC Analysis		
Analyte	Duplicate Analysis**	Split Analysis**
Hexavalent Chromium		
Carbon-14		
Cesium-137		
Cobalt-60		
Europium-152		
Europium-154		
Nickel-63		
Plutonium-239/240		
Strontium-90		

Relative Percent Difference (RPD) Results (Deep Zone)* QA/QC Analysis		
Analyte	Duplicate Analysis**	Split Analysis**
Hexavalent Chromium	18%	42%
Carbon-14		
Cesium-137	11%	21%
Cobalt-60	15%	40%
Europium-152	8.7%	39%
Europium-154	32%	34%
Nickel-63	17%	56%
Plutonium-239/240	34%	58%
Strontium-90	11%	28%

*A blank cell indicates that RPD evaluation was not required.

**The significance of the reported RPD values, including values greater than 30%, is addressed within the Data Quality Assessment for the CVP for this site.

QA/QC = quality assurance/quality control

RESRAD = RESidual RADioactivity (dose model)

RPD = relative percent difference

U = undetected

UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project 100-K Area Field Remediation
Subject 116-K-2 Trench (East End) Cleanup Verification 95% UCL Calculations

Date 10/13/05
Job No. 14655

Calc. No. 0100K-CA-V0056
Checked T. M. Blakley TMB

Rev. No. 0
Date 10/13/05
Sheet No. 3 of 5

Shallow Zone Sample Data

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Nickel-63			Plutonium-239/240			Strontium-90		
			mg/kg	Q	PQL	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
B7	J03JW8	8/18/2005	2.0E-01	U	2.0E-01	-1.04E+00	U	2.6E+00	1.67E-01		3.2E-02	3.0E-02	U	3.0E-02	1.1E-01	U	1.1E-01	1.0E-01	U	1.0E-01	1.09E+00	U	3.3E+00	0	U	3.1E-01	-6.3E-02	U	2.6E-01
Duplicate of J03JW8	J03JW9	8/18/2005	2.0E-01	U	2.0E-01	4.5E-02	U	2.8E+00	1.48E-01		3.0E-02	3.0E-02	U	3.0E-02	1.1E-01	U	1.1E-01	9.8E-02	U	9.8E-02	3.41E-01	U	3.2E+00	5.3E-02	U	4.1E-01	6.0E-02	U	2.8E-01
A1	J103C0[a]	9/6/2005	2.0E-01	U	2.0E-01	-2.87E+00	U	4.4E+00	3.46E-01		2.8E-02	4.1E-02	U	4.1E-02	3.46E-01		7.5E-02	1.2E-01	U	1.2E-01	1.97E+00	U	4.3E+00	0	U	2.9E-01	1.94E-01		1.8E-01
A2	J03JW3	8/18/2005	2.5E-01		2.0E-01	2.98E+00		2.9E+00	5.1E-02	U	5.1E-02	3.2E-02	U	3.2E-02	7.5E-02	U	7.5E-02	1.1E-01	U	1.1E-01	3.56E-01	U	3.4E+00	0	U	2.7E-01	-5.1E-02	U	2.3E-01
A3	J03W34[b]	8/18/2005	2.2E-01		2.0E-01	-5.18E-01	U	1.8E+00	3.4E-02	U	3.4E-02	3.1E-02	U	3.1E-02	1.1E-01	U	1.1E-01	1.0E-01	U	1.0E-01	4.99E-01	U	3.3E+00	3.7E-02	U	2.8E-01	1.80E-01		1.8E-01
A4	J03JW5	8/18/2005	2.0E-01	U	2.0E-01	5.14E-01	U	2.6E+00	1.46E-01		3.4E-02	3.2E-02	U	3.2E-02	1.2E-01	U	1.2E-01	1.1E-01	U	1.1E-01	2.24E+00	U	3.3E+00	3.6E-02	U	2.7E-01	1.2E-02	U	2.4E-01
B5	J03JW6	7/6/2005	2.3E-01		2.0E-01	-8.08E-01	U	2.2E+00	1.45E+00		1.0E-01	3.5E-02	U	3.5E-02	1.7E-01	U	1.7E-01	1.1E-01	U	1.1E-01	7.83E+00		3.7E+00	0	U	2.5E-01	1.02E-01	U	3.0E-01
B6	J03JW7	8/19/2005	2.0E-01	U	2.0E-01	-5.96E-01	U	2.6E+00	3.8E-02	U	3.8E-02	3.5E-02	U	3.5E-02	1.2E-01	U	1.2E-01	1.1E-01	U	1.1E-01	8.75E-01	U	3.2E+00	0	U	3.0E-01	1.7E-02	U	2.3E-01
B8	J03JX0	7/7/2005	8.5E-01		2.0E-01	-1.92E-01	U	1.6E+00	3.2E-02	U	3.2E-02	2.8E-02	U	2.8E-02	1.0E-01	U	1.0E-01	9.7E-02	U	9.7E-02	-1.25E+01	U	7.3E+00	0	U	3.5E-01	2.13E-01	U	2.3E-01

Note: Radiological analytical methods use statistically-determined floating calibration curves that are not forced through the origin; therefore, negative values are routinely reported for undetected analytes. This does not diminish the usability of the data.

Statistical Computation Input Data

Sampling Area	HEIS Number	Sample Date	Cr^{6+} mg/kg			C-14 pCi/g			Cs-137 pCi/g			Co-60 pCi/g			Eu-152 pCi/g			Eu-154 pCi/g			Ni-63 pCi/g			Pu-239/240 pCi/g			Sr-90 pCi/g		
B7	J03JW8/J03JW9	8/18/2005	1.0E-01			-5.0E-01			1.58E-01			1.5E-02			5.5E-02			5.0E-02			7.16E-01			2.7E-02			-1.5E-03		
A1	J103C0[a]	9/6/2005	1.0E-01			-2.87E+00			3.46E-01			2.1E-02			3.46E-01			6.0E-02			1.97E+00			0			1.94E-01		
A2	J03JW3	8/18/2005	2.5E-01			2.98E+00			2.6E-02			1.6E-02			3.8E-02			5.5E-02			3.56E-01			0			-5.1E-02		
A3	J03W34[b]	8/18/2005	2.2E-01			-5.18E-01			1.7E-02			1.6E-02			5.5E-02			5.0E-02			4.99E-01			3.7E-02			1.80E-01		
A4	J03JW5	8/18/2005	1.0E-01			5.14E-01			1.46E-01			1.6E-02			6.0E-02			5.5E-02			2.24E+00			3.6E-02			1.2E-02		
B5	J03JW6	7/6/2005	2.3E-01			-8.08E-01			1.45E+00			1.8E-02			8.5E-02			5.5E-02			7.83E+00			0			1.02E-01		
B6	J03JW7	8/19/2005	1.0E-01			-5.96E-01			1.9E-02			1.8E-02			6.0E-02			5.5E-02			8.75E-01			0			1.7E-02		
B8	J03JX0	7/7/2005	8.5E-01			-1.92E-01			1.6E-02			1.4E-02			5.0E-02			4.9E-02			-1.25E+01			0			2.13E-01		

Statistical Computations

Statistical value based on	Cr^{6+}	C-14	Cs-137	Co-60	Eu-152	Eu-154	Ni-63	Pu-239/240	Sr-90
	Small (n<10) 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.	Radionuclide data set. Use nonparametric z-statistic.
N	8	8	8	8	8	8	8	8	8
% < Detection limit	50%	88%	50%	100%	88%	100%	88%	100%	75%
mean	2.4E-01	-2.5E-01	2.7E-01	1.7E-02	9.4E-02	5.4E-02	2.5E-01	1.2E-02	8.3E-02
st. dev.	2.5E-01	1.62E+00	4.9E-01	2.E-03	1.03E-01	4.E-03	5.70E+00	1.7E-02	1.02E-01
Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
95% UCL on mean	3.9E-01	7.0E-01	5.6E-01	1.8E-02	1.53E-01	5.6E-02	3.56E+00	2.3E-02	1.43E-01
max value	8.5E-01	2.98E+00	1.45E+00	4.1E-02	3.46E-01	1.2E-01	7.83E+00	5.3E-02	2.13E-01
Statistical value	3.9E-01	7.0E-01	5.6E-01	1.8E-02	1.53E-01	5.6E-02	3.56E+00	2.3E-02	1.43E-01
Background	NA	NA	NA	NA	NA	NA	NA	NA	NA
Statistical value above background	3.9E-01	7.0E-01	5.6E-01	1.8E-02	1.53E-01	5.6E-02	3.56E+00	2.3E-02	1.43E-01
Lookup Value - 15 mrem/yr for rad		8.69	6.2	1.4	3.3	3.05	83	35.1	4.5
Most Stringent Cleanup Limit for nonradionuclide and RAG type	2 River Protection								
WAC 173-340 3-PART Test									
95% UCL > Cleanup Limit?	NO								
> 10% above Cleanup Limit?	NO								
Any sample > 2X Cleanup Limit?	NO								
EXCESS RISK EVALUATION									
WAC 173-340 Non-Carcinogenic Cleanup:	240								
Hazard quotient for each nonradionuclide:	1.6E-03								
WAC 173-340 Carcinogenic Cleanup:	2.1								
Risk for each carcinogenic nonradionuclide:	1.9E-07								
WAC 173-340 3-Part-Test Compliance?	YES								
Nonrad noncarcinogenic index sum:	1.6.E-03								
Nonrad carcinogenic risk:	1.9E-07								

[a]Replaces Sample J03W33, collected on 8/2/2005 and Sample J03JW2, collected on 7/6/2005.
[b]Replaces Sample J03JW4, collected on 7/6/2005.

HEIS = Hanford Environmental Information System
MDA = minimum detectable activity
NA = not applicable
PQL = practical quantitation limit
Q = qualifier
RAG = remedial action goal
U = undetected
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project 100-K Area Field Remediation
Subject 116-K-2 Trench (East End) Cleanup Verification 95% UCL Calculations

Date 10/13/05
Job No. 14655

Calc. No. 0100K-CA-V0056
Checked T. M. Blakley TMB

Rev. No. 0
Date 10/13/05
Sheet No. 4 of 5

1 **Deep Zone Sample Data**

2 Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Nickel-63			Plutonium-239/240			Strontium-90		
3			mg/kg	Q	PQL	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	B6	J03D02	8.7E+00		4.0E-01	2.00E+00		1.9E+00	1.83E+02		3.0E-01	4.12E+00		1.2E-01	8.92E+01		9.0E-01	8.14E+00		4.5E-01	1.22E+03		9.5E+00	7.22E+00		2.3E-01	9.83E+00		3.2E-01
5	Duplicate of J03D02	J03D03	7.3E+00		4.0E-01	8.54E-01	U	2.1E+00	1.64E+02		3.3E-01	3.56E+00		1.5E-01	8.18E+01		8.9E-01	5.90E+00		5.5E-01	1.45E+03		1.0E+01	1.02E+01		2.8E-01	8.80E+00		2.9E-01
6	A1	J03CY7	2.7E+00		2.0E-01	1.69E-01	U	1.5E+00	1.03E+02		2.8E-01	1.52E+00		9.5E-02	2.53E+01		7.9E-01	2.75E+00		3.1E-01	2.48E+02		7.9E+00	1.58E+00		2.6E-01	2.96E+00		2.2E-01
7	A2	J03CY8	2.5E+00		4.1E-01	4.23E-01	U	1.7E+00	1.04E+02		2.6E-01	7.35E-01		7.8E-02	2.02E+01		1.0E-01	2.04E+00		3.1E-01	2.27E+02		4.1E+00	2.56E+00		2.1E-01	2.60E+00		2.9E-01
8	A3	J03CY9	3.3E+00		2.0E-01	1.32E+00	U	1.4E+00	1.10E+02		3.3E-01	1.66E+00		1.1E-01	6.29E+01		1.1E+00	5.28E+00		4.4E-01	8.22E+02		7.2E+00	7.38E+00		2.9E-01	6.65E+00		2.1E-01
9	B4	J03D00	3.6E+00		4.0E-01	7.58E-01	U	1.7E+00	6.06E+01		1.7E-01	8.33E-01		5.5E-02	1.06E+01		5.9E-01	7.70E-01		2.1E-01	3.38E+02		4.9E+00	2.30E+00		2.6E-01	4.84E+00		3.1E-01
10	B5	J03D01	3.3E+00		2.0E-01	1.33E+00	U	1.6E+00	6.18E+01		2.3E-01	1.79E+00		8.9E-02	5.46E+01		6.2E-01	5.20E+00		3.6E-01	5.64E+02		7.4E+00	6.40E+00		3.3E-01	6.21E+00		2.9E-01

11 **Statistical Computation Input Data**

12 Sampling Area	HEIS Number	Sample Date	Cr^{6+} mg/kg			C-14 pCi/g			Cs-137 pCi/g			Co-60 pCi/g			Eu-152 pCi/g			Eu-154 pCi/g			NI-63 pCi/g			Pu-239/240 pCi/g			Sr-90 pCi/g		
13																												
14	B6	J03D02/J03D03	8.0E+00			1.43E+00			1.74E+02			3.84E+00			8.55E+01			7.02E+00			1.34E+03			8.7E+00			9.32E+00		
15	A1	J03CY7	2.7E+00			1.69E-01			1.03E+02			1.52E+00			2.53E+01			2.75E+00			2.48E+02			1.58E+00			2.96E+00		
16	A2	J03CY8	2.5E+00			4.23E-01			1.04E+02			7.35E-01			2.02E+01			2.04E+00			2.27E+02			2.56E+00			2.60E+00		
17	A3	J03CY9	3.3E+00			1.32E+00			1.10E+02			1.66E+00			6.29E+01			5.28E+00			8.22E+02			7.38E+00			6.65E+00		
18	B4	J03D00	3.6E+00			7.58E-01			6.06E+01			8.33E-01			1.06E+01			7.70E-01			3.38E+02			2.30E+00			4.84E+00		
19	B5	J03D01	3.3E+00			1.33E+00			6.18E+01			1.79E+00			5.46E+01			5.20E+00			5.64E+02			6.40E+00			6.21E+00		

20 **Statistical Computations**

21		Cr^{6+}			C-14			Cs-137			Co-60			Eu-152			Eu-154			Ni-63			Pu-239/240			Sr-90		
22	Statistical value based on	Small (n<10) 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.			Radionuclide data set. Use nonparametric z-statistic.		
23	N	6			6			6			6			6			6			6			6			6		
24	% < Detection limit	0%			83%			0%			0%			0%			0%			0%			0%			0%		
25	mean	3.9E+00			9.0E-01			1.02E+02			1.73E+00			4.32E+01			3.8E+00			5.9E+02			4.8E+00			5.43E+00		
26	st. dev.	2.1E+00			5.3E-01			4.1E+01			1.12E+00			2.90E+01			2.E+00			4.3E+02			3.0E+00			2.52E+00		
27	Z-statistic	1.645			1.645			1.645			1.645			1.645			1.645			1.645			1.645			1.645		
28	95% UCL on mean	5.3E+00			1.26E+00			1.30E+02			2.48E+00			6.27E+01			5.4E+00			8.8E+02			6.9E+00			7.12E+00		
29	max value	8.7E+00			2.00E+00			1.83E+02			4.12E+00			8.92E+01			8.1E+00			1.45E+03			1.02E+01			9.83E+00		
30	Statistical value	5.3E+00			1.26E+00			1.30E+02			2.48E+00			6.27E+01			5.4E+00			8.8E+02			6.9E+00			7.12E+00		
31	Background	NA			NA			NA			NA			NA			NA			NA			NA			NA		
32	Statistical value above background	5.3E+00			1.26E+00			1.30E+02			2.48E+00			6.27E+01			5.4E+00			8.8E+02			6.9E+00			7.12E+00		
33	**Lookup Value - Protection of Groundwater and River**				NV			1,465			13,900			NV			NV			83			NV			27.6		
34	**Most Stringent Cleanup Limit for nonradionuclide and RAG type**	2	River Protection																									
35	**WAC 173-340 3-PART Test**																											
36	95% UCL > Cleanup Limit?	YES																										
37	> 10% above Cleanup Limit?	YES																										
38	Any sample > 2X Cleanup Limit?	YES																										
39	**WAC 173-340 3-Part-Test Compliance?**	NO																										

40 HEIS = Hanford Environmental Information System
41 MDA = minimum detectable activity
42 NA = not applicable
43 NV = no value
44 PQL = practical quantitation limit

Q = qualifier
RAG = remedial action goal
U = undetected
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron
Project 100-K Area Field Remediation
Subject 116-K-2 Trench (East End) Cleanup Verification 95% UCL Calculations

Date 1/30/06
Job No. 14655

Calc. No. 0100K-CA-V0056
Checked T. M. Blakley

Rev. No. 1
Date 4/3/06
Sheet No. 5 of 5

Split-Duplicate Analysis

Shallow Zone Sample Results:

Sampling Area	HEIS Number	Hexavalent Chromium			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Nickel-63			Plutonium-239/240			Strontium-90		
		mg/kg	Q	PQL	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
B7	J03JW8	2.0E-01	U	2.0E-01	-1.04E+00		2.6E+00	1.67E-01		3.2E-02	3.0E-02	U	3.0E-02	1.1E-01	U	1.1E-01	1.0E-01	U	1.0E-01	1.09E+00	U	3.3E+00	0	U	3.1E-01	-6.3E-02	U	2.6E-01
Duplicate of J03JW8	J03JW9	2.0E-01	U	2.0E-01	4.5E-02	U	2.8E+00	1.48E-01		3.0E-02	3.0E-02	U	3.0E-02	1.1E-01	U	1.1E-01	9.8E-02	U	9.8E-02	3.41E-01	U	3.2E+00	5.3E-02	U	4.1E-01	6.0E-02	U	2.8E-01
Split of J03JW8	J03JX1	3.50E+00	UR	3.50E+00	-1.51E-01	U	8.02E-01	2.04E-01		1.50E-02	3.89E-06	U	1.54E-02	1.09E-01	U	4.86E-02	-7.73E-03	U	4.90E-02	4.55E+00	U	1.06E+01	2.82E-02	U	7.64E-02	8.63E-02	U	1.24E-01

Shallow Zone Analysis:

TDL		0.5	50	0.1	0.05	0.10	0.10	30	1.0	1.0
Duplicate Analysis	Both > MDA?	No-Stop (acceptable)	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 > MDA?	No-Stop (acceptable)	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									

Deep Zone Sample Results:

Sampling Area	HEIS Number	Hexavalent Chromium			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Nickel-63			Plutonium-239/240			Strontium-90		
		mg/kg	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	pCi/g	Q	MDA
B6	J03D02	8.7E+00		4.0E-01	2.00E+00		1.9E+00	1.83E+02		3.0E-01	4.12E+00		1.2E-01	8.92E+01		9.0E-01	8.14E+00		4.5E-01	1.22E+03		9.5E+00	7.22E+00		2.3E-01	9.83E+00		3.2E-01
Duplicate of J03D02	J03D03	7.3E+00		4.0E-01	8.54E-01	U	2.1E+00	1.64E+02		3.3E-01	3.56E+00		1.5E-01	8.18E+01		8.9E-01	5.90E+00		5.5E-01	1.45E+03		1.0E+01	1.02E+01		2.8E-01	8.80E+00		2.9E-01
Split of J03D02	J03D04	1.33E+01		3.50E+00	1.50E-01	U	8.06E-01	2.27E+02		1.10E-01	6.16E+00		4.29E-02	1.32E+02		3.66E-01	1.15E+01		1.60E-01	2.18E+03		7.15E+00	1.31E+01		5.56E-02	1.30E+01		1.65E-01

Deep Zone Analysis:

TDL		0.5	50	0.1	0.05	0.10	0.10	30	1.0	1.0
Duplicate Analysis	Both > MDA?	**Yes (continue)**	No-Stop (acceptable)	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both > 5xTDL?	**Yes (calc RPD)**		**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	18%		11%	15%	8.7%	32%	17%	34%	11%
Split Analysis	Both > MDA?	**Yes (continue)**	No-Stop (acceptable)	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both > 5xTDL?	**Yes (calc RPD)**		**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**
	RPD	42%		21%	40%	39%	34%	56%	58%	28%

Note: The significance of the reported RPD values, including values greater than 30%, is addressed within the Data Quality Assessment for the Cleanup Verification Package for this site.
HEIS = Hanford Environmental Information System
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
R = rejected
RPD = relative percent difference
TDL = target detection limit
U = undetected

CALCULATION COVER SHEET

Project Title 100-K Field Remediation Project **Job No.** 14655
Area 100-K Area
Discipline Environmental ***Calc. No.** 0100K-CA-V0058
Subject 116-K-2 Trench (East End) RESRAD Calculation
Computer Program RESRAD **Program No.** Version 6.3

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

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0 SWC 10-17-05	Cover – 1 pg Summary – 6 pg Attm. 1 - 1 pg Attm. 2 - 19 pg Attm. 3 - 19 pg Attm. 4 - 9 pg Attm. 5 - ~~18~~ 25 pg Attm. 6 - 37 pg Attm. 7 - 17 pg Total – ~~125~~ 134 pages	S. W. Clark 10/12/05 M.W. Perrott 10/12/05	T. M. Blakley 10/13/05	Stacey Callison 10-17-05	~~Mark Buckmaster~~ SW Callison 10-17-05	10-17-05
SUMMARY OF REVISION						

*Obtain Calc. No. from DIS

DE01-437.03 (12/09/2004)

River Corridor Closure Project

CALCULATION SHEET

Originator:	S. W. Clark / M.W. Perrott	Date: 10/3/05		Calc. No.:	0100K-CA-V0058	Rev.:	0
Project:	100-K Field Remediation Project	Job No:	14655	Checked:	T. M. Blakley	Date:	10/13/05
Subject:	116-K-2 Trench (East End) RESRAD Calculation					Sheet No.	1 of 6

PURPOSE:

Calculate the soil and groundwater concentrations, dose, and risk contributions from remaining radionuclide contaminants in the vadose zone over a period of 1,000 years.

GIVEN/REFERENCES:

1) Cleanup verification data from *116-K-2 Trench (East End) Cleanup Verification 95% UCL Calculations*, Calculation No. 0100K-CA-V0056, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
2) *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
3) Radioactive and nonradioactive contaminants of concern from the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP), DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington. For the purpose of these RESRAD calculations, the radioactive contaminants of concern (COCs) are carbon-14, cesium-137, cobalt-60, europium-152, europium-154, nickel-63, and plutonium-239/240. Hexavalent chromium is the only nonradionuclide contaminant of concern
4) RESidual RADioactivity (RESRAD) computer code, version 6.3, to calculate compliance with residual radioactivity guidelines, developed for the U.S. Department of Energy by the Environmental Assessment Division of Argonne National Laboratory, Argonne, Illinois.
5) Sample design data from the *116-K-2 Trench (East End) Sampling Plan,* Calculation No. 0100K-CA-V0057, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. For the purpose of these RESRAD calculations, the sampling areas identified in the sampling plan calculation brief are 8653.26 m^2 for the Shallow Zone and 9140.52 m^2 for the Deep Zone. Total sampling area of 17,794 m^2 was used for all RESRAD calculations.
6) Plutonium isotope ratios from *Ratios of Plutonium Isotopes at 100 Areas Remedial Action Sites*, Calculation No. 0100B-CA-V0013, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
7) Thickness of uncontaminated deep zone determined using analogous site data for the 116-C-1 test pit from *Cleanup Verification Package for the 116-C-1 Process Effluent Trench*, CVP-98-00006, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
8) Attainment of the river protection RAGs is based on comparison of results from the *100 F Area Soil Hexavalent Chromium and Carbon-14 Leachability Study Summary Report* (Appendix D of the *Cleanup Verification Package for the 100-F-19:1 North Pipelines, 100-F-19:3 West Pipelines, 100-F-34 Biology Facility French Drain, and 116-F-12 French Drain*, CVP-2001-00002, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.), *100-H Area Soil Hexavalent Chromium Leachability Study Summary Report* (Appendix D of the *Cleanup Verification Package for the 116-H-7 Retention*

River Corridor Closure Project CALCULATION SHEET

Originator:	S. W. Clark / M.W. Perrott	Date: 10/3/05	Calc. No.:	0100K-CA-V0058	Rev.: 0
Project:	100-K Field Remediation Project	Job No: 14655	Checked:	T. M. Blakley	Date: 10/13/05
Subject:	116-K-2 Trench (East End) RESRAD Calculation				Sheet No. 2 of 6

Basin, CVP-2000-00027, Rev. 0, Bechtel Hanford, Inc., Richland, Washington), and *Estimation of Distribution Coefficients and Leachability of Hexavalent Chromium in 100-D Area Hanford Formation Sediments* (Appendix D of the *Cleanup Verification Package for the 116-D-7 Retention Basin*, CVP-99-00007, Rev. 0, Bechtel Hanford, Inc., Richland, Washington).

SOLUTION:

1) Table 1 shows the waste site parameters used for RESRAD modeling. Based on the conservative assumption (discussed in the 100 Area RDR/RAWP) that residual contamination levels from the deep zone data set extend uniformly to groundwater, RESRAD predicted that the residual soil concentration of nickel-63 would result in groundwater concentrations that exceed the drinking water standard. Because this approach is too conservative, test pit data from the 116-C-1 Process Effluent Trench was used to include an uncontaminated deep zone between the contaminated deep zone and groundwater to more accurately describe the 116-K-2 site for modeling using RESRAD.
2) Table 2 shows the radionuclide activities for each COC. Input factors for each RESRAD run are shown in the "Summary" section of the RESRAD "Mixture Sums and Single Radionuclide Guidelines" printouts in Attachments to this Calculation Summary.
3) The year where the peak dose (or concentration) occurs from each individual radionuclide COC was determined by a preliminary run. This year was then included in all final RESRAD runs. For the direct exposure pathway (i.e. soil ingestion and inhalation and external radiation), the peak year occurred at year zero (year 2005) for all COCs. For the water pathways (i.e., drinking water and food ingestion) the peak year also occurred at year zero (year 2005) for all COCs.

Table 1. Waste Site Dimensions for RESRAD Modeling

Parameter	Units	Value	Comments
Shallow Zone Cover Depth	m	0	
Area of Shallow and Deep Zone	m^2	17794	Based on Sample Design [a]
Thickness: Shallow Zone	m	4.6	Appendix B of 100 Area RDR/RAWP
Elevation: Ground Surface	m	133.5	NAVD88
Elevation: Groundwater	m	118.5	NAVD88
Thickness: Total Deep Zone	m	10.4	Vadose zone thickness minus shallow zone
Thickness: Uncontaminated Deep Zone	m	3.1	Based on deep zone model from 116-C-1 test pit [b]
Thickness: Contaminated Deep Zone	m	7.3	Deep zone thickness minus uncontaminated deep zone
Length Parallel to Aquifer Flow	m	292	Based on Sample Design [a]

[a] Sample design data from the *116-K-2 Trench (East End) Sampling Plan,* Calculation No. 0100K-CA-V0057, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
[b] Two-layer deep zone model based on test pit data from *Cleanup Verification Package for the 116-C-1 Process Effluent Trench*, CVP-98-00006, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

River Corridor Closure Project

CALCULATION SHEET

Originator:	S. W. Clark / M.W. Perrott MWP	Date: 10/13/05	Calc. No.:	0100K-CA-V0058	Rev.:	0
Project:	100-K Field Remediation Project	Job No: 14655	Checked:	T. M. Blakley 2MB	Date:	10/13/05
Subject:	116-K-2 Trench (East End) RESRAD Calculation				Sheet No. 3 of 6	

METHODOLOGY:

1) Runs of RESRAD version 6.3 were completed for the shallow zone and deep zone using the radionuclide concentrations shown in Table 2. RESRAD numerical output reports for dose, risk, and concentration for the shallow zone and deep zone are presented in the Attachments to this calculation summary.

Table 2. Cleanup Verification Data Set [a]

COCs	Shallow Zone	Deep Zone
Radionuclide Activity (pCi/g)		
C-14	0.70	1.26
Cs-137	0.56	130
Co-60	0.018 U [b]	2.48
Eu-152	0.153	62.7
Eu-154	0.056 U [b]	5.4
Ni-63	3.56	880
Pu-239/240	0.023 U [b]	6.9
Sr-90	0.143	7.12
Nonradionuclide Concentration (mg/Kg)		
Cr (VI)	0.39	5.3

[a] Cleanup verification data from the *116-K-2 Trench (East End) Cleanup Verification 95% UCL Calculations*, Calculation No. 0100K-CA-V0056, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
[b] Value was not input into RESRAD because all analyses were below detection limits.

2) Pu-239/240 Conversion: The relative individual Pu-239 and Pu-240 activities used in the RESRAD model were calculated from the reported combined Pu-239/249 analytical results. The calculations were performed in accordance with Calculation No. 0100B-CA-V0013. The relative activities for Pu-239 and Pu-240 were calculated by multiplying the cleanup verification values for Pu-239/240 in each decision unit of the site by 0.807 and 0.193, respectively. Table 3 shows the results of these calculations.

Table 3. Conversion of Pu-239/240 Activity to Relative Pu-239 and Pu-240 Activities

RESRAD Run #	Vadose Zone Horizon	Pu-239/240 Activity (pCi/g)	Pu-239, (pCi/g) (0.807 multiplier)	Pu-240, (pCi/g) (0.193 multiplier)
1	Shallow Zone	0.023 U	0.0186 U	.0044 U
2	Deep Zone	6.9	5.57	1.33

3) Protectiveness of residual hexavalent chromium soil concentrations: Shallow zone soil concentrations of hexavalent chromium represented by the 95% UCL value in

River Corridor Closure Project

CALCULATION SHEET

Originator:	S. W. Clark / M.W. Perrott MWP	Date: 10/13/05	Calc. No.:	0100K-CA-V0058	Rev.: 0
Project:	100-K Field Remediation Project	Job No: 14655	Checked:	T. M. Blakley	Date: 10/13/05
Subject:	116-K-2 Trench (East End) RESRAD Calculation				Sheet No. 4 of 6

Table 2 are less than the applicable RAGs (i.e., 2.1 mg/kg for direct exposure or 2.0 mg/kg for river protection). However, the deep zone hexavalent chromium soil concentration exceeds the applicable RAG of 2.0 mg/kg for river protection. Because this RAG was not met for the deep zone soils, a more detailed assessment of the potential impact of residual hexavalent chromium to groundwater was made using the 100-F, 100-H, and 100-D Area-specific hexavalent chromium leach studies (Appendix D of CVP-2001-00002, CVP-2000-00027, and CVP-99-00007). Using the simple and conservative approach of comparing the residual soil concentration of hexavalent chromium to the soil concentrations used in leach testing, and comparing the leachate concentrations from the leach tests to the surface water hexavalent chromium cleanup level, indicates that remaining hexavalent chromium in deep zone soil at the 116-K-2 site is protective of the river. The river protection soil RAG of 2.0 mg/kg is based on the MTCA "100 times dilution attenuation factor (DAF) times surface water quality criteria" rule. The near-shore river water hexavalent chromium cleanup level is 20 µg/L (surface water quality criteria of 10 µg/L times the dilution attenuation factor of 2). Based on the hexavalent chromium leach studies, the hexavalent chromium soil concentration at which the leachate did not exceed the surface water quality criteria was 6.8 mg/kg. Therefore, using the simple and conservative approach of comparing the hexavalent chromium deep zone soil concentration to the leach study hexavalent chromium soil concentrations demonstrates that cleanup of the deep zone hexavalent chromium is protective of the river (i.e., 5.3 mg/kg is less than 6.8 mg/kg).

RESULTS:

1) Radionuclide "All Pathways" Dose Rate: The "all pathways" (maximum) dose rates are shown in Table 4. The maximum total all-pathways dose rate is 4.62 mrem/yr which occurs at year zero (2005).

Table 4. All Pathway Dose Rate (mrem/yr)

Vadose Zone Horizon	"All Pathways" Dose Contributions in mrem/yr at each time slice (yr)							
	0	1	3	13	30	100	300	1000
Shallow Zone	4.62E+00	3.13E+00	2.49E+00	1.83E+00	1.14E+00	2.01E-01	3.66E-03	9.73E-06
Deep Zone	1.29E-22	1.16E-22	9.37E-23	3.49E-23	9.01E-24	4.21E-06	4.46E-04	9.89E-04
Total All Pathways Dose Rate (mrem/yr)	4.62E+00	3.13E+00	2.49E+00	1.83E+00	1.14E+00	2.01E-01	4.10E-03	9.99E-04

River Corridor Closure Project CALCULATION SHEET

Originator:	S. W. Clark / M.W. Perrott		Date: 10/13/05	Calc. No.:	0100K-CA-V0058	Rev.:	0
Project:	100-K Field Remediation Project		Job No: 14655	Checked:	T. M. Blakley	Date:	10/13/05
Subject:	116-K-2 Trench (East End) RESRAD Calculation					Sheet No.	5 of 6

2) Radionuclide Excess Cancer Risk: The radionuclide excess lifetime cancer risk results are shown in Table 5. The maximum total excess lifetime cancer risk (4.39 x 10^{-5}) occurs at year zero (2005).

Table 5. Radionuclide Excess Lifetime Cancer Risk

Vadose Zone Horizon	Excess Cancer Risk at Each Time Slice (yr)							
	0	1	3	13	30	100	300	1000
Shallow Zone	4.39E-05	3.94E-05	3.61E-05	2.72E-05	1.74E-05	3.33E-06	1.14E-07	4.33E-10
Deep Zone	9.31E-28	8.45E-28	6.99E-28	2.76E-28	6.00E-29	1.36E-10	3.75E-09	7.76E-09
Total Excess Cancer Risk	4.39E-05	3.94E-05	3.61E-05	2.72E-05	1.74E-05	3.33E-06	1.17E-07	8.19E-09

3) Radionuclide Groundwater Protection: The radionuclide concentrations in groundwater calculated by the RESRAD model are summarized in Table 6. Because all concentrations presented here are zero no comparison to drinking water standards calculation was necessary.

Table 6. RESRAD Predicted Radionuclide Groundwater (Well Water) Concentrations

Radio-nuclides	Vadose Zone Horizon	Groundwater Concentrations in pCi/L at Each Time Slice (yr)								RAGs From RDR
		0	1	3	13	30	100	300	1000	
C-14	**Total**	0	0	0	0	0	0	0	0	2000
Co-60	**Total**	0	0	0	0	0	0	0	0	100
Cs-137	**Total**	0	0	0	0	0	0	0	0	60
Eu-152	**Total**	0	0	0	0	0	0	0	0	200
Eu-154	**Total**	0	0	0	0	0	0	0	0	60
Ni-63	**Total**	0	0	0	0	0	0	0	0	50
Sr-90	**Total**	0	0	0	0	0	0	0	0	8

CONCLUSIONS:

- The combined maximum all-pathways dose rate for the shallow and deep zones shown in Table 4 is 4.62 mrem/yr which occurs at year zero (2005).
- The dominant pathway for the dose rate is direct external exposure.
- The primary radionuclide contributing to the direct exposure pathway is cesium-137.
- None of the site COCs are projected to exceed remedial action goals (RAGs).

River Corridor Closure Project

CALCULATION SHEET

Originator:	S. W. Clark / M.W. Perrott		Date:		Calc. No.:	0100K-CA-V0058	Rev.:	0
Project:	100-K Field Remediation Project	Job No:	14655		Checked:	T. M. Blakley	Date:	10/13/05
Subject:	116-K-2 Trench (East End) RESRAD Calculation						Sheet No.	6 of 6

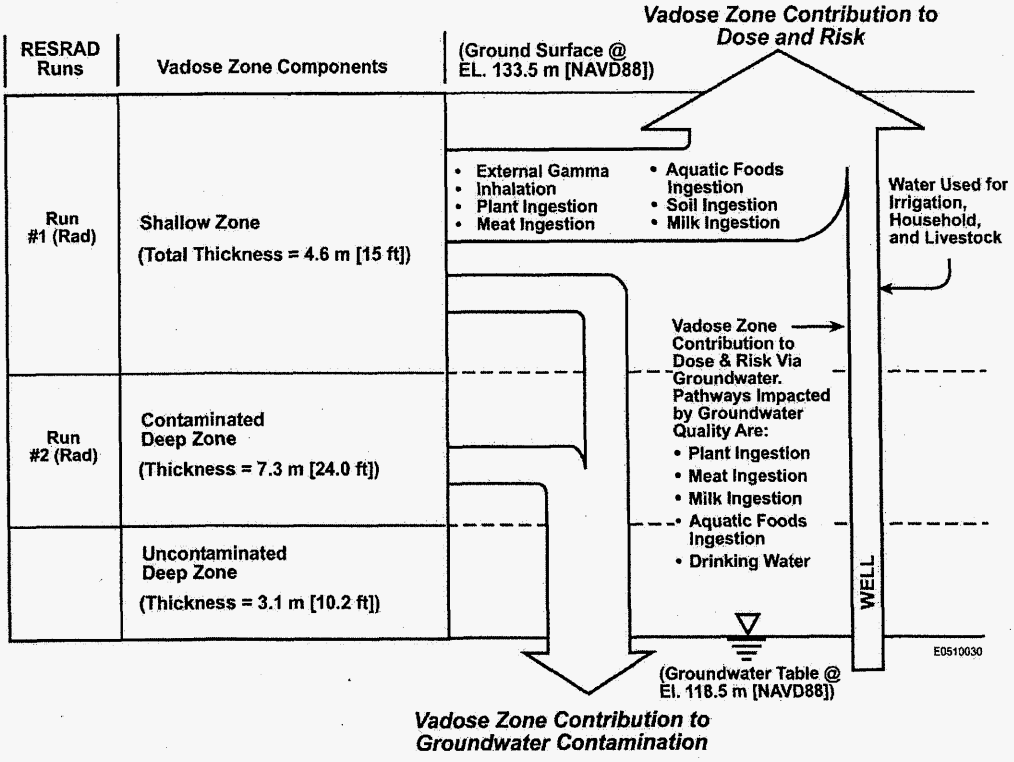
- The maximum combined shallow and deep zone excess lifetime cancer risk shown in Table 5 (4.39×10^{-5}) occurs at year zero (2005).
- None of the radionuclide contaminants of concern are predicted to reach groundwater in the 1,000 years of the RESRAD model runs.

ATTACHMENTS:

1. Graphic showing 116-K-2 Cleanup Verification Model (1 page)
2. RESRAD Output: 116-K-2 Shallow Zone Radionuclides, Mixture Sums and Single Radionuclide Guidelines (19 pages)
3. RESRAD Output: 116-K-2 Shallow Zone Radionuclides, Intake Quantities and Health Risk Factors (19 pages)
4. RESRAD Output: 116-K-2 Shallow Zone Radionuclides, Concentration of Radionuclides, (9 pages)
5. RESRAD Output: 116-K-2 Deep Zone Radionuclides, Mixture Sums and Single Radionuclide Guidelines (18 pages)
6. RESRAD Output: 116-K-2 Deep Zone Radionuclides, Intake Quantities and Health Risk Factors (37 pages)
7. RESRAD Output: 116-K-2 Deep Zone Radionuclides, Concentration of Radionuclides, (17 pages)

ATTACHMENT 1

116-K-2 Trench Cleanup Verification Model



Attachment	1	Sheet No.	1 of 1
Originators:	S. W. Clark	Date	10/13/05
	M. W. Perrott	Date	10/13/05
Chk'd By	T. M. Blakley	Date	10/13/05
Calc. No.	0100K-CA-V0058	Rev. No.	0

CALCULATION COVER SHEET

Project Title:	**116-K-2 (West End) Trench Sample Design**	**Job No.**	**14655**
Area	**100-K**		
Discipline	**Environmental Engineering**	**Calc. No.**	**0100K-CA-V0062**
Subject	**116-K-2 (West End) Trench Shallow, Deep Zone and Overburden Sampling Plan**		
Computer Program	**Excel**	**Program No.**	**Excel 2003**

The attached calculations have been generated to document compliance with established cleanup levels. These documents should be used in 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 = 5 Shts Total = 10 Shts	G. Cruz 12/15/05	C.A. Bentz 12/19/05	R.T. Coffman 12/21/05	S.W. Callison 12/21/05	12/21/05
SUMMARY OF REVISIONS						

*Obtain Calc. No. from DIS

DE01437.03 (12/09/2004)

Washington Closure Hanford

CALCULATION SHEET

Originator G. Cruz Date 12/15/2005 Calc. No. 0100K-CA-V0062 Rev. No. 0

Project 116-K-2 (West End) Trench Sample Design Job No. 14655 Checked aB Date 12/19/05

Subject 116-K-2 (West End) Trench Shallow, Deep Zone and Overburden Sampling Plan Sheet No. 1 of 2

Problem:	Calculate and display required sampling nodes in concurrence with 100 Area			
	SAP DOE/RL-96-22 Rev. 3 for verification and closure.			
Given:	-SAP (DOE/RL-96-22 Rev. 3) and IG (0100X-IG-G0001 Rev. 5) requirements			
	-Shallow Zone Sampling Area (Surface area of each zone determined from CAD program,			
	Attachment 3, Sht 1 of 5, CAD file 1K:121505A, 116-K-2 (West End) Trench Shallow Zone Sampling Plan)			
	Attachment 3, Sht 2 of 5, CAD file 1K:121505B, 116-K-2 (West End) Trench Shallow Zone Coordinate Table)			
	-Deep Zone Sampling Area (Surface area of each zone determined from CAD program,			
	Attachment 3, Sht 3 of 5, CAD file 1K:121505C, 116-K-2 (West End) Trench Deep Zone Sampling Plan)			
	Attachment 3, Sht 4 of 5, CAD file 1K:121505D, 116-K-2 (West End) Trench Deep Zone Coordinate Table)			
	-Overburden Sampling Area (Surface area of each zone determined from CAD program,			
	Attachment 3, Sht 5 of 5, CAD file 1K:121505E, 116-K-2 (West End) Trench Overburden 6 and 7 Sampling Plan)			
SAP and IG Requirements:				
	-Develop a 16 node sampling grid for the sampling area			
Shallow Zone	-Use appendix A of the IG to determine which six of the sixteen will be sampled			
	to collect variance and clean up verification samples			
	-Develop a 16 node sampling grid for the sampling area			
Overburden:	-Use appendix A of the IG to determine which six of the sixteen will be sampled			
	to collect variance and clean up verification samples			
	-Develop a 16 node sampling grid for the sampling area			
Deep Zone:	-Use appendix A of the IG to determine which four of the sixteen will be sampled			
	to collect variance/verification samples			
Determination of Shallow Zone Sampling Grid:				
Shallow Zone Sampling Grid Area determined from Table 5-1, IG				
Attachment 2, Number of Decision Subunits Based on Area (Converted to Sq Meters)				
Total Area:		14695.50	m^2	
Area of Decision Subunits (total area 4 subunits)		3673.87	m^2	
Decision Subunit divided into 4 Sampling Areas:		918.46	m^2	
Sampling Areas divided into a 16 node grid (node numbers 1-16):		57.40	m^2	
Nodes to be Sampled (as determined from Attachment 1, Table A-1, Sample Grid Point Lookup Table)				
	See Attachment 3, Sht 1 of 5, 116-K-2 (West End) Trench Shallow Zone Sampling Plan,			
	for Sample Location Table			

Washington Closure Hanford

CALCULATION SHEET

Originator G. Cruz **Date** 12/15/2005 **Calc. No.** 0100K-CA-V0062 **Rev. No.** 0

Project 116-K-2 (West End) Trench Sample Design **Job No.** 14655 **Checked** GB **Date** 12/19/05

Subject 116-K-2 (West End) Trench Shallow, Deep Zone and Overburden Sampling Plan **Sheet No.** 2 of 2

Determination of Deep Zone Sampling Grid:

Deep Zone Sampling Grid Area determined from Table 5-1, IG
Attachment 2, Number of Decision Subunits Based on Area (Converted to Sq Meters)

Total Area:	23046.93	m^2
Area of Decision Subunits (total area 6 subunits)	3841.15	m^2
Decision Subunits divided into 3 Sampling Areas:	1280.38	m^2
Sampling Areas divided into a 16 node grid (node numbers 1-16):	80.02	m^2

Nodes to be Sampled (as determined from Attachment 1, Table A-1, Sample Grid Point Lookup Table)
See Attachment 3, Sht 3 of 5, 116-K-2 (West End) Trench Deep Zone Sampling Plan, for Sample Location Table

Determination of Overburden Sampling Grid:

Overburden Sampling Grid Area determined from Table 5-1, IG
Attachment 2, Number of Decision Subunits Based on Area (Converted to Sq Meters)

Total Area:	8676.07	m^2
Area of Decision Subunits (total area 2 subunits)	4338.03	m^2
Decision Subunits divided into 3 Sampling Areas:	1084.50	m^2
Sampling Areas divided into a 16 node grid (node numbers 1-16):	67.78	m^2

Nodes to be Sampled (as determined from Attachment 1, Table A-1, Sample Grid Point Lookup Table)
See Attachment 3, Sht 5 of 5, 116-K-2 (West End) Trench Overburden 6 and 7 Sampling Plan, for Sample Location Table

CALCULATION COVER SHEET

Project Title:	100-K Remedial Action	**Job No.**	**14655**
Area	100-K		
Discipline	Environmental	***Calc. No.**	0100K-CA-V0064
Subject	116-K-2 Mile Long Trench Variance Calculation (Phase 2, west)		
Computer Program	Excel	**Program No.**	Excel 2003

Committed Calculation X **Preliminary** **Superseded**

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover - 1 Summary - 1 Calculations - 2 Total - 4	R. T. Coffman RTCoffman 12/12/05	S. W. Callison SW Callison 12-12-05	M. A. Buckmaster 12/12/05	M. A. Buckmaster	12/12/05

SUMMARY OF REVISIONS

Scanned	Rev.	Date	Bar Code No.

* Obtain Calc. No. from DIS.

CALCULATION SHEET

Washington Closure Hanford

Originator	R. T. Coffman	Date	12/12/2005	Calc. No.	0100K-CA-V0064	Rev. No.	0
Project	100-K Remedial Action	Job No.	14655	Checked	S. W. Callison SWC	Date	12-12-05
Subject	116-K-2 Mile Long Trench Variance Calculation (Phase 2, west)					Sheet No.	1 of 3

Conclusion:
The required number of samples calculated (1sample) for each decision sub-unit is less than the default number (4 samples) specified in the DOE/RL-96-22, Rev 4. Therefore, the default number of samples will be collected from each shallow zone decision sub-unit.

Problem:
Calculate the number of close out samples required for 116-K-2 Mile Long Trench Shallow Unit verification sampling as required in "100 Area Remedial Action Sampling and Analysis Plan" (DOE/RL-96-22, Rev 4) and "Instruction Guide for the Remediation of 100 Areas Waste Sites" (0100X-IG-G0001, Rev 5).

Given:
1) Sample locations for the 116-K-2 Mile Long Trench Shallow Decision Unit are identified on the 116-K-2 Mile Long Trench Shallow Sample Design, Calculation number 0100K-CA-V0062, Rev. 0.
2) Lookup values from DOE/RL-96-22, Rev 4.
3) Sample Design requirements from DOE/RL-96-22, Rev 4 and 0100X-IG-G0001, Rev 5.
4) Field sampling information from sampling logbook EL-1572-3.

Solution:
Calculation methodology is described in Appendix A of DOE/RL-96-22, Rev 4. Data from attached worksheets are used to calculate the required number of closeout samples. Variance calculation is based on the same three isotopes used to develop the statistical approach in DOE/RL-96-22, Rev 4. The statistical design is based on the premise that these isotopes are the predominant components of the contamination and are representative of the contamination distribution.

Sheet No.	Contents	Topic
1	Calc. Summary	Summary of Calc Brief
2	Shallow Zone	Required Number of Samples Calculation

Calc. Summary

CALCULATION SHEET

Washington Closure Hanford

Originator	R. T. Coffman	Date 12/12/2005	Calc. No.	0100K-CA-V0064	Rev. No.	0	
Project	100-K Remedial Action	Job No. 14655	Checked	S. W. Callison SWC	Date	12-12-05	
Subject	116-K-2 Mile Long Trench Variance Calculation (Phase 2, west)				Sheet No.	2 of 3	

Statistical Evaluation of Analytical Data

The required number of samples resulting from the calculation is highlighted at the bottom of the page.
Each value is reflective of the specific analyte evaluated.
The highest value of the three evaluations is used to determine the required number of samples as compared against the default of four.
Sample locations are from Calculation 0100K-CA-V0062.
Mean, Standard Deviation, *t*, and Number of Samples formulas are from DOE/RL-96-22, Appendix A.

Decision Unit: 116-K-2 Trench Shallow Zone
Samples values from GEA analysis

Sample Areas **A1 thru 4, B5 thru 8, C9, 10, 1, 2 & D3 thru 6**

Sample #	Sample Date	Location	Constituent: Cobalt-60 pCi/g	Q	Cesium-137 pCi/g	Q	Europium-152 pCi/g	Q
Look-up Value (HT) ==========>			**1.4**		**6.2**		**3.3**	
J107C9	9/28/2005	S-A1-2	0.081	U	0.071	U	0.17	U
J107D0	9/28/2005	S-A1-3	0.066	U	0.067	U	0.24	U
J107D1	9/28/2005	S-A1-4	0.061	U	0.068	U	0.15	U
J107D2	9/28/2005	S-A1-10	0.068	U	0.079	U	0.11	U
J107D3	9/28/2005	S-A1-13	0.07	U	5.22		2.33	
J107D4	9/28/2005	S-A1-16	0.479		4.79		8.47	
J107D5	9/28/2005	S-A2-3	0.069	U	0.063	U	0.14	U
J107D6	9/28/2005	S-A2-6	0.037	U	0.048	U	0.15	U
J107D7	9/28/2005	S-A2-7	0.054	U	0.156		0.09	
J107D8	9/28/2005	S-A2-10	0.065	U	0.195		0.173	
J107D9	9/28/2005	S-A2-14	0.043	U	0.804		0.18	U
J107F0	9/28/2005	S-A2-15	0.045	U	0.046	U	0.11	U
J107F1	9/28/2005	S-A3-1	0.063	U	0.05	U	0.13	U
J107F2	9/28/2005	S-A3-2	0.05	U	0.044	U	0.16	U
J107F3	9/28/2005	S-A3-4	0.045	U	0.043	U	0.11	U
J107F4	9/28/2005	S-A3-5	0.062	U	0.065	U	0.202	
J107F5	9/28/2005	S-A3-9	0.04	U	0.048	U	0.16	U
J107F6	9/28/2005	S-A3-11	0.037	U	0.057	U	0.14	U
J107F7	9/28/2005	S-A4-3	0.101		5.54		1.82	
J107F8	9/28/2005	S-A4-4	0.057	U	0.701		0.24	U
J107F9	9/28/2005	S-A4-7	0.055	U	0.048	U	0.13	U
J107H0	9/28/2005	S-A4-9	0.059	U	0.063	U	0.13	U
J107H1	9/28/2005	S-A4-12	0.038	U	0.042	U	0.15	U
J107H2	9/28/2005	S-A4-13	0.056	U	0.455		0.15	U
J107H3	10/3/2005	S-B5-1	0.07	U	0.062	U	0.14	U
J107H4	10/3/2005	S-B5-2	0.06	U	0.214		0.17	U
J107H5	10/3/2005	S-B5-5	0.055	U	0.07	U	0.2	
J107H6	10/3/2005	S-B5-7	0.065	U	2.8		0.511	
J107H7	10/3/2005	S-B5-13	0.069	U	0.534		0.899	
J107H8	10/3/2005	S-B5-15	0.073	U	3.76		2.15	
J107H9	10/3/2005	S-B6-1	0.063	U	0.06	U	0.16	U
J107J0	10/3/2005	S-B6-10	0.076	U	0.074	U	0.18	U
J107J1	10/3/2005	S-B6-12	0.063	U	0.107		0.21	U
J107J2	10/3/2005	S-B6-13	0.083	U	0.073	U	0.19	U
*J107J3	10/3/2005	S-B6-15	0.092	U	6.18		2.92	
J107J4	10/3/2005	S-B6-16	0.061	U	0.187		0.24	U
J107J5	10/3/2005	S-B7-1	0.099	U	0.071	U	0.19	U
J107J6	10/3/2005	S-B7-3	0.085	U	1.72		0.464	
J107J7	10/3/2005	S-B7-4	0.057	U	0.068	U	0.21	U
J107J8	10/3/2005	S-B7-5	0.087	U	0.065	U	0.141	
J107J9	10/3/2005	S-B7-8	0.11	U	10.3		4.16	
J107K0	10/3/2005	S-B7-11	0.083	U	0.078	U	0.17	U
J107K1	10/3/2005	S-B8-2	0.06	U	0.07	U	0.22	U
J107K2	10/3/2005	S-B8-3	0.072	U	0.093	U	0.2	U
J107K3	10/3/2005	S-B8-4	0.11	U	0.079	U	0.29	U
J107K4	10/3/2005	S-B8-8	0.086	U	0.07	U	0.16	U
J107K5	10/3/2005	S-B8-12	0.057	U	1.57		0.27	U
J107K6	10/3/2005	S-B8-13	0.077	U	0.185		0.17	U
J107K7	10/24/2005	S-C9-3	0.11	U	0.378		0.844	
*J10L47	11/3/2005	S-C9-4	0.076	U	0.13	U	0.22	U
J107K9	10/24/2005	S-C9-5	0.069	U	0.219		0.256	
J107L0	10/24/2005	S-C9-10	0.076	U	0.446		0.208	
J107L1	10/24/2005	S-C9-14	0.11	U	0.087	U	0.18	U
J107L2	10/24/2005	S-C9-16	0.086	U	0.12		0.126	

Shallow Zone

CALCULATION SHEET

Washington Closure Hanford

Originator	R. T. Coffman	Date 12/12/2005	Calc. No.	0100K-CA-V0064	Rev. No.	0	
Project	100-K Remedial Action	Job No. 14655	Checked	S. W. Callison SWC	Date	12-12-05	
Subject	116-K-2 Mile Long Trench Variance Calculation (Phase 2, west)				Sheet No.	2 of 3	

3
RTC 12/12/05

1 Statistical Evaluation of Analytical Data
2
3 The required number of samples resulting from the calculation is highlighted at the bottom of the page.
4 Each value is reflective of the specific analyte evaluated.
5 The highest value of the three evaluations is used to determine the required number of samples as compared
6 against the default of four.
7 Sample locations are from Calculation 0100K-CA-V0062.
8 Mean, Standard Deviation, *t*, and Number of Samples formulas are from DOE/RL-96-22, Appendix A.
10
11 Decision Unit: 116-K-2 Trench Shallow Zone
12 Samples values from GEA analysis

13 Sample Areas **A1 thru 4, B5 thru 8, C9, 10, 1, 2 & D3 thru 6**

14 Sample #	Sample Date	Location	Constituent: Cobalt-60 pCi/g	Q	Cesium-137 pCi/g	Q	Europium-152 pCi/g	Q
16 **Look-up Value (HT) ==========>**			**1.4**		**6.2**		**3.3**	
71 J107L3	10/5/2005	S-C10-3	0.06	U	0.098		0.16	U
72 J107L4	10/5/2005	S-C10-4	0.027	U	0.016	U	0.048	U
73 J107L5	10/5/2005	S-C10-8	0.053	U	0.058	U	0.15	U
74 J107L6	10/5/2005	S-C10-10	0.053	U	0.054	U	0.18	U
75 J107L7	10/5/2005	S-C10-14	0.074	U	0.078	U	0.16	U
76 J107L8	10/5/2005	S-C10-16	0.064	U	0.063	U	0.16	U
77 J107L9	10/5/2005	S-C1-2	0.244		2.58		4.75	
78 J107M0	10/5/2005	S-C1-3	0.047	U	0.03		0.1	U
79 J107M1	10/5/2005	S-C1-4	0.084	U	0.482		0.29	U
80 J107M2	10/5/2005	S-C1-10	0.11	U	2.37		1.5	
81 J107M3	10/5/2005	S-C1-13	0.075	U	0.077	U	0.18	U
82 J107M4	10/5/2005	S-C1-16	0.068	U	0.061	U	0.2	U
83 J107M5	10/5/2005	S-C2-3	0.055	U	0.07		0.14	U
84 J107M6	10/5/2005	S-C2-6	0.056	U	0.748		0.22	U
85 J107M7	10/5/2005	S-C2-7	0.052	U	1.13		0.332	
86 J107M8	10/5/2005	S-C2-10	0.054	U	0.053	U	0.17	U
87 J107M9	10/5/2005	S-C2-14	0.074	U	0.073	U	0.21	U
88 J107N0	10/5/2005	S-C2-15	0.056	U	0.048	U	0.17	U
89 J107N1	10/5/2005	S-D3-1	0.058	U	0.422		0.151	
90 J107N2	10/5/2005	S-D3-2	0.06	U	0.597		0.358	
91 J107N3	10/5/2005	S-D3-4	0.06	U	0.062	U	0.13	U
92 J107N4	10/5/2005	S-D3-5	0.051	U	0.047	U	0.15	U
93 J107N5	10/5/2005	S-D3-9	0.066	U	0.053	U	0.15	U
94 J107N6	10/5/2005	S-D3-11	0.047	U	0.041	U	0.14	U
95 J107N7	10/4/2005	S-D4-3	0.076	U	0.069	U	0.15	U
96 J107N8	10/4/2005	S-D4-4	0.056	U	0.054	U	0.18	U
97 J107N9	10/4/2005	S-D4-7	0.069	U	0.062	U	0.15	U
98 J107P0	10/4/2005	S-D4-9	0.085	U	0.074	U	0.24	U
99 J107P1	10/4/2005	S-D4-12	0.062	U	0.065	U	0.16	U
100 J107P2	10/4/2005	S-D4-13	0.051	U	0.05	U	0.19	U
101 J107P3	10/4/2005	S-D5-1	0.059	U	0.047	U	0.15	U
102 J107P4	10/4/2005	S-D5-2	0.071	U	0.06	U	0.21	U
103 J107P5	10/4/2005	S-D5-5	0.084	U	0.081		0.18	U
104 J107P6	10/4/2005	S-D5-7	0.052	U	0.057	U	0.2	U
105 J107P7	10/4/2005	S-D5-13	0.075	U	0.053	U	0.14	U
106 J107P8	10/4/2005	S-D5-15	0.067	U	0.06	U	0.2	U
107 J107P9	10/6/2005	S-D6-1	0.051	U	0.054	U	0.12	U
108 J107R0	10/6/2005	S-D6-10	0.038	U	0.039	U	0.13	U
109 J107R1	10/6/2005	S-D6-12	0.051	U	0.11	U	0.11	U
110 J107R2	10/6/2005	S-D6-13	0.065	U	0.081	U	0.16	U
111 J107R3	10/6/2005	S-D6-15	0.054	U	0.054	U	0.17	U
112 J107R4	10/6/2005	S-D6-16	0.055	U	0.047	U	0.14	U
113 Mean (LV) ==========>			0.07		0.62		0.47	
114 Standard Deviation (S) ==========>			0.05		1.57		1.12	
115 α (5%) ==========>			1.645		1.645		1.645	
116 β (20%) ==========>			0.842		0.842		0.842	
117 **Number of Samples ==========>**			1		1		1	

118 * Denotes sample node replacement sample and data, following additional remediation.

Shallow Zone

CALCULATION COVER SHEET

Project Title:	100-K Remedial Action	**Job No.**	**14655**
Area	100-K		
Discipline	Environmental	***Calc. No.**	0100K-CA-V0065
Subject	116-K-2 Overburden Variance Calculation		
Computer Program	Excel	**Program No.**	Excel 2003

Committed Calculation **X** **Preliminary** **Superseded**

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0 0	Cover - 1 Summary - 1 Calculations - 2 Total - 4	R. T. Coffman RT Coffman 12/13/05	S. W. Callison SW Callison 12-13-05	M. A. Buckmaster 12/14/05	M. A. Buckmaster	12/14/05

SUMMARY OF REVISIONS

Scanned	Rev.	Date	Bar Code No.

* Obtain Calc. No. from DIS.

CALCULATION SHEET

Washington Closure Hanford

Originator	R. T. Coffman RTC	Date	12/12/2005	Calc. No.	0100K-CA-V0065	Rev. No.	0
Project	100-K Remedial Action	Job No.	14655	Checked	S. W. Callison SWC	Date	12-13-05
Subject	116-K-2 Overburden Variance Calculation					Sheet No.	1 of 3

Conclusion:
The required number of samples calculated (1sample) for each decision sub-unit is less than the default number (4 samples) specified in the DOE/RL-96-22, Rev 4. Therefore, the default number of samples will be collected from each shallow zone decision sub-unit.

Problem:
Calculate the number of close out samples required for 116-K-2 Mile Long Trench Shallow Unit verification sampling as required in "100 Area Remedial Action Sampling and Analysis Plan" (DOE/RL-96-22, Rev 4) and "Instruction Guide for the Remediation of 100 Areas Waste Sites" (0100X-IG-G0001, Rev 5).

Given:
1) Sample locations for the 116-K-2 Mile Long Trench Shallow Decision Unit are identified on the 116-K-2 Mile Long Trench Shallow Sample Design, Calculation number 0100K-CA-V0062, Rev. 0.
2) Lookup values from DOE/RL-96-22, Rev 4.
3) Sample Design requirements from DOE/RL-96-22, Rev 4 and 0100X-IG-G0001, Rev 5.
4) Field sampling information from sampling logbook EL-1572-3.

Solution:
Calculation methodology is described in Appendix A of DOE/RL-96-22, Rev 4. Data from attached worksheets are used to calculate the required number of closeout samples. Variance calculation is based on the same three isotopes used to develop the statistical approach in DOE/RL-96-22, Rev 4. The statistical design is based on the premise that these isotopes are the predominant components of the contamination and are representative of the contamination distribution.

Sheet No.	Contents	Topic
1	Calc. Summary	Summary of Calc Brief
2	Shallow Zone	Required Number of Samples Calculation

CALCULATION SHEET

Washington Closure Hanford

Originator	R. T. Coffman RTC	Date	12/12/2005	Calc. No.	0100K-CA-V0065	Rev. No.	0
Project	100-K Remedial Action	Job No.	14655	Checked	S. W. Callison SWC	Date	12-13-05
Subject	116-K-2 Overburden Variance Calculation					Sheet No.	2 of 3

Statistical Evaluation of Analytical Data

The required number of samples resulting from the calculation is highlighted at the bottom of the page.
Each value is reflective of the specific analyte evaluated.
The highest value of the three evaluations is used to determine the required number of samples as compared against the default of four.
Sample locations are from Calculation 0100K-CA-V0062.
Mean, Standard Deviation, t, and Number of Samples formulas are from DOE/RL-96-22, Appendix A.

Decision Unit: 116-K-2 Trench Shallow Zone
Samples values from GEA analysis
Sample Areas A1 thru 4, B5 thru 8

			Constituent					
Sample #	Sample Date	Location	Cobalt-60 pCi/g	Q	Cesium-137 pCi/g	Q	Europium-152 pCi/g	Q
Look-up Value (HT) ==========>			1.4		6.2		3.3	
J10L73	11/8/2005	O-A1-2	0.054	U	0.047	U	0.15	U
J10L74	11/8/2005	O-A1-3	0.068	U	0.125	U	0.398	U
J10L75	11/8/2005	O-A1-4	0.069	U	0.058	U	0.14	U
J10L76	11/8/2005	O-A1-10	0.043	U	0.049	U	0.13	U
J10L77	11/8/2005	O-A1-13	0.061	U	0.055	U	0.14	U
J10L78	11/8/2005	O-A1-16	0.045	U	0.083	U	0.14	U
J10L79	11/8/2005	O-A2-3	0.057	U	0.1	U	0.12	U
J10L80	11/8/2005	O-A2-6	0.041	U	0.043	U	0.12	U
J10L81	11/8/2005	O-A2-7	0.052	U	0.042	U	0.099	U
J10L82	11/8/2005	O-A2-10	0.067	U	0.082	U	0.14	U
J10L83	11/8/2005	O-A2-14	0.054	U	0.062		0.12	U
J10L84	11/8/2005	O-A2-15	0.037	U	0.039	U	0.12	U
J10L85	11/8/2005	O-A3-1	0.062	U	0.15	U	0.18	U
J10L86	11/8/2005	O-A3-2	0.083	U	0.068	U	0.18	U
J10L87	11/8/2005	O-A3-4	0.046	U	0.046	U	0.14	U
J10L88	11/8/2005	O-A3-5	0.059	U	0.058	U	0.08	U
J10L89	11/8/2005	O-A3-9	0.076	U	0.079	U	0.2	U
J10L90	11/8/2005	O-A3-11	0.06	U	0.172		0.18	U
J10L91	11/9/2005	O-A4-3	0.047	U	0.052	U	0.14	U
J10L92	11/9/2005	O-A4-4	0.072	U	0.12		0.19	U
J10L93	11/9/2005	O-A4-7	0.055	U	0.18	U	0.16	U
J10L94	11/9/2005	O-A4-9	0.046	U	0.044	U	0.14	U
J10L95	11/9/2005	O-A4-12	0.046	U	0.054	U	0.12	U
J10L96	11/9/2005	O-A4-13	0.073	U	0.059		0.19	U
J10L97	11/9/2005	O-B5-1	0.08	U	0.46		0.706	
J10L98	11/9/2005	O-B5-2	0.093	U	0.089	U	0.18	U
J10L99	11/9/2005	O-B5-5	0.05	U	0.043	U	0.13	U
J10LB0	11/9/2005	O-B5-7	0.07	U	0.066	U	0.14	U
J10LB1	11/9/2005	O-B5-13	0.086	U	0.069	U	0.22	U
J10LB2	11/9/2005	O-B5-15	0.061	U	0.055	U	0.17	U
J10LB3	11/9/2005	O-B6-1	0.077	U	0.065	U	0.17	U
J10LB4	11/9/2005	O-B6-10	0.049	U	0.046	U	0.15	U
J10LB5	11/9/2005	O-B6-12	0.055	U	0.055	U	0.13	U
J10LB6	11/9/2005	O-B6-13	0.065	U	0.056	U	0.18	U
J10LB7	11/9/2005	O-B6-15	0.063	U	0.071	U	0.2	U
J10LB8	11/9/2005	O-B6-16	0.079	U	0.066	U	0.14	U
J10LB9	11/9/2005	O-B7-1	0.042	U	0.044	U	0.13	U
J10LC0	11/9/2005	O-B7-3	0.051	U	0.051	U	0.13	U
J10LC1	11/9/2005	O-B7-4	0.07	U	0.059	U	0.19	U
J10LC2	11/9/2005	O-B7-5	0.065	U	0.066	U	0.2	U
J10LC3	11/9/2005	O-B7-8	0.065	U	0.067	U	0.15	U
J10LC4	11/9/2005	O-B7-11	0.046	U	0.047	U	0.14	U
J10LC5	11/9/2005	O-B8-2	0.065	U	0.06	U	0.12	U
J10LC6	11/9/2005	O-B8-3	0.07	U	0.065	U	0.19	U
J10LC7	11/9/2005	O-B8-4	0.055	U	0.054	U	0.15	U
J10LC8	11/9/2005	O-B8-8	0.035	U	0.043	U	0.12	U
J10LC9	11/9/2005	O-B8-12	0.046	U	0.043	U	0.1	U
J10LD0	11/9/2005	O-B8-13	0.069	U	0.057	U	0.14	U

CALCULATION SHEET

Washington Closure Hanford

Originator	R. T. Coffman RTC	Date 12/12/2005	Calc. No.	0100K-CA-V0065	Rev. No.	0	
Project	100-K Remedial Action	Job No. 14655	Checked	S. W. Callison SWC	Date	12-13-05	
Subject	116-K-2 Overburden Variance Calculation				Sheet No.	2 of 3	

3 RTC 12/12/05

1 Statistical Evaluation of Analytical Data
2
3 The required number of samples resulting from the calculation is highlighted at the bottom of the page.
4 Each value is reflective of the specific analyte evaluated.
5 The highest value of the three evaluations is used to determine the required number of samples as compared
6 against the default of four.
7 Sample locations are from Calculation 0100K-CA-V0062.
8 Mean, Standard Deviation, *t*, and Number of Samples formulas are from DOE/RL-96-22, Appendix A.
10
11 Decision Unit: 116-K-2 Trench Shallow Zone
12 Samples values from GEA analysis
13 Sample Areas A1 thru 4, B5 thru 8

14 Sample #	Sample Date	Location	Constituent: Cobalt-60 pCi/g	Q	Cesium-137 pCi/g	Q	Europium-152 pCi/g	Q
16 **Look-up Value (HT) ==========>**			**1.4**		**6.2**		**3.3**	
65 Mean (LV) ==========>			0.06		0.08		0.17	
66 Standard Deviation (S) ==========>			0.01		0.06		0.09	
67 α (5%) ==========>			1.645		1.645		1.645	
68 β (20%) ==========>			0.842		0.842		0.842	
69 **Number of Samples ==========>**			**1**		**1**		**1**	
70								

CALCULATION COVER SHEET

Project Title:	100-K Area Field Remediation	**Job No.**	14655
Area	100-K		
Discipline	Environmental	***Calc. No.**	0100K-CA-V0061
Subject	116-K-2 Trench (West End) Cleanup Verification 95% UCL Calculations		
Computer Program	Excel	**Program No.**	Excel 2003

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

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 7 Total = 8	S.W. Clark S.W. Clark 12/19/05 ~~J. M. Capron~~	12/19/05 K.E. Cook FOR T. M. Blakley	L M Dittmer 12/20/05 L. M. Dittmer	SW Callison 12-21-05 S. W. Callison	12-21-05

SUMMARY OF REVISIONS

* Obtain calc no. from DIS

DE01437.03 (12/09/2004)

Washington Closure Hanford **CALCULATION SHEET**

Originator ~~J. M. Capron~~ S. W. Clark SWC 12/19/05 Date 12/19/05 Calc. No. 0100K-CA-V0061 Rev. No. 0
Project 100-K Area Field Remediation Job No. 14655 Checked T. M. Blakley KEC for Date 12/M/05
Subject 116-K-2 Trench (West End) Cleanup Verification 95% UCL Calculations Sheet No. 1 of 7

Purpose:
Calculate the 95% upper confidence limit (UCL) to evaluate compliance with cleanup standards for the subject site. Also, calculate the carcinogenic risk for applicable nonradionuclide analytes, perform the *Washington Administrative Code* (WAC) 173-340 (Model Toxics Control Act [MTCA]) 3-part test, if required, and calculate the relative percent difference (RPD) for each contaminant of concern (COC).

Table of Contents:

Given/References:
1) Sample Results
2) All lookup values and remedial action goals (RAGs) are taken from DOE-RL (2005b) and Ecology (1996).
3) DOE-RL, 2005a, *100 Area Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) DOE-RL, 2005b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
5) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington State Department of Ecology, Olympia, Washington.
6) 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 State Department of Ecology, Olympia, Washington.
7) Ecology, 1996, *Model Toxics Control Act Cleanup Levels and Risk Calculations (CLARC II)*, Publication #94-145, Washington State Department of Ecology, Olympia, Washington.
8) 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.
9) WAC 173-340, 1996, "Model Toxics Control Act--Cleanup," *Washington Administrative Code*.
10) WCH, 2005, *116-K-2 Trench (East End) Cleanup Verification 95% UCL Calculations*, Calc. No. 0100K-CA-V0056, Rev. 0, Washington Closure Hanford, Richland, Washington.

Solution:
Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2005b). Use data from 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 in the primary-duplicate and primary-split sample pairs.

Calculation Description:
The subject calculations were performed on data from soil verification samples from the southwest portion of the 116-K-2 waste site; calculations for the remainder of the waste site are documented in WCH (2005). 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 2005b) is documented by this calculation. Split and duplicate RPD results are used in evaluation of data quality and are presented in the cleanup verification package (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 minimal 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.

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 test for distribution is performed. For nonradionuclide data sets of ten or greater, distributional testing is done using Ecology's MTCAStat software (Ecology 1993).

The hazard quotient (for shallow zone nonradionuclide COCs) is determined by dividing the statistical value (derived in this calculation) by the WAC 173-340 non-carcinogenic 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 non-radionuclide COC,
2) greater than 10% of the raw data exceed the most stringent cleanup limit for each non-radionuclide COC,
3) the maximum value of the raw data set exceeds two times the most stringent cleanup limit for each non-radionuclide COC.

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 pre-determined for each analytical method, listed in Table II-1 of the SAP (DOE-RL 2005a). The RPD calculations use the following formula: $RPD = [|M-S|/((M+S)/2)]*100$

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

For quality assurance/quality control (QA/QC) split and duplicate RPD calculations, a value less than +/- 30% indicates the data compare favorably. For regulatory splits, a threshold of 35% is used (EPA 1994). If the RPD is greater than 30% (or 35% for regulatory split data), further investigation regarding the usability of the data is performed. Additional discussion as necessary is provided in the data quality assessment section of the applicable 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.

Washington Closure Hanford CALCULATION SHEET

Originator ~~J. M. Capron~~ S.W. Clark SWC 12/19/05 Date 12/19/05 Calc. No. 0100K-CA-V0061 Rev. No. 0
Project 100-K Area Field Remediation Job No. 14655 Checked T. M. Blakley KEC for Date 12-19-05
Subject 116-K-2 Trench (West End) Cleanup Verification 95% UCL Calculations Sheet No. 2 of 7

Summary (continued)

Results:
The results presented in the summary tables that follow are for use in RESidual RADioactivity dose/risk analysis and the CVP for this site.

Results Summary

Analyte	Shallow Zone		Deep Zone		Overburden		Units
	Result	Qualifier	Result	Qualifier	Result	Qualifier	
Hexavalent Chromium	2.3E-01		2.4E+00		2.7E-01		mg/kg
Carbon-14	2.9E-01		1.44E+00		6.8E-01	U	pCi/g
Cesium-137	1.10E+00		1.17E+02		0(<BG)		pCi/g
Cobalt-60	2.3E-02	U	4.23E+00		1.2E-02	U	pCi/g
Europium-152	6.26E-01		7.6E+01		1.7E-01		pCi/g
Europium-154	1.29E-01		7.2E+00		3.5E-02	U	pCi/g
Nickel-63	1.77E+00		6.5E+02		6.89E-01	U	pCi/g
Plutonium-239/240	2.4E-02	U	4.7E+00		6.E-03	U	pCi/g
Strontium-90	2.01E-01		6.3E+00		0(<BG)	U	pCi/g

WAC 173-340 Evaluation (Shallow Zone)

3-Part Test:
95% UCL > Cleanup Limit? NO
> 10% above Cleanup Limit? NO
Any sample > 2x Cleanup Limit? NO

Risk Estimate:
Nonrad noncarcinogenic index sum: 9.6E-04
Nonrad carcinogenic risk: 1.1E-07

WAC 173-340 Evaluation (Deep Zone)

3-Part Test:
95% UCL > Cleanup Limit? YES
> 10% above Cleanup Limit? YES
Any sample > 2x Cleanup Limit? YES

Because of the "yes" answers to the MTCA 3-part test for hexavalent chromium, a site-specific assessment will be performed for this contaminant within the CVP.

WAC 173-340 Evaluation (Overburden)

3-Part Test:
95% UCL > Cleanup Limit? NO
> 10% above Cleanup Limit? NO
Any sample > 2x Cleanup Limit? NO

Risk Estimate:
Nonrad noncarcinogenic index sum: 1.1E-03
Nonrad carcinogenic risk: 1.3E-07

Relative Percent Difference Results* QA/QC Analysis

Analyte	Shallow Zone		Deep Zone		Overburden
	Duplicate Analysis**	Split Analysis**	Duplicate Analysis**	Split Analysis**	Duplicate Analysis**
Hexavalent Chromium					
Carbon-14					
Cesium-137			*67%*	*56%*	
Cobalt-60			*64%*	*43%*	
Europium-152			*62%*	*53%*	
Europium-154			*57%*	*49%*	
Nickel-63			10%	10%	
Plutonium-239/240					
Strontium-90					

*A blank cell indicates that RPD evaluation was not required.
**The significance of the reported RPD values, including values greater than 30%, is addressed within the Data Quality Assessment for the CVP for this site.
QA/QC = quality assurance/quality control
RESRAD = RESidual RADioactivity (dose model)
RPD = relative percent difference
U = undetected

CALCULATION SHEET

Washington Closure Hanford
Originator ~~C. M. Capron~~ S.W. Clark SWC 12/19/05
Project 100-K Area Field Remediation
Subject 116-K-2 Trench (West End) Cleanup Verification 95% UCL Calculations

Date 12/19/05
Job No. 14655

Calc. No. 0100K-CA-V0061
Checked T. M. Blakley MEC for

Rev. No. 0
Date 12/19/05
Sheet No. 3 of 7

1 **Shallow Zone Sample Data**

2	Sampling	HEIS	Sample	Hexavalent Chromium			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Nickel-63			Plutonium-239/240			Strontium-90		
3	Area	Number	Date	mg/kg	Q	PQL	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	A3	J10DL0	11/2/2005	2.1E-01	U	2.1E-01	1.08E+00	U	3.6E+00	4.2E-02	U	4.2E-02	4.6E-02	U	4.6E-02	9.1E-02	U	9.1E-02	1.5E-01	U	1.5E-01	-5.04E-01	U	3.8E+00	0	U	3.2E-01	9.0E-02	U	1.9E-01
5	Duplicate of J10DL0	J10DM4	11/2/2005	2.1E-01	U	2.1E-01	-9.13E-01	U	3.6E+00	3.2E-02	U	3.2E-02	3.2E-02	U	3.2E-02	1.1E-01	U	1.1E-01	1.1E-01	U	1.1E-01	-1.83E+00	U	3.9E+00	0	U	2.8E-01	1.36E-01	U	1.8E-01
6	A1	J10DK8	11/2/2005	2.1E-01	U	2.1E-01	1.82E+00	U	3.3E+00	4.4E-02	U	4.4E-02	4.1E-02	U	4.1E-02	1.2E-01	U	1.2E-01	1.4E-01	U	1.4E-01	-1.04E+00	U	3.7E+00	0	U	3.1E-01	1.54E-01		2.2E-01
7	A2	J10DK9	11/2/2005	2.1E-01	U	2.1E-01	1.45E+00		3.2E+00	4.4E-02	U	4.4E-02	3.8E-02	U	3.8E-02	8.9E-02	U	8.9E-02	1.4E-01	U	1.4E-01	-1.11E+00	U	3.7E+00	3.5E-02	U	2.7E-01	1.24E-01	U	2.0E-01
8	A4	J10DL1	10/27/2005	2.1E-01	U	2.1E-01	-5.04E-01	U	3.6E+00	4.28E-01		4.1E-02	3.4E-02	U	3.4E-02	2.37E-01		8.6E-02	1.1E-01	U	1.1E-01	-3.94E-01	U	3.6E+00	0	U	1.3E-01	3.74E-01		2.0E-01
9	B5	J10DL2	10/27/2005	2.5E-01		2.0E-01	-1.16E+00	U	3.4E+00	2.08E+00		4.9E-02	3.4E-02	U	3.4E-02	8.16E-01		1.6E-01	1.3E-01	U	1.3E-01	2.07E+00	U	3.6E+00	0	U	2.5E-01	2.85E-01		1.8E-01
10	B6	J10DL3	10/27/2005	2.9E-01		2.1E-01	-2.00E+00	U	3.6E+00	4.69E+00		6.6E-02	4.4E-02	U	4.4E-02	2.62E+00		1.4E-01	2.95E-01		1.5E-01	4.22E+00		3.4E+00	3.6E-02	U	2.7E-01	2.71E-01		1.8E-01
11	B7	J10DL4	10/27/2005	2.3E-01		2.1E-01	-2.63E+00	U	3.4E+00	4.0E-02	U	4.0E-02	4.2E-02	U	4.2E-02	1.3E-01	U	1.3E-01	1.5E-01	U	1.5E-01	2.10E+00	U	3.8E+00	0	U	2.6E-01	9.9E-02	U	2.4E-01
12	B8	J10DL5	10/27/2005	2.5E-01		2.0E-01	-1.20E+00	U	2.2E+00	5.4E-02		4.4E-02	4.1E-02	U	4.1E-02	1.1E-01	U	1.1E-01	1.3E-01	U	1.3E-01	1.27E+00	U	3.5E+00	0	U	3.6E-01	1.57E-01	U	1.9E-01
13	C9	J10DL6	11/2/2005	2.1E-01		2.1E-01	9.95E-01	U	3.5E+00	6.16E-01		4.8E-02	3.9E-02	U	3.9E-02	3.65E-01		1.1E-01	1.3E-01	U	1.3E-01	2.25E-01	U	3.7E+00	0	U	2.3E-01	2.40E-01		2.0E-01
14	C10	J10DL7	10/26/2005	2.1E-01	U	2.1E-01	-2.52E+00	U	3.6E+00	3.6E-02	U	3.6E-02	3.4E-02	U	3.4E-02	1.2E-01	U	1.2E-01	1.3E-01	U	1.3E-01	7.6E-02	U	3.2E+00	0	U	1.8E-01	-3.5E-02	U	2.7E-01
15	C1	J10DL8	10/26/2005	2.3E-01		2.0E-01	-1.52E+00	U	3.5E+00	1.17E+00		5.8E-02	6.8E-02	U	6.8E-02	9.36E-01		1.1E-01	2.99E-01		1.6E-01	5.03E+00		3.5E+00	0	U	2.4E-01	3.6E-02	U	2.4E-01
16	C2	J10DL9	10/26/2005	3.1E-01		2.1E-01	-2.51E+00	U	3.7E+00	2.52E-01		4.6E-02	4.7E-02	U	4.7E-02	1.5E-01	U	1.5E-01	1.5E-01	U	1.5E-01	1.87E+00	U	3.2E+00	0	U	2.4E-01	2.E-03	U	2.6E-01
17	D3	J10DM0	10/25/2005	2.2E-01		2.0E-01	1.80E+00	U	3.3E+00	4.3E-02	U	4.3E-02	4.9E-02	U	4.9E-02	1.5E-01	U	1.5E-01	1.5E-01	U	1.5E-01	9.08E-01	U	3.6E+00	0	U	2.9E-01	3.20E-01		2.2E-01
18	D4	J10DM1	10/25/2005	2.0E-01	U	2.0E-01	-5.00E-01		3.5E+00	9.0E-02		4.8E-02	4.5E-02	U	4.5E-02	1.2E-01	U	1.2E-01	1.4E-01	U	1.4E-01	3.50E-01	U	4.3E+00	1.13E-01	U	2.2E-01	1.09E-01	U	2.0E-01
19	D5	J10DM2	10/25/2005	2.4E-01		2.0E-01	7.42E-01	U	3.1E+00	4.4E-02		3.9E-02	4.9E-02	U	4.9E-02	1.1E-01	U	1.1E-01	1.7E-01	U	1.7E-01	1.14E+00	U	4.3E+00	0	U	2.6E-01	1.16E-01	U	2.8E-01
20	D6	J10DM3	10/25/2005	3.0E-01		2.0E-01	1.63E+00	U	3.4E+00	3.4E-02	U	3.4E-02	3.1E-02	U	3.1E-02	1.2E-01	U	1.2E-01	1.1E-01	U	1.1E-01	1.18E+00	U	4.1E+00	0	U	3.4E-01	1.00E-01	U	1.0E+00

21 Note: Radiological analytical methods use statistically-determined floating calibration curves that are not forced through the origin; therefore, negative values are routinely reported for undetected analytes. This does not diminish the usability of the data.

22 **Statistical Computation Input Data**

23	Sampling	HEIS	Sample	Cr^{6+}	C-14	Cs-137	Co-60	Eu-152	Eu-154	Ni-63	Pu-239/240	Sr-90
24	Area	Number	Date	mg/kg	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
25	A3	J10DL0/J10DM4	11/2/2005	1.1E-01	8.4E-02	1.9E-02	2.0E-02	5.E-02	6.5E-02	-1.17E+00	0	1.13E-01
26	A1	J10DK8	11/2/2005	1.1E-01	1.82E+00	2.2E-02	2.1E-02	6.0E-02	7.0E-02	-1.04E+00	0	1.54E-01
27	A2	J10DK9	11/2/2005	1.1E-01	1.45E+00	2.2E-02	1.9E-02	4.5E-02	7.0E-02	-1.11E+00	3.5E-02	1.24E-01
28	A4	J10DL1	10/27/2005	1.1E-01	-5.04E-01	4.28E-01	1.7E-02	2.37E-01	5.5E-02	-3.94E-01	0	3.74E-01
29	B5	J10DL2	10/27/2005	2.5E-01	-1.16E+00	2.08E+00	1.7E-02	8.16E-01	6.5E-02	2.07E+00	0	2.85E-01
30	B6	J10DL3	10/27/2005	2.9E-01	-2.00E+00	4.69E+00	2.2E-02	2.62E+00	2.95E-01	4.22E+00	3.6E-02	2.71E-01
31	B7	J10DL4	10/27/2005	2.3E-01	-2.63E+00	2.0E-02	2.1E-02	6.5E-02	7.5E-02	2.10E+00	0	9.9E-02
32	B8	J10DL5	10/27/2005	2.5E-01	-1.20E+00	5.4E-02	2.1E-02	5.5E-02	6.5E-02	1.27E+00	0	1.57E-01
33	C9	J10DL6	11/2/2005	2.1E-01	9.95E-01	6.16E-01	2.0E-02	3.65E-01	6.5E-02	2.25E-01	0	2.40E-01
34	C10	J10DL7	10/26/2005	1.1E-01	-2.52E+00	1.8E-02	1.7E-02	6.0E-02	6.5E-02	7.6E-02	0	-3.5E-02
35	C1	J10DL8	10/26/2005	2.3E-01	-1.52E+00	1.17E+00	3.4E-02	9.36E-01	2.99E-01	5.03E+00	0	3.6E-02
36	C2	J10DL9	10/26/2005	3.1E-01	-2.51E+00	2.52E-01	2.4E-02	7.5E-02	7.5E-02	1.87E+00	0	2.E-03
37	D3	J10DM0	10/25/2005	2.2E-01	1.80E+00	2.2E-02	2.5E-02	7.5E-02	7.5E-02	9.08E-01	0	3.20E-01
38	D4	J10DM1	10/25/2005	1.0E-01	-5.00E-01	9.0E-02	2.3E-02	6.0E-02	7.0E-02	3.50E-01	1.13E-01	1.09E-01
39	D5	J10DM2	10/25/2005	2.4E-01	7.42E-01	4.4E-02	2.5E-02	5.5E-02	8.5E-02	1.14E+00	0	1.16E-01
40	D6	J10DM3	10/25/2005	3.0E-01	1.63E+00	1.7E-02	1.6E-02	6.0E-02	5.5E-02	1.18E+00	0	1.00E-01

41 **Statistical Computations**

42		Cr^{6+}	C-14	Cs-137	Co-60	Eu-152	Eu-154	Ni-63	Pu-239/240	Sr-90
43	Statistical value based on	Large data set (n >10), lognormal and normal distribution rejected, use Z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclice 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.
44	N	16	16	16	16	16	16	16	16	16
45	% < Detection limit	38%	88%	44%	100%	69%	88%	88%	100%	63%
46	mean	2.0E-01	-3.6E-01	6.0E-01	2.1E-02	3.5E-01	9.7E-02	1.05E+00	1.2E-02	1.5E-01
47	st. dev.	8.E-02	1.63E+00	1.23E+00	4.E-03	6.7E-01	7.9E-02	1.77E+00	3.0E-02	1.2E-01
48	Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
49	95% UCL on mean	2.3E-01	2.9E-01	1.10E+00	2.3E-02	6.3E-01	1.29E-01	1.77E+00	2.4E-02	2.0E-01
50	max value	3.1E-01	1.82E+00	4.69E+00	6.8E-02	2.62E+00	2.99E-01	5.03E+00	1.13E-01	3.74E-01
51	Statistical value	2.3E-01	2.9E-01	1.10E+00	2.3E-02	6.3E-01	1.29E-01	1.77E+00	2.4E-02	2.0E-01
52	Background	NA	NA	NA	NA	NA	NA	NA	NA	NA
53	Statistical value above background	2.3E-01	2.9E-01	1.10E+00	2.3E-02	6.26E-01	1.29E-01	1.77E+00	2.4E-02	2.0E-01

54	**Most Stringent Cleanup Limit for nonradionuclide and RAG type**	2 River Protection
55	**WAC 173-340 3-PART Test**	
56	95% UCL > Cleanup Limit?	NO
57	> 10% above Cleanup Limit?	NO
58	Any sample > 2X Cleanup Limit?	NO
59	**EXCESS RISK EVALUATION**	
60	**WAC 173-340 Non-Carcinogenic Cleanup:**	240
61	Hazard quotient for each nonradionuclide:	9.6E-04
62	**WAC 173-340 Carcinogenic Cleanup:**	2.1
63	Risk for each carcinogenic nonradionuclide:	1.1E-07
64	**WAC 173-340 3-Part-Test Compliance?**	YES
65	**Nonrad noncarcinogenic index sum:**	9.6.E-04
66	**Nonrad carcinogenic risk:**	1.1E-07

67 HEIS = Hanford Environmental Information System
68 MDA = minimum detectable activity
69 NA = not applicable
70 PQL = practical quantitation limit
Q = qualifier
RAG = remedial action goal
U = undetected
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator ~~J. M. Capron~~ J. W. Clark JWC 12/19/05
Project 100-K Area Field Remediation
Subject 116-K-2 Trench (West End) Cleanup Verification 95% UCL Calculations

Date 12/19/05
Job No. 14655

Calc. No. 0100K-CA-V0061
Checked T. M. Blakley KEC for

Rev. No. 0
Date ~~12/19/05~~ KEC 12/19/05
Sheet No. 1 4 of 7

1 **Deep Zone Sample Data**

2	Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Nickel-63			Plutonium-239/240			Strontium-90		
3				mg/kg	Q	PQL	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	D10	J10CW7	10/18/2005	9.7E-01		2.1E-01	1.08E+00	U	2.4E+00	2.18E+02		4.0E-01	6.68E+00		1.5E-01	1.94E+02		1.1E+00	1.80E+01		5.8E-01	4.80E+02		4.0E+00	4.33E+00		2.8E-01	3.27E+00		2.6E-01
5	Duplicate of J10CW7	J10CX6	10/18/2005	2.0E+00		2.0E-01	1.71E+00	U	2.4E+00	1.09E+02		3.0E-01	3.45E+00		1.3E-01	1.02E+02		8.6E-01	1.00E+01		5.2E-01	5.30E+02		3.9E+00	5.47E+00		1.8E-01	5.38E+00		2.3E-01
6	A1	J10CV8	10/11/2005	2.1E+00		2.0E-01	4.87E-01	U	4.2E+00	3.77E+01		2.4E-01	4.71E+00		1.1E-01	4.65E+01		6.4E-01	4.75E+00		4.1E-01	3.93E+02		5.6E+00	2.67E+00		3.2E-01	2.48E+00		2.2E-01
7	A2	J10CV9	10/11/2005	1.2E+00		2.0E-01	-1.24E+00		4.3E+00	1.57E+01		1.9E-01	1.78E+00		8.7E-02	1.68E+01		6.4E-01	1.59E+00		3.2E-01	1.92E+02		4.1E+00	4.62E-01		2.7E-01	4.27E+00		2.1E-01
8	A3	J10CW0	10/11/2005	2.0E+00		2.1E-01	-2.19E+00		4.0E+00	1.13E+02		3.9E-01	4.85E+00		1.5E-01	9.00E+01		1.0E+00	9.45E+00		5.5E-01	5.88E+02		6.7E+00	3.81E+00		2.9E-01	3.93E+00		2.2E-01
9	B4	J10CW1	10/12/2005	9.3E-01		2.0E-01	-7.82E-01		2.5E+00	9.48E-01		4.4E-02	7.7E-02	U	7.7E-02	1.42E+00		1.3E-01	1.2E-01	U	1.2E-01	2.16E+01		3.5E+00	0	U	3.7E-01	8.24E-01		2.9E-01
10	B5	J10CW2	10/12/2005	1.2E+00		2.0E-01	5.52E-01		2.2E+00	2.71E+01		1.9E-01	1.54E+00		9.3E-02	1.93E+01		3.3E-01	2.21E+00		3.2E-01	2.43E+02		4.4E+00	1.43E+00		2.8E-01	2.19E+00		2.8E-01
11	B6	J10CW3	10/12/2005	2.2E+00		2.0E-01	1.56E+00		2.2E+00	8.87E+01		2.1E-01	7.53E+00		9.6E-02	3.70E+01		6.5E-01	3.45E+00		3.0E-01	7.39E+02		7.5E+00	1.71E+00		4.2E-01	1.88E+00		2.8E-01
12	C7	J10CW4	10/17/2005	3.6E+00		2.0E-01	4.62E+00		2.3E+00	1.11E+02		3.4E-01	9.62E+00		1.8E-01	1.24E+02		8.8E-01	1.03E+01		6.2E-01	1.57E+03		4.4E+00	1.34E+01		2.6E-01	2.01E+01		3.1E-01
13	C8	J10CW5	10/17/2005	2.0E-01	U	2.0E-01	-5.13E-01	U	2.4E+00	1.21E+00		4.3E-02	4.40E-02		3.1E-02	1.15E+00		9.9E-02	1.4E-01	U	1.4E-01	9.10E+00		4.2E+00	8.8E-02	U	3.4E-01	1.44E+00		2.8E-01
14	C9	J10CW6	10/17/2005	1.7E+00		2.1E-01	1.33E+00	U	2.3E+00	2.2E-02	U	2.2E-01	3.7E-02	U	3.7E-02	6.0E-02	U	6.0E-02	7.3E-02	U	7.3E-02	4.49E+02		3.9E+00	3.82E+00		3.3E-01	2.79E+00		2.5E-01
15	D1	J10CW8	10/18/2005	1.1E+00		2.1E-01	8.21E-01	U	2.4E+00	4.64E+01		2.4E-01	2.01E+00		1.2E-01	6.93E+01		5.0E-01	5.67E+00		4.6E-01	5.15E+02		3.6E+00	2.56E+00		3.8E-01	1.14E+00		2.5E-01
16	D2	J10CW9	10/18/2005	4.6E+00		2.0E-01	1.48E+00	U	2.3E+00	2.61E+02		2.7E-01	6.80E+00		1.5E-01	1.51E+02		1.2E+00	1.48E+01		5.6E-01	1.11E+03		3.8E+00	7.28E+00		3.3E-01	6.62E+00		2.7E-01
17	E3	J10CX0	10/18/2005	2.2E+00		2.0E-01	2.34E-01	U	2.3E+00	1.73E+02		4.1E-01	4.38E+00		1.5E-01	5.56E+01		1.1E+00	5.07E+00		5.3E-01	6.69E+02		3.4E+00	2.60E+00		1.9E-01	5.68E+00		2.4E-01
18	E4	J10CX1	10/18/2005	1.0E+00		2.0E-01	4.7E-02	U	2.3E+00	1.12E+00		4.0E-02	3.6E-02	U	3.6E-02	9.15E-01		1.4E-01	1.2E-01	U	1.2E-01	6.88E+00		3.7E+00	1.71E-01		3.3E-01	4.57E+00		2.5E-01
19	E5	J10CX2	10/24/2005	1.7E+00		2.0E-01	1.02E+00	U	3.5E+00	4.63E+01		1.4E-01	6.15E-01		7.6E-02	1.79E+01		5.7E-01	1.66E+00		3.0E-01	1.56E+02		5.1E+00	1.10E+00		3.5E-01	4.24E+00		2.0E-01
20	F6	J10CX3	10/24/2005	4.3E+00		2.0E-01	3.66E+00	U	5.0E+00	2.32E+02		5.7E-01	5.09E+00		2.1E-01	1.61E+02		1.5E+00	1.57E+01		8.2E-01	1.17E+03		9.8E+00	1.11E+01		3.3E-01	8.41E+00		2.0E-01
21	F7	J10CX4	10/24/2005	1.7E+00		2.0E-01	1.48E+00	U	3.1E+00	4.12E+01		1.6E-01	6.18E-01		7.1E-02	2.41E+01		3.5E-01	2.38E+00		2.7E-01	1.36E+02		3.7E+00	1.11E+00		3.7E-01	2.81E+00		2.3E-01
22	F8	J10CX5	10/24/2005	2.3E+00		2.0E-01	8.19E-01		3.2E+00	1.63E+02		1.7E-01	3.87E-01		5.3E-02	1.52E+01		4.7E-01	1.30E+00		2.1E-01	8.89E+01		4.0E+00	6.50E-01		4.1E-01	4.82E+00		2.7E-01

23 Note: Radiological analytical methods use statistically-determined floating calibration curves that are not forced through the origin; therefore, negative values are routinely reported for undetected analytes. This does not diminish the usability of the data.

24 **Statistical Computation Input Data**

25	Sampling Area	HEIS Number	Sample Date	Cr^{6+}		C-14		Cs-137		Co-60		Eu-152		Eu-154		Ni-63		Pu-239/240		Sr-90	
26				mg/kg		pCi/g		pCi/g		pCi/g		pCi/g		pCi/g		pCi/g		pCi/g		pCi/g	
27	D10	J10CW7/J10CX6	7/26/2005	1.5E+00		1.40E+00		1.64E+02		5.07E+00		1.48E+02		1.40E+01		5.05E+02		4.90E+00		4.33E+00	
28	A1	J10CV8	10/11/2005	2.1E+00		4.87E-01		3.77E+01		4.71E+00		4.65E+01		4.75E+00		3.93E+02		2.67E+00		2.48E+00	
29	A2	J10CV9	10/11/2005	1.2E+00		-1.24E+00		1.57E+01		1.78E+00		1.68E+01		1.59E+00		1.92E+02		4.62E-01		4.27E+00	
30	A3	J10CW0	10/11/2005	2.0E+00		-2.19E+00		1.13E+02		4.85E+00		9.00E+01		9.45E+00		5.88E+02		3.81E+00		3.93E+00	
31	B4	J10CW1	10/12/2005	9.3E-01		-7.82E-01		9.48E-01		3.9E-02		1.42E+00		6.0E-02		2.16E+01		0		8.24E-01	
32	B5	J10CW2	10/12/2005	1.2E+00		5.52E-01		2.71E+01		1.54E+00		1.93E+01		2.21E+00		2.43E+02		1.43E+00		2.19E+00	
33	B6	J10CW3	10/12/2005	2.2E+00		1.56E+00		8.87E+01		7.53E+00		3.70E+01		3.45E+00		7.39E+02		1.71E+00		1.88E+00	
34	C7	J10CW4	10/17/2005	3.6E+00		4.62E+00		1.11E+02		9.62E+00		1.24E+02		1.03E+01		1.57E+03		1.34E+01		2.01E+01	
35	C8	J10CW5	10/17/2005	1.0E-01		-5.13E-01		1.21E+00		4.40E-02		1.15E+00		7.0E-02		9.10E+00		8.8E-02		1.44E+00	
36	C9	J10CW6	10/17/2005	1.7E+00		1.33E+00		2.2E-02		1.9E-02		3.0E-02		3.7E-02		4.49E+02		3.82E+00		2.79E+00	
37	D1	J10CW8	10/18/2005	1.1E+00		8.21E-01		4.64E+01		2.01E+00		6.93E+01		5.67E+00		5.15E+02		2.56E+00		1.14E+00	
38	D2	J10CW9	10/18/2005	4.6E+00		1.48E+00		2.61E+02		6.80E+00		1.51E+02		1.48E+01		1.11E+03		7.28E+00		6.62E+00	
39	E3	J10CX0	10/18/2005	2.2E+00		2.34E-01		1.73E+02		4.38E+00		5.56E+01		5.07E+00		6.69E+02		2.60E+00		5.68E+00	
40	E4	J10CX1	10/18/2005	1.0E+00		4.7E-02		1.12E+00		1.8E-02		9.15E-01		6.0E-02		6.88E+00		1.71E-01		4.57E+00	
41	E5	J10CX2	10/24/2005	1.7E+00		1.02E+00		4.63E+01		6.15E-01		1.79E+01		1.66E+00		1.56E+02		1.10E+00		4.24E+00	
42	F6	J10CX3	10/24/2005	4.3E+00		3.66E+00		2.32E+02		5.09E+00		1.61E+02		1.57E+01		1.17E+03		1.11E+01		8.41E+00	
43	F7	J10CX4	10/24/2005	1.7E+00		1.48E+00		4.12E+01		6.18E-01		2.41E+01		2.38E+00		1.36E+02		1.11E+00		2.81E+00	
44	F8	J10CX5	10/24/2005	2.3E+00		8.19E-01		1.63E+02		3.87E-01		1.52E+01		1.30E+00		8.89E+01		6.50E-01		4.82E+00	

45 **Statistical Computations**

46		Cr^{6+}	C-14	Cs-137	Co-60	Eu-152	Eu-154	Ni-63	Pu-239/240	Sr-90
47	Statistical value based on	Large data set (n >10), lognormal and normal distribution rejected, use 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.	Radionuclide data set. Use nonparametric z-statistic.
48	N	18	18	18	18	18	18	18	18	18
49	% < Detection limit	6%	61%	6%	17%	6%	22%	0%	11%	0%
50	mean	2.0E+00	8.2E-01	8.5E+01	3.06E+00	5.4E+01	5.1E+00	4.8E+02	3.3E+00	4.6E+00
51	st. dev.	1.2E+00	1.60E+00	8.3E+01	3.01E+00	5.6E+01	5.4E+00	4.4E+02	3.8E+00	4.3E+00
52	Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
53	95% UCL on mean	2.4E+00	1.44E+00	1.17E+02	4.23E+00	7.6E+01	7.2E+00	6.5E+02	4.7E+00	6.3E+00
54	max value	4.6E+00	4.62E+00	2.61E+02	9.62E+00	1.94E+02	1.80E+01	1.57E+03	1.34E+01	2.01E+01
55	Statistical value	2.4E+00	1.44E+00	1.17E+02	4.23E+00	7.6E+01	7.2E+00	6.5E+02	4.7E+00	6.3E+00
56	Background	NA	NA	NA	NA	NA	NA	NA	NA	NA
57	Statistical value above background	2.4E+00	1.44E+00	1.17E+02	4.23E+00	7.6E+01	7.2E+00	6.5E+02	4.7E+00	6.3E+00
58	**Most Stringent Cleanup Limit for nonradionuclide and RAG type**	2	River Protection							
59	**WAC 173-340 3-PART Test**									
60	95% UCL > Cleanup Limit?	YES								
61	> 10% above Cleanup Limit?	YES								
62	Any sample > 2X Cleanup Limit?	YES								
63	**WAC 173-340 3-Part-Test Compliance?**	NO								

64 #HEIS = Hanford Environmental Information System
65 #MDA = minimum detectable activity
66 #NA = not applicable
67 #PQL = practical quantitation limit

Q = qualifier
RAG = remedial action goal
U = undetected
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator ~~J. M. Capron~~ S.W. Clark 12/19/05
Project 100-K Area Field Remediation
Subject 116-K-2 Trench (West End) Cleanup Verification 95% UCL Calculations

Date 12/19/05
Job No. 14655

Calc. No. 0100K-CA-V0061
Checked T. M. Blakley KEC for

Rev. No. 0
Date 12/19/05
Sheet No. 5 of 7

Overburden Sample Data

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium mg/kg	Q	PQL	Carbon-14 pCi/g	Q	MDA	Cesium-137 pCi/g	Q	MDA	Cobalt-60 pCi/g	Q	MDA	Europium-152 pCi/g	Q	MDA	Europium-154 pCi/g	Q	MDA	Nickel-63 pCi/g	Q	MDA	Plutonium-239/240 pCi/g	Q	MDA	Strontium-90 pCi/g	Q	MDA
B8	J10M07	11/15/2005	3.0E-01		2.2E-01	-1.37E+00	U	2.4E+00	4.3E-02	U	4.3E-02	4.7E-02	U	4.7E-02	9.7E-02	U	9.7E-02	1.6E-01	U	1.6E-01	1.15E-01	U	3.2E+00	0	U	2.9E-01	-3.1E-02	U	2.6E-01
Duplicate of J10M07	J10M08	11/15/2005	2.6E-01		2.2E-01	-6.04E-01	U	2.4E+00	3.2E-02	U	3.2E-02	2.9E-02	U	2.9E-02	1.2E-01	U	1.2E-01	1.1E-01	U	1.1E-01	8.42E-01	U	3.4E+00	1.20E-01	U	4.6E-01	-6.8E-02	U	2.2E-01
A1	J10M00	11/14/2005	2.1E-01	U	2.1E-01	-1.06E+00	U	2.4E+00	1.01E-01		3.9E-02	3.8E-02	U	3.8E-02	2.57E-01		8.0E-02	1.2E-01	U	1.2E-01	9.24E-01	U	4.5E+00	0	U	3.4E-01	-3.2E-02	U	2.3E-01
A2	J10M01	11/14/2005	2.6E-01		2.2E-01	-3.78E-01	U	2.2E+00	2.6E-02	U	2.6E-02	2.6E-02	U	2.6E-02	8.1E-02	U	8.1E-02	8.3E-02	U	8.3E-02	4.49E-01	U	2.9E+00	0	U	2.6E-01	8.3E-02	U	2.6E-01
A3	J10M02	11/14/2005	2.1E-01	U	2.1E-01	-1.08E+00	U	2.4E+00	1.30E-01		4.9E-02	3.9E-02	U	3.9E-02	1.64E-01		7.8E-02	1.3E-01	U	1.3E-01	7.06E-01	U	4.5E+00	3.1E-02	U	2.4E-01	1.70E-01	U	1.8E-01
A4	J10M03	11/14/2005	2.2E-01	U	2.2E-01	-2.58E-01	U	2.3E+00	4.1E-02	U	4.1E-02	3.9E-02	U	3.9E-02	1.1E-01	U	1.1E-01	1.4E-01	U	1.4E-01	-5.94E-01	U	2.9E+00	0	U	3.1E-01	-3.1E-02	U	2.7E-01
B5	J10M04	11/14/2005	2.7E-01		2.2E-01	2.13E+00	U	2.2E+00	1.08E-01		3.8E-02	3.8E-02	U	3.8E-02	2.34E-01		8.0E-02	1.2E-01	U	1.2E-01	9.75E-01	U	2.9E+00	0	U	2.1E-01	-7.E-03	U	2.4E-01
B6	J10M05	11/14/2005	3.4E-01		2.1E-01	1.74E+00	U	2.3E+00	3.0E-02	U	3.0E-02	3.2E-02	U	3.2E-02	9.6E-02	U	9.6E-02	1.1E-01	U	1.1E-01	-5.54E-01	U	3.3E+00	0	U	2.1E-01	-3.E-03	U	2.0E-01
B7	J10M06	11/14/2005	2.7E-01		2.2E-01	-5.45E-01	U	2.4E+00	4.4E-02	U	4.4E-02	4.7E-02	U	4.7E-02	1.3E-01	U	1.3E-01	1.5E-01	U	1.5E-01	2.99E-01	U	3.6E+00	4.4E-02	U	3.4E-01	2.5E-02	U	2.7E-01

Note: Radiological analytical methods use statistically-determined floating calibration curves that are not forced through the origin; therefore, negative values are routinely reported for undetected analytes. This does not diminish the usability of the

Statistical Computation Input Data

Sampling Area	HEIS Number	Sample Date	Cr^{6+} mg/kg			C-14 pCi/g			Cs-137 pCi/g			Co-60 pCi/g			Eu-152 pCi/g			Eu-154 pCi/g			Ni-63 pCi/g			Pu-239/240 pCi/g			Sr-90 pCi/g		
B8	J10M07/J10M08	11/14/2005	2.8E-01			-9.9E-01			1.88E-02			1.9E-02			5.4E-02			6.8E-02			4.79E-01			6.0E-02			-5.0E-02		
A1	J10M00	11/14/2005	1.1E-01			-1.06E+00			1.01E-01			1.9E-02			2.57E-01			6.0E-02			9.24E-01			0			-3.2E-02		
A2	J10M01	11/14/2005	2.6E-01			-3.78E-01			1.3E-02			1.3E-02			4.1E-02			4.2E-02			4.49E-01			0			8.3E-02		
A3	J10M02	11/14/2005	1.1E-01			-1.08E+00			1.30E-01			2.0E-02			1.64E-01			6.5E-02			7.06E-01			3.1E-02			1.70E-01		
A4	J10M03	11/14/2005	1.1E-01			-2.58E-01			2.1E-02			2.0E-02			5.5E-02			7.0E-02			-5.94E-01			0			-3.1E-02		
B5	J10M04	11/14/2005	2.7E-01			2.13E+00			1.08E-01			1.9E-02			2.34E-01			6.0E-02			9.75E-01			0			-7.E-03		
B6	J10M05	11/14/2005	3.4E-01			1.74E+00			1.5E-02			1.6E-02			4.8E-02			5.5E-02			-5.54E-01			0			-3.E-03		
B7	J10M06	11/14/2005	2.7E-01			-5.45E-01			2.2E-02			2.4E-02			6.5E-02			7.5E-02			2.99E-01			4.4E-02			2.5E-02		

Statistical Computations

Statistical value based on	Cr^{6+}	C-14	Cs-137	Co-60	Eu-152	Eu-154	Ni-63	Pu-239/240	Sr-90
	Small data set (n<10). 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.	Radionuclide data set. Use nonparametric z-statistic.
N	8	8	8	8	8	8	8	8	8
% < Detection limit	38%	100%	63%	100%	63%	100%	100%	100%	100%
mean	2.2E-01	-5.E-02	5.4E-02	1.9E-02	1.1E-01	6.2E-02	3.35E-01	1.7E-02	1.9E-02
st. dev.	9.E-02	1.27E+00	5.0E-02	3.E-03	8.99E-02	1.0E-02	6.07E-01	2.5E-02	7.4E-02
Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
95% UCL on mean	2.7E-01	6.8E-01	8.3E-02	2.0E-02	1.7E-01	6.8E-02	6.89E-01	3.1E-02	6.2E-02
max value	3.4E-01	2.13E+00	1.30E-01	4.7E-02	2.57E-01	1.60E-01	9.75E-01	1.20E-01	1.70E-01
Statistical value	2.7E-01	6.8E-01	8.3E-02	2.0E-02	1.7E-01	6.8E-02	6.89E-01	3.1E-02	6.2E-02
Background	NA	NA	1.1E+00	8.E-03	NA	3.3E-02	NA	2.5E-02	1.8E-01
Statistical value above background	2.7E-01	6.8E-01	0(<BG)	1.2E-02	1.7E-01	3.5E-02	6.89E-01	6.E-03	0(<BG)
Most Stringent Cleanup Limit for nonradionuclide and RAG type	2 River Protection								
WAC 173-340 3-PART Test									
95% UCL > Cleanup Limit?	NO								
> 10% above Cleanup Limit?	NO								
Any sample > 2X Cleanup Limit?	NO								
EXCESS RISK EVALUATION									
WAC 173-340 Non-Carcinogenic Cleanup:	240								
Hazard quotient for each nonradionuclide:	1.1E-03								
WAC 173-340 Carcinogenic Cleanup:	2.1								
Risk for each carcinogenic nonradionuclide:	1.3E-07								
WAC 173-340 3-Part-Test Compliance?	YES								
Nonrad noncarcinogenic index sum:	1.1E-03								
Nonrad carcinogenic risk:	1.3E-07								

HEIS = Hanford Environmental Information System
MDA = minimum detectable activity
NA = not applicable
PQL = practical quantitation limit
Q = qualifier
RAG = remedial action goal
U = undetected
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator ~~J. M. Capron~~ S.W. Clark SWC 12/19/05
Project 100-K Area Field Remediation
Subject 116-K-2 Trench (West End) Cleanup Verification 95% UCL Calculations

Date 12/19/05
Job No. 14655

Calc. No. 0100K-CA-V0061
Checked T. M. Blakley TMB for

Rev. No. 0
Date 12/19/05
Sheet No. 6 of 7

Split-Duplicate Analysis

Shallow Zone Sample Results:

Sampling Area	HEIS Number	Hexavalent Chromium mg/kg	Q	PQL	Carbon-14 pCi/g	Q	MDA	Cesium-137 pCi/g	Q	MDA	Cobalt-60 pCi/g	Q	MDA	Europium-152 pCi/g	Q	MDA	Europium-154 pCi/g	Q	MDA	Nickel-63 pCi/g	Q	MDA	Plutonium-239/240 pCi/g	Q	MDA	Strontium-90 pCi/g	Q	MDA
A3	J10DL0	2.1E-01	U	2.1E-01	1.08E+00	U	3.6E+00	4.2E-02	U	4.2E-02	4.6E-02	U	4.6E-02	9.1E-02	U	9.1E-02	1.5E-01	U	1.5E-01	-5.04E-01	U	3.8E+00	0	U	3.2E-01	9.0E-02	U	1.9E-01
Duplicate of J10DL0	J10DM4	2.1E-01	U	2.1E-01	-9.13E-01	U	3.6E+00	3.2E-02	U	3.2E-02	3.2E-02	U	3.2E-02	1.1E-01	U	1.1E-01	1.1E-01	U	1.1E-01	-1.83E+00	U	3.9E+00	0	U	2.8E-01	1.36E-01	U	1.8E-01
Split of J10DL0	J10F85	3.50E-01	U	3.50E-01	2.62E-01	U	8.10E-01	1.21E-03	U	1.56E-02	9.70E-05	U	1.57E-02	7.88E-03	U	3.90E-02	6.80E-03	U	5.04E-02	6.59E+00	U	9.34E+00	0.00E+00		5.18E-02	6.11E-02		1.29E-01

Shallow Zone Analysis:

TDL		Hexavalent Chromium 0.5	Carbon-14 50	Cesium-137 0.1	Cobalt-60 0.05	Europium-152 0.10	Europium-154 0.10	Nickel-63 30	Plutonium-239/240 1.0	Strontium-90 1.0
Duplicate Analysis	Both > 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)	No-Stop (acceptable)
	Both > 5xTDL?									
	RPD									
Split Analysis	Both > 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)	No-Stop (acceptable)
	Both > 5xTDL?									
	RPD									

Deep Zone Sample Results:

Sampling Area	HEIS Number	Hexavalent Chromium mg/kg	Q	MDA	Carbon-14 pCi/g	Q	MDA	Cesium-137 pCi/g	Q	MDA	Cobalt-60 pCi/g	Q	MDA	Europium-152 pCi/g	Q	MDA	Europium-154 pCi/g	Q	MDA	Nickel-63 pCi/g	Q	MDA	Plutonium-239/240 pCi/g	Q	MDA	Strontium-90 pCi/g	Q	MDA
D10	J10CW7	9.7E-01		2.1E-01	1.08E+00	U	2.4E+00	2.18E+02		4.0E-01	6.68E+00		1.5E-01	1.94E+02		1.1E+00	1.80E+01		5.8E-01	4.80E+02		4.0E+00	4.33E+00		2.8E-01	3.27E+00		2.6E-01
Duplicate of J10CW7	J10CX6	2.0E+00		2.0E-01	1.71E+00	U	2.4E+00	1.09E+02		3.0E-01	3.45E+00		1.3E-01	1.02E+02		8.6E-01	1.00E+01		5.2E-01	5.30E+02		3.9E+00	5.47E+00		1.8E-01	5.38E+00		2.3E-01
Split of J10CW7	J10CX7	7.50E-01		3.50E-01	5.59E-01	U	8.01E-01	1.22E+02		1.13E-01	4.30E+00		5.10E-02	1.13E+02		3.11E-01	1.09E+01		1.91E-01	5.28E+02		5.73E+00	7.33E+00		1.25E-01	4.30E+00		1.39E-01

Deep Zone Analysis:

TDL		Hexavalent Chromium 0.5	Carbon-14 50	Cesium-137 0.1	Cobalt-60 0.05	Europium-152 0.10	Europium-154 0.10	Nickel-63 30	Plutonium-239/240 1.0	Strontium-90 1.0
Duplicate Analysis	Both > MDA?	**Yes (continue)**	No-Stop (acceptable)	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both > 5xTDL?	No-Stop (acceptable)		**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)
	RPD			*67%*	*64%*	*62%*	57%	10%		
Split Analysis	Both > MDA?	**Yes (continue)**	No-Stop (acceptable)	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**	**Yes (continue)**
	Both > 5xTDL?	No-Stop (acceptable)		**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	**Yes (calc RPD)**	No-Stop (acceptable)	No-Stop (acceptable)
	RPD			*56%*	43%	53%	49%	10%		

Overburden Sample Results:

Sampling Area	HEIS Number	Hexavalent Chromium mg/kg	Q	MDA	Carbon-14 pCi/g	Q	MDA	Cesium-137 pCi/g	Q	MDA	Cobalt-60 pCi/g	Q	MDA	Europium-152 pCi/g	Q	MDA	Europium-154 pCi/g	Q	MDA	Nickel-63 pCi/g	Q	MDA	Plutonium-239/240 pCi/g	Q	MDA	Strontium-90 pCi/g	Q	MDA
B8	J10M07	3.0E-01		2.2E-01	-1.37E+00	U	2.4E+00	4.3E-02	U	4.3E-02	4.7E-02	U	4.7E-02	9.7E-02	U	9.7E-02	1.6E-01	U	1.6E-01	1.15E-01	U	3.2E+00	0	U	2.9E-01	-3.1E-02	U	2.6E-01
Duplicate of J10M07	J10M08	2.6E-01		2.2E-01	-6.04E-01	U	2.4E+00	3.2E-02	U	3.2E-02	2.9E-02	U	2.9E-02	1.2E-01	U	1.2E-01	1.1E-01	U	1.1E-01	8.42E-01	U	3.4E+00	1.20E-01	U	4.6E-01	-6.8E-02	U	2.2E-01

Deep Zone Analysis:

TDL		Hexavalent Chromium 0.5	Carbon-14 50	Cesium-137 0.1	Cobalt-60 0.05	Europium-152 0.10	Europium-154 0.10	Nickel-63 30	Plutonium-239/240 1.0	Strontium-90 1.0
Duplicate Analysis	Both > MDA?	**Yes (continue)**	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?	No-Stop (acceptable)								
	RPD									

Note: The significance of the reported RPD values, including values greater than 30%, is addressed within the Data Quality Assessment for the Cleanup Verification Package for this site.
HEIS = Hanford Environmental Information System
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
RPD = relative percent difference
TDL = target detection limit
U = undetected

Washington Closure Hanford

CALCULATION SHEET

Originator ~~J. M. Capron~~ S. W. Clark SWC 12/19/05 **Date** 12/19/05 **Calc. No.** 0100K-CA-V0061 **Rev. No.** 0

Project 100-K Area Field Remediation **Job No.** 14655 **Checked** T. M. Blakley KEC for **Date** 12/19/05

Subject 116-K-2 Trench (West End) Cleanup Verification 95% UCL Calculations **Sheet No.** 7 of 7

Ecology Software (MTCAStat) Results

	DATA	ID	Hexavalent Chromium 95% UCL Calculation (Shallow Zone)			
1	DATA	ID	Hexavalent Chromium 95% UCL Calculation (Shallow Zone)			
2	1.1E-01	J10DL0/J10DM4				
3	1.1E-01	J10DK8				
4	1.1E-01	J10DK9	Number of samples		Uncensored values	
5	1.1E-01	J10DL1	Uncensored	16	Mean	0.20
6	2.5E-01	J10DL2	Censored		Lognormal mean	0.20
7	2.9E-01	J10DL3	Detection limit or PQL		Std. devn.	0.08
8	2.3E-01	J10DL4	Method detection limit		Median	0.23
9	2.5E-01	J10DL5	TOTAL	16	Min.	0.10
10	2.1E-01	J10DL6			Max.	0.31
11	1.1E-01	J10DL7				
12	2.3E-01	J10DL8	Lognormal distribution?		Normal distribution?	
13	3.1E-01	J10DL9	r-squared is:	0.815	r-squared is:	0.863
14	2.2E-01	J10DM0	Recommendations:			
15	1.0E-01	J10DM1	Reject BOTH lognormal and normal distributions. See Statistics Guidance.			
16	2.4E-01	J10DM2				
17	3.0E-01	J10DM3	UCL (based on Z-statistic) is	0.23		
18						

DATA	ID	Hexavalent Chromium 95% UCL Calculation (Deep Zone)			
1.5E+00	J10CW7/J10CX6				
2.1E+00	J10CV8				
1.2E+00	J10CV9	Number of samples		Uncensored values	
2.0E+00	J10CW0	Uncensored	18	Mean	2.0
9.3E-01	J10CW1	Censored		Lognormal mean	2.2
1.2E+00	J10CW2	Detection limit or PQL		Std. devn.	1.2
2.2E+00	J10CW3	Method detection limit		Median	1.7
3.6E+00	J10CW4	TOTAL	18	Min.	0.10
1.0E-01	J10CW5			Max.	4.6
1.7E+00	J10CW6				
1.1E+00	J10CW8	Lognormal distribution?		Normal distribution?	
4.6E+00	J10CW9	r-squared is:	0.768	r-squared is:	0.888
2.2E+00	J10CX0	Recommendations:			
1.0E+00	J10CX1	Reject BOTH lognormal and normal distributions. See Statistics Guidance.			
1.7E+00	J10CX2				
4.3E+00	J10CX3	UCL (based on Z-statistic) is	2.42		
1.7E+00	J10CX4				
2.3E+00	J10CX5				

CALCULATION COVER SHEET

Project Title 100-K Field Remediation Project **Job No.** 14655
Area 100-K Area
Discipline Environmental ***Calc. No.** 0100K-CA-V0063
Subject 116-K-2 Trench (West End) RESRAD Calculation
Computer Program RESRAD **Program No.** Version 6.30

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

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover – 1 pg Summary – 6 pg Attm. 1 - 1 pg Attm. 2 - 21 pg Attm. 3 - 26 pg Attm. 4 - 9 pg Attm. 5 - 25 pg Attm. 6 - 36 pg Attm. 7 - 17 pg Attm. 8 - 18 pg Attm. 9 - 18 pg Attm. 10 - 9 pg Total – 187 pages	S. W. Clark 12/19/05	M.W. Perrott 12/19/05	Stacey Callison 12-20-05	Mark Buckmaster	12/21/05
SUMMARY OF REVISION						

*Obtain Calc. No. from DIS

DE01-437.03 (12/09/2004)

Washington Closure Hanford CALCULATION SHEET

Originator:	S. W. Clark	Date:	12/19/05	Calc. No.:	0100K-CA-V0063	Rev.:	0
Project:	100-K Field Remediation Project	Job No:	14655	Checked:	M.W. Perrott	Date:	12/19/05
Subject:	116-K-2 Trench (West End) RESRAD Calculation					Sheet No. 1 of 6	

PURPOSE:

Calculate the soil and groundwater concentrations, dose, and risk contributions from remaining radionuclide contaminants in the overburden and vadose zone over a period of 1,000 years.

GIVEN/REFERENCES:

1) Cleanup verification data from *116-K-2 Trench (West End) Cleanup Verification 95% UCL Calculations*, Calculation No. 0100K-CA-V0061, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
2) *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
3) Radioactive and nonradioactive contaminants of concern from the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP), DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington. For the purpose of these RESRAD calculations, the radioactive contaminants of concern (COCs) are carbon-14, cesium-137, cobalt-60, europium-152, europium-154, nickel-63, plutonium-239/240, and strontium-90. Hexavalent chromium is the only nonradionuclide contaminant of concern.
4) Plutonium isotope ratios from *Ratios of Plutonium Isotopes at 100 Areas Remedial Action Sites*, Calculation No. 0100B-CA-V0013, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
5) RESidual RADioactivity (RESRAD) computer code, version 6.30, to calculate compliance with residual radioactivity guidelines, developed for the U.S. Department of Energy by the Environmental Assessment Division of Argonne National Laboratory, Argonne, Illinois.
6) Sample design data from the *116-K-2 Trench (West End) Sampling Plan,* Calculation No. 0100K-CA-V0062, Rev. 0, Bechtel Hanford, Inc., Richland, Washington. For the purpose of these RESRAD calculations, the sampling areas identified in the sampling plan calculation brief are 14695.5 m^2 for the shallow zone, 23046.93 m^2 for the deep zone, and 8676 m^2 for the overburden. Total sampling area of 37742 m^2 was used for the combined shallow and deep zones for all RESRAD calculations.
7) Thickness of uncontaminated deep zone determined using analogous site data for the 116-C-1 test pit from *Cleanup Verification Package for the 116-C-1 Process Effluent Trench*, CVP-98-00006, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
8) Attainment of the river protection RAGs is based on comparison of results from the *100 F Area Soil Hexavalent Chromium and Carbon-14 Leachability Study Summary Report* (Appendix D of the *Cleanup Verification Package for the 100-F-19:1 North Pipelines, 100-F-19:3 West Pipelines, 100-F-34 Biology Facility French Drain, and 116-F-12 French Drain*, CVP-2001-00002, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.), *100-H Area Soil Hexavalent Chromium Leachability Study Summary Report* (Appendix D of the *Cleanup Verification Package for the 116-H-7 Retention Basin*, CVP-2000-00027, Rev. 0, Bechtel Hanford, Inc., Richland, Washington), and *Estimation of Distribution Coefficients and Leachability of Hexavalent Chromium in 100-D Area Hanford Formation Sediments* (Appendix D of the *Cleanup Verification Package for the 116-D-7 Retention Basin*, CVP-99-00007, Rev. 0, Bechtel Hanford, Inc., Richland, Washington).

Washington Closure Hanford CALCULATION SHEET

Originator:	S. W. Clark	Date:	12/19/05	Calc. No.:	0100K-CA-V0063	Rev.:	0
Project:	100-K Field Remediation Project	Job No:	14655	Checked:	M.W. Perrott	Date:	12/19/05
Subject:	116-K-2 Trench (West End) RESRAD Calculation					Sheet No. 2 of 6	

SOLUTION:

1) Table 1 shows the waste site parameters used for RESRAD modeling. Based on the conservative assumption (discussed in the 100 Area RDR/RAWP) that residual contamination levels from the deep zone data set extend uniformly to groundwater, RESRAD predicted that the residual soil concentration of nickel-63 would result in groundwater concentrations that exceed the drinking water standard. Because this approach is too conservative, test pit data from the 116-C-1 Process Effluent Trench was used to include an uncontaminated deep zone between the contaminated deep zone and the groundwater to more accurately describe the 116-K-2 site for modeling using RESRAD.
2) Table 2 shows the radionuclide activities for each COC. Input factors for each RESRAD run are shown in the "Summary" section of the RESRAD "Mixture Sums and Single Radionuclide Guidelines" printouts in Attachments to this Calculation Summary.
3) The year where the peak dose (or concentration) occurs from each individual radionuclide COC was determined by a preliminary run. This year was then included in all final RESRAD runs. For the direct exposure pathway (i.e. soil ingestion and inhalation and external radiation), the peak year occurred at year zero (year 2005) for all COCs. For the water pathways (i.e., drinking water and food ingestion) the peak year also occurred at year zero (year 2005) for all COCs.

Table 1. Waste Site Dimensions for RESRAD Modeling

Parameter	Units	Value	Comments
Shallow Zone and Overburden Cover Depth	m	0	
Area of Shallow and Deep Zone	m^2	37742	Based on Sample Design [a]
Area of Overburden	m^2	8676	Based on Sample Design [a]
Thickness: Shallow Zone and Overburden	m	4.6	Appendix B of 100 Area RDR/RAWP
Elevation: Ground Surface	m	133.5	NAVD88
Elevation: Excavation Bottom	m	125.9	NAVD88
Elevation: Groundwater	m	118.5	NAVD88
Thickness: Total Deep Zone	m	10.4	Vadose zone thickness minus shallow zone
Thickness: Uncontaminated Deep Zone	m	3.1	Based on deep zone model from 116-C-1 test pit [b]
Thickness: Contaminated Deep Zone	m	7.3	Deep zone thickness minus uncontaminated deep zone
Length Parallel to Aquifer Flow	m	319	Based on Sample Design [a]

[a] Sample design data from the *116-K-2 Trench (West End) Sampling Plan,* Calculation No. 0100K-CA-V0062, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
[b] Two-layer deep zone model based on test pit data from *Cleanup Verification Package for the 116-C-1 Process Effluent Trench,* CVP-98-00006, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

METHODOLOGY:

1) Runs of RESRAD version 6.30 were completed for the shallow zone, deep zone, and overburden using the radionuclide concentrations shown in Table 2. RESRAD numerical output reports for dose, risk, and concentration for the shallow zone, deep zone, and overburden are presented in the Attachments to this calculation summary.

Table 2. Cleanup Verification Data Set [a]

COCs	Shallow Zone	Deep Zone	Overburden	Overburden Minus Background
Radionuclide Activity (pCi/g)				
C-14	0.29	1.44	0.68 U [b]	0.68 U [b]
Cs-137	1.10	117	0.083	<0 U [b]
Co-60	0.023 U [b]	4.23	0.020 U [b]	<0 U [b]
Eu-152	0.626	76.0	0.17	0.17
Eu-154	0.129	7.2	0.068 U [b]	<0 U [b]
Ni-63	1.77	650	0.689 U [b]	0.689 U [b]
Pu-239/240	0.024 U [b]	4.7	0.031 U [b]	<0 U [b]
Sr-90	0.201	6.30	0.062 U [b]	<0 U [b]
Nonradionuclide Concentration (mg/Kg)				
Cr (VI)	0.23	2.4	0.27	0.27

[a] Cleanup verification data from the *116-K-2 Trench (West End) Cleanup Verification 95% UCL Calculations,* Calculation No. 0100K-CA-V0061, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
[b] Value was not input into RESRAD because all analyses were below detection limits.

2) Pu-239/240 Conversion: The relative individual Pu-239 and Pu-240 activities used in the RESRAD model were calculated from the reported combined Pu-239/240 analytical results. The calculations were performed in accordance with Calculation No. 0100B-CA-V0013. The relative activities for Pu-239 and Pu-240 were calculated by multiplying the cleanup verification values for Pu-239/240 in each decision unit of the site by 0.807 and 0.193, respectively. Table 3 shows the results of these calculations.

Table 3. Conversion of Pu-239/240 Activity to Relative Pu-239 and Pu-240 Activities

RESRAD Run #	Vadose Zone Horizon	Pu-239/240 Activity (pCi/g)	Pu-239, (pCi/g) (0.807 multiplier)	Pu-240, (pCi/g) (0.193 multiplier)
1	Shallow Zone	0.024 U	0.019 U	0.005 U
2	Deep Zone	4.7	3.8	0.9
3	Overburden	0.062 U	0.050 U	0.012 U

3) Protectiveness of residual hexavalent chromium soil concentrations: Shallow zone soil concentrations of hexavalent chromium represented by the 95% UCL value in Table 2 are less than the applicable RAGs (i.e., 2.1 mg/kg for direct exposure or 2.0 mg/kg for river protection). However, the deep zone hexavalent chromium soil concentration exceeds the applicable RAG of 2.0 mg/kg for river protection. Because this RAG was not met for the

deep zone soils, a more detailed assessment of the potential impact of residual hexavalent chromium to groundwater was made using the 100-F, 100-H, and 100-D Area-specific hexavalent chromium leach studies (Appendix D of CVP-2001-00002, CVP-2000-00027, and CVP-99-00007). Using the simple and conservative approach of comparing the residual soil concentration of hexavalent chromium to the soil concentrations used in leach testing, and comparing the leachate concentrations from the leach tests to the surface water hexavalent chromium cleanup level, indicates that remaining hexavalent chromium in deep zone soil at the 116-K-2 site is protective of the river. The river protection soil RAG of 2.0 mg/kg is based on the MTCA "100 times dilution attenuation factor (DAF) times surface water quality criteria" rule. The near-shore river water hexavalent chromium cleanup level is 20 μg/L (surface water quality criteria of 10 μg/L times the dilution attenuation factor of 2). Based on the hexavalent chromium leach studies, the hexavalent chromium soil concentration at which the leachate did not exceed the surface water quality criteria was 6.8 mg/kg. Therefore, using the simple and conservative approach of comparing the hexavalent chromium deep zone soil concentration to the leach study hexavalent chromium soil concentrations demonstrates that cleanup of the deep zone hexavalent chromium is protective of the river (i.e., 2.4 mg/kg is less than 6.8 mg/kg).

RESULTS:

1) Radionuclide "All Pathways" Dose Rate: The "all pathways" (maximum) dose rates are shown in Table 4. The maximum total all pathways dose rate for the shallow and deep zones is 7.77 mrem/yr which occurs at year zero (2005). The maximum all pathways dose rate for the overburden is 0.740 mrem/yr which occurs at year zero (2005).

Table 4. All Pathway Dose Rate (mrem/yr)

Vadose Zone Horizon	"All Pathways" Dose Contributions in mrem/yr at each time slice (yr)							
	0	1	3	13	30	100	300	1000
Shallow Zone	7.77E+00	6.96E+00	6.29E+00	4.33E+00	2.45E+00	3.67E-01	4.21E-03	5.23E-06
Deep Zone	1.70E-22	1.53E-22	1.24E-22	4.61E-23	1.17E-23	3.06E-06	3.26E-04	7.34E-04
Total All Pathways Dose Rate (mrem/yr)	7.77E+00	6.96E+00	6.29E+00	4.33E+00	2.45E+00	3.67E-01	4.54E-03	7.39E-04
Overburden	7.40E-01	7.02E-01	6.33E-01	3.76E-01	1.55E-01	4.06E-03	1.22E-07	2.61E-16

2) Radionuclide Excess Cancer Risk: The radionuclide excess lifetime cancer risk results are shown in Table 5. The maximum total excess lifetime cancer risk for the shallow and deep zones (9.70×10^{-5}) occurs at year zero (2005). The maximum excess lifetime cancer risk for the overburden (8.72×10^{-6}) occurs at year zero (2005).

Table 5. Radionuclide Excess Lifetime Cancer Risk

Vadose Zone Horizon	Excess Cancer Risk at Each Time Slice (yr)							
	0	1	3	13	30	100	300	1000
Shallow Zone	9.70E-05	9.29E-05	8.63E-05	6.13E-05	3.61E-05	5.86E-06	9.71E-08	2.34E-10
Deep Zone	1.30E-27	1.18E-27	9.73E-28	3.91E-28	9.40E-29	9.34E-11	2.75E-09	5.80E-09
Total Excess Cancer Risk	9.70E-05	9.29E-05	8.63E-05	6.13E-05	3.61E-05	5.86E-06	9.98E-08	6.03E-09
Overburden	8.72E-06	8.27E-06	7.46E-06	4.43E-06	1.83E-06	4.78E-08	1.44E-12	1.78E-21

3) Radionuclide Groundwater Protection: The radionuclide concentrations in groundwater calculated by the RESRAD model are summarized in Table 6. Because all concentrations presented here are zero no comparison to drinking water standards calculation was necessary.

Table 6. RESRAD Predicted Radionuclide Groundwater (Well Water) Concentrations

Radio-nuclides	Vadose Zone Horizon	Groundwater Concentrations in pCi/L at Each Time Slice (yr)								RAGs From RDR
		0	1	3	13	30	100	300	1000	
C-14	**Total**	0	0	0	0	0	0	0	0	2000
Co-60	**Total**	0	0	0	0	0	0	0	0	100
Cs-137	**Total**	0	0	0	0	0	0	0	0	60
Eu-152	**Total**	0	0	0	0	0	0	0	0	200
Eu-154	**Total**	0	0	0	0	0	0	0	0	60
Ni-63	**Total**	0	0	0	0	0	0	0	0	50
Sr-90	**Total**	0	0	0	0	0	0	0	0	8

CONCLUSIONS:

- The combined maximum all-pathways dose rate for the shallow and deep zones shown in Table 4 is 7.77 mrem/yr which occurs at year zero (2005).
- The maximum all-pathways dose rate for the overburden shown in Table 4 is 0.740 mrem/yr which occurs at year zero (2005).
- The dominant pathway for the dose rate is direct external exposure.
- The primary radionuclides contributing to the direct exposure pathway are cesium-137 and europium-152.
- The maximum combined shallow and deep zone excess lifetime cancer risk shown in Table 5 (9.70×10^{-5}) occurs at year zero (2005).
- The maximum overburden excess lifetime cancer risk shown in Table 5 (8.72×10^{-6}) occurs at year zero (2005).

Washington Closure Hanford CALCULATION SHEET

Originator:	S. W. Clark	Date:	12/19/05	Calc. No.:	0100K-CA-V0063	Rev.:	0
Project:	100-K Field Remediation Project	Job No:	14655	Checked:	M.W. Perrott	Date:	12/19/05
Subject:	116-K-2 Trench (West End) RESRAD Calculation					Sheet No. 6 of 6	

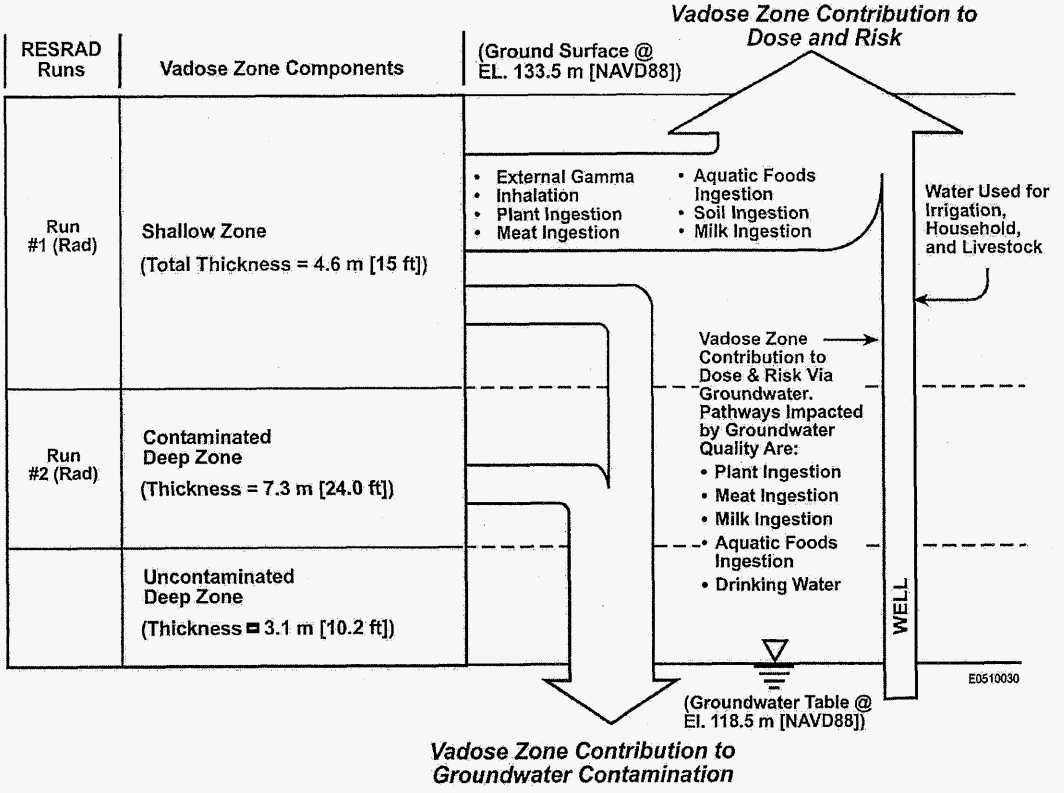
- None of the radionuclide contaminants of concern are predicted to reach groundwater in the 1,000 years of the RESRAD model runs.
- None of the site COCs are projected to exceed remedial action goals (RAGs).

ATTACHMENTS:

1. Graphic showing 116-K-2 Cleanup Verification Model (1 page)
2. RESRAD Output: 116-K-2 Shallow Zone Radionuclides, Mixture Sums and Single Radionuclide Guidelines (21 pages)
3. RESRAD Output: 116-K-2 Shallow Zone Radionuclides, Intake Quantities and Health Risk Factors (26 pages)
4. RESRAD Output: 116-K-2 Shallow Zone Radionuclides, Concentration of Radionuclides, (9 pages)
5. RESRAD Output: 116-K-2 Deep Zone Radionuclides, Mixture Sums and Single Radionuclide Guidelines (25 pages)
6. RESRAD Output: 116-K-2 Deep Zone Radionuclides, Intake Quantities and Health Risk Factors (36 pages)
7. RESRAD Output: 116-K-2 Deep Zone Radionuclides, Concentration of Radionuclides, (17 pages)
8. RESRAD Output: 116-K-2 Overburden Radionuclides, Mixture Sums and Single Radionuclide Guidelines (18 pages)
9. RESRAD Output: 116-K-2 Overburden Radionuclides, Intake Quantities and Health Risk Factors (18 pages)
10. RESRAD Output: 116-K-2 Overburden Radionuclides, Concentration of Radionuclides, (9 pages)

ATTACHMENT 1

116-K-2 Trench Cleanup Verification Model



Attachment 1 Sheet No. 1 of 1
Originators: S. W. Clark Date 12/19/05
Chk'd By M. W. Perrott Date 12/19/05
Calc. No. 0100K-CA-V0063 Rev. No. 0

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