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Rev. 0

Cleanup Verification Package/ Clean Closure Report for the Soil Column of the 116-N-3 Trench, Crib, and 100-N-63:1 Pipeline

Prepared for the U.S. Department of Energy
by Bechtel Hanford, Inc.

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EXECUTIVE SUMMARY

E1.0 INTRODUCTION

This cleanup verification package (CVP)/closure report documents completion of remedial action for the 116-N-3 Trench, Crib, and Pipeline. The 116-N-3 Crib and Trench are also referred to as the 1325-N Liquid Waste Disposal Facility, or the 1325-N Crib and Trench. The portion of the 116-N-3 pipeline included in this CVP/closure report is identified in the Waste Information Data System (WIDS) as 100-N-63:1. Also included in this CVP/closure report is a pipeline bypass structure. Although it was never put into service for waste transfer activities, the removal of the pipeline bypass structure is included in this CVP/closure report. The bypass structure ran parallel to the pipeline and was connected to the southwest end of the crib. Because the pipeline bypass structure never handled waste, it is not considered a waste site and as such does not have a WIDS identifier beyond its association with the 116-N-3 Crib. However, all of these site components (crib, trench, pipeline, and bypass structure) comprise the *Resource Conservation and Recovery Act of 1976* (RCRA) permitted waste treatment, storage, and disposal (TSD) unit. For purposes of the CVP/closure report and consistent with the permitted TSD site designation, the 116-N-3 Crib and Trench, the 100-N-63:1 Pipeline, and the bypass structure are collectively referred to as the 116-N-3 site throughout this CVP/closure report. The 116-N-3 site is located within the 100-NR-1 Operable Unit in the 100 Areas of the Hanford Site in southeastern Washington State.

The 116-N-3 Crib was built in 1983 to replace the 116-N-1 Crib and was used for the disposal of N Reactor cooling water. The 116-N-3 Trench was put into service in September 1985 to provide additional disposal capacity. The 116-N-3 Crib then became the primary liquid disposal facility for the N Reactor, and the 116-N-1 Crib was taken out of service. The pipeline included in this CVP/closure report includes a 0.9-m (36-in.)-diameter pipeline that transported N Reactor cooling water effluent from the 116-N-1 diversion box to the 1312-N emergency basin diversion box and to the 116-N-3 Crib. Remedial action objectives, remedial action goals, and closure

performance standards for the 116-N-3 site were established by the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology), in concurrence with the U.S. Department of Energy, Richland Operations Office (DOE-RL). These goals and objectives are documented in the *100-NR-1 Interim Remedial Action Record of Decision* (ROD) (Ecology 2000) and the *Remedial Design Report/Remedial Action Work Plan for the 100-NR-1 Treatment, Storage, and Disposal Units* (RDR/RAWP) (DOE-RL 2000). Closure performance standards are documented in the *100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan* (CMS/CP) (DOE-RL 2002a). Permit conditions were established in the Hanford Facility Dangerous Waste Permit (Ecology 1994). The ROD (Ecology 2000) states that EPA, Ecology, and DOE elected to coordinate response actions under RCRA closure, RCRA corrective action, and *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) remedial action. By applying CERCLA authority concurrently with RCRA closure and corrective action requirements, EPA and Ecology are able to address all regulatory and environmental obligations at this operable unit as effectively and efficiently as possible. The ROD does not preclude or supercede closure compliance conditions included in the RCRA permit.

Based on consideration of the requirements of RCRA and CERCLA, detailed analysis of the alternatives, and public comments, the Tri-Parties have selected the remove/dispose alternative under a rural-residential land-use scenario for the 116-N-3 TSD unit. The selected remedial action for the 116-N-3 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 at the 200 Areas of the Hanford Site, and (3) backfilling the site with clean soil to the average adjacent grade elevation. Excavation was driven by remedial action objectives for direct exposure, protection of groundwater, and protection of the Columbia River. For the respective points of compliance, remedial action goals (RAGs) were established to identify radionuclide and nonradionuclide contaminants of concern (COCs). Waste site COCs identified through process knowledge were listed in the *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units*

During Remediation and Closeout (DOE-RL 2002b). The COCs for this site consist of the following:

- Americium-241
- Cesium-137
- Cobalt-60
- Europium-154
- Europium-155
- Tritium (H-3)
- Nickel-63
- Plutonium-239/240
- Strontium-90
- Mercury
- Nitrate

E2.0 RESULTS

Site excavation and waste disposal activities are complete, and the exposed surfaces have been sampled and analyzed to verify attainment of the RAGs. The primary statistical calculation used 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 were computed for each decision unit by combining the analytical results for the trench, crib, and pipeline verification sampling (Section 4.4) (e.g., for the shallow and deep zones, and overburden). In summary, the analytical results for the crib, trench, and pipeline shallow zones were combined to determine the 95% UCL result for the shallow zone decision unit. Likewise, the analytical results for the crib and trench deep zones were combined to determine the 95% UCL result for the deep zone decision unit. Since only the pipeline had an overburden, combining of analytical data did not take place for the overburden decision unit. Appendix C shows the 95% UCL calculation brief for the combined 116-N-3 Trench, Crib, and Pipeline. Individual 95% UCL calculation briefs

were also completed for the trench, crib, and pipeline, evaluated separately. Each of these calculation briefs went through the cleanup verification calculation brief approval process, and are archived in the Environmental Restoration Contract (ERC) Project files.

At the completion of the remedial action, the total excavation was approximately 21,980 m^2 (236,590 ft^2) in area. Approximately 140,270 metric tons (154,578 tons) of material from the site were disposed of at the Environmental Restoration Disposal Facility. Figures 2 and 3 illustrate the pre- and post-remediation topograph plans of the entire 116-N-3 waste site (i.e., trench, crib, and pipeline and bypass structure). On Figure 3, the post-remediation boundary is represented by the bold border. As specified in the ROD and closure plan, soils were removed beneath the crib and the contaminated portion of the trench to a minimum of 1.5 m (5 ft) below the engineered structures. Because N Reactor effluent percolated into the soil column before reaching the end of the trench, a large portion of the trench did not require remediation.

Cleanup verification samples from the trench were collected from the contaminated portion of the trench. The distinction between contaminated and uncontaminated portions of the trench was established through a separate sampling effort (transition zone). Figures 2 and 3 show the location of the transition zone of the trench. Also shown are three dams, included on the trench portion of the 116-N-3 site. These three dams divided the trench into four equal sections. This was done in order to control the flow of effluent by allowing the first trench segment to fill before the effluent progressed to the next segments. In reality, only the first 226 m (740 ft) of the 116-N-3 Trench was used because effluent levels never rose high enough to cross the first dam.

Results of the sampling, laboratory analyses, and data evaluations for the 116-N-3 site indicate that all remedial action objectives and goals for direct exposure, protection of groundwater, and protection of the Columbia River have been met (see Table ES-1). The following sections discuss these results.

Table ES-1. Summary of Cleanup Verification Results for the 116-N-3 Site.

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 5.95 mrem/yr (not accounting for clean backfill) and overburden is 1.11 mrem/yr.	Yes	a
Direct Exposure – Nonradionuclides	1. Attain individual COC RAGs.	1. All individual COC concentrations are below the RAGs.	Yes	b
Meet Nonradionuclide Risk Requirements	1. Hazard quotient of <1 for noncarcinogens.	1. All hazard quotients are below 1.	Yes	b
	2. Cumulative hazard quotient of <1 for noncarcinogens.	2. Cumulative hazard quotient for the site and for overburden are <1.		b
	3. Excess cancer risk of <1 x 10^{-6} for individual carcinogens.	3. Excess cancer risk for individual carcinogens are all less than 1 x 10^{-6}.		b
	4. Attain a total excess cancer risk of <1 x 10^{-5} for carcinogens.	4. Total excess cancer risk for the site and overburden are below 1 x 10^{-5}.		b
Groundwater/River Protection – Radionuclides	1. Attain single-COC groundwater and river protection RAGs.	1. All single-COC groundwater and river RAGs have been attained.	Yes	c
	2. Attain National Primary Drinking Water Standards: 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.	2. All organ-specific dose rates are below the 4 mrem/yr dose rate limit.		c
	3. Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L maximum contaminant level or 1/25th of the derived concentration guide for DOE Order 5400.5.	3. The alpha activity is 0 pCi/L for all years.		c
	4. Meet total uranium standard of 21.2 pCi/L.	4. Isotopic uranium is not a COC for this site.		
Groundwater/River Protection – Nonradionuclides	1. Attain individual nonradionuclide groundwater and river cleanup requirements.	1. All the groundwater and river RAGs have been attained.	Yes	b
Other supporting Information	1. Sample variance calculation (Appendix C).			d
	2. Sample location design (Appendix C).			e

[a] *116-N-3 Combined Trench, Crib, and Pipeline RESRAD Calculation*, 0100N-CA-V0059, Rev. 2, Bechtel Hanford, Inc., Richland, Washington.
[b] *116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification 95% UCL Calculations*, 0100N-CA-V0058, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
[c] *116-N-3 Combined Trench, Crib, and Pipeline Comparison to Drinking Water Standards*, 0100N-CA-V0060, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
[d] *116-N-3 Trench Shallow Zone Variance Calculation*, 0100N-CA-V0041, Rev. 0, Bechtel Hanford, Inc., Richland, Washington, and *116-N-3 Crib Shallow Zone Pilot Study Sample Variance Calculation*, 0100N-CA-V0053, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.
[e] *116-N-3 Trench Pilot Study (Variance) Sampling to Support Decision Statement #3 Sample Design*, 0100N-CA-V0030, Rev. 0, Bechtel Hanford, Inc., Richland, Washington; *Shallow and Deep Zone Sample Design for the 116-N-3 Trench*, 0100N-CA-V0040, Rev. 1, Bechtel Hanford, Inc., Richland, Washington; *116-N-3 to 116-N-1 Pipeline and Bypass Corridor Sample Design*, 0100N-CA-V0044, Rev. 1, Bechtel Hanford, Inc., Richland, Washington; *Cleanup Verification Sampling of Overburden from the 116-N-3 to 116-N-1 Pipeline and Bypass Corridor*, 0100N-CA-V0048, Rev. 0, Bechtel Hanford, Inc., Richland, Washington; and *116-N-3 Crib Variance and Closeout Sample Design*, 0100N-CA-V0049, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

Note: The table above reflects an assessment of the site as a whole (i.e., crib, trench, and pipeline). The crib, trench, and pipeline were also assessed against the RAGs individually. Individual calculation briefs were also completed for the crib, trench, and pipeline. The crib, trench, and pipeline each met all of the RAGs listed above on an individual basis. Calculation references are included in Section 9.0.

E2.1 DIRECT EXPOSURE SOIL CLEANUP STANDARDS

E2.1.1 Radionuclides

The ROD (Ecology 2000), developed in compliance with the "National Oil and Hazardous Substances Pollution Contingency Plan" (NCP) (40 CFR 300), expresses the RAG for direct exposure to radionuclides in terms of an allowable radiation dose rate above background (i.e., 15 mrem/yr). The total dose rate above background, considering all radionuclide COCs and pathways, was predicted from the RESidual RADioactivity (RESRAD) dose assessment model (ANL 2002).

The rural-residential scenario used in RESRAD modeling is similar to that used for other 100 Area CVPs, except as specified in the RDR/RAWP (DOE-RL 2000). Contaminated groundwater is not used for drinking, irrigation, or any other use. The results indicate that the maximum dose rate above background from the site and overburden is 5.95 mrem/yr and 1.11 mrem/yr, respectively, and would occur at present (year 2002); this dose rate decreases to 1.58×10^{-02} mrem/yr and 5.06×10^{-03} mrem/yr, respectively, in 1,000 years. The majority of the maximum dose rate is due to cobalt-60 and cesium-137. The estimated total dose rate in the year 2018 from the site is 2.22 mrem/yr and 0.18 mrem/yr in the overburden. The 2018 date corresponds to the 30-year site cleanup schedule of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1998). Total dose rate estimates never exceed the direct exposure RAG of 15 mrem/yr above background. In addition, each individual component of the 116-N-3 site (i.e., crib, trench, and pipeline) was assessed separately for RAG attainment. Total dose rate estimates for each site component never exceeded the 15 mrem/yr direct exposure RAG.

Although the RAG for radionuclides is expressed in terms of radiation dose, the CVP/closure report also includes radionuclide excess lifetime cancer risk estimates as additional information. The NCP (40 CFR 300) presents a target range for residual risk of 10^{-4} to 10^{-6}. The RESRAD model calculated the total excess cancer risk for radionuclides. Because of radioactive decay, the risk associated with radionuclides

decreases over time. Based on RESRAD results, the excess lifetime cancer risk is largest, 5.81×10^{-05} from the site and 7.16×10^{-06} in the overburden, both at present (year 2002), and decreases to 3.53×10^{-08} from the site and 1.37×10^{-08} in the overburden in 1,000 years. The estimated excess cancer risk due to radionuclides in the year 2018 is 2.99×10^{-05} from the site and 1.13×10^{-06} in the overburden.

E2.1.2 Nonradionuclides

The nonradionuclide COCs are mercury and nitrate. All nonradionuclide COC concentrations are below the RAGs for direct exposure.

With respect to noncarcinogenic risk, the individual and cumulative hazard quotients for COCs with noncarcinogenic effects are below the corresponding RAGs (a hazard quotient of 1.0 in both cases). With respect to carcinogenic risk, mercury and nitrate are not considered carcinogens. Therefore, the excess lifetime cancer risk estimates for the shallow zone (0 to 4.6 m [15 ft]) are below the risk limit for individual COCs of 1×10^{-6}. The total excess lifetime cancer risk estimate is also below its corresponding risk limit of 1×10^{-5}.

E2.2 PROTECTION OF GROUNDWATER AND THE RIVER

E2.2.1 Radionuclides

The estimated radionuclide dose rate via the groundwater and river pathways is below the RAG of 4 mrem/yr for beta and gamma emitters. The rural-residential scenario used in RESRAD modeling is similar to that used for other 100 Area CVPs, except as specified in the RDR/RAWP (DOE-RL 2000). Contaminated groundwater is not used for drinking, irrigation, or any other use. The RESRAD model predicts that alpha emitters will not reach groundwater within 1,000 years; therefore, they meet drinking water standards for alpha emitters per DOE Order 5400.5 based on the more stringent maximum contaminant level of 15 pCi/L or 1/25th of the derived concentration guide. In summary, all radionuclide RAGs for protection of groundwater and the Columbia River

have been met. Again, each individual component of the 116-N-3 site (i.e., crib, trench, and pipeline) was assessed separately for RAG attainment. Each site component met all radionuclide RAGs for groundwater and river protection.

E2.2.2 Nonradionuclides

Based on comparison with groundwater and river protection RAGs and RAOs, cleanup verification results indicate that residual concentrations of nonradionuclide COCs (i.e., mercury and nitrate) are protective of groundwater and the river.

E3.0 WASTE SITE RECLASSIFICATION

The site meets closure performance/cleanup standards and has been reclassified as "interim closed out" in accordance with the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1998) 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.

Attachment ES-1

Waste Site Reclassification Form

Date Submitted: 11/18/02 **Originator:** R. A. Carlson **Phone:** 372-9632	**Operable Unit(s):** 100-NR-1 **Waste Site ID:** 116-N-3 Trench, Crib, and 100-N-63:1 Pipeline **Type of Reclassification Action:** Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number:** 2002-055, Rev. 0 **Lead Agency:** Ecology

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 (NPL) of no action or closed out sites will occur at a future date.

Description of current waste site condition:

Remedial action at the 116-N-3 site has been performed in accordance with remedial action objectives and goals established by the U.S. Environmental Protection Agency and the Washington State Department of Ecology (Ecology), in concurrence with the U.S. Department of Energy, Richland Operations Office. The selected remedial action involves (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 at the 200 Areas of the Hanford Site, and (3) backfilling the site with clean soil to adjacent grade elevations. The CERCLA excavation and disposal actions have been completed; RCRA TSD closure actions are pending.

After this waste site is backfilled, a Certification of Closure shall be prepared for this site by an independent professional engineer and shall be submitted to Ecology. A Certification of Closure Acceptance Letter signed by Ecology shall be issued for the reclassification control number for this waste site to complete the RCRA TSD closure requirements.

Basis for reclassification:

The 116-N-3 Trench, Crib, and 100-N-63:1 Pipeline have been remediated to meet the closure performance/cleanup standards specified in the *100-NR-1 Interim Remedial Action Record of Decision,* Washington State Department of Ecology, Olympia, Washington, and the *100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan*. Remedial action was performed to protect for direct exposure from shallow zone soils (i.e., surface to 4.6 m [15 ft] deep) and to protect groundwater and the Columbia River. The basis for reclassification is described in detail in the *Cleanup Verification Package/Clean Closure Report of the Soil Column of the 116-N-3 Trench, Crib, and 100-N-63:1 Pipeline* (CVP-2002-00002), Bechtel Hanford, Inc, Richland, Washington.

The cleanup verification package does not demonstrate the acceptability of unrestricted access to deep zone soils (i.e., below 4.6 m [15 ft]); therefore, institutional controls to prevent uncontrolled drilling or excavation into deep zone soils are required. Institutional controls will be implemented in accordance with DOE/RL-2001-41, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions*. Consistent with the rural-residential exposure scenario specified in the *100-NR-1 Interim Remedial Action Record of Decision* (ROD), it is assumed that contaminated groundwater would not be used for drinking, irrigation, or any other use for the time period specified in the ROD.

R. Chris Smith DOE Project Manager	R. C. Smith Signature	11/18/02 Date
Wayne Soper Ecology Project Manager	Wayne Soper Signature	12/23/02 Date
NA EPA Project Manager	Signature	Date

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ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
CMS	corrective measures study
COC	contaminant of concern
CP	closure plan
CVP	cleanup verification package
DCG	derived concentration guide
DOE-RL	U.S. Department of Energy, Richland Operations Office
DQA	data quality assessment
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
GEA	gamma energy analysis
MDA	minimum detectable activity
MS	matrix spike
MTCA	Model Toxics Control Act
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PQL	practical quantitation limit
QA/QC	quality assurance/quality control
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
RPD	relative percent difference
SAP	sampling and analysis plan
SDG	sample delivery group
TDL	target detection limit
TSD	treatment, storage, and disposal
UCL	upper confidence limit
UMM	Unit Managers' Meeting
WAC	Washington Administrative Code

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this cleanup verification package (CVP)/closure report is to document that the 116-N-3 Trench, Crib, and 100-N-63:1 Pipeline site (herein referred to as the 116-N-3 site) was remediated in accordance with the *100-NR-1 Interim Remedial Action Record of Decision* (ROD) (Ecology 2000) and the *100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan* (CMS/CP) (DOE-RL 2002a).

The ROD (Ecology 2000) and the CMS/CP (DOE-RL 2002a) provide the U.S. Department of Energy (DOE), Richland Operations Office the authority, guidance, and objectives to conduct this remedial action. The remedies specified in the ROD and the CMS/CP and conducted for the 116-N-3 site were excavation and disposal of contaminated materials at the Environmental Restoration Disposal Facility (ERDF).

1.2 DOCUMENT ORGANIZATION

The cleanup verification evaluation and assessment is presented in the following sections:

- Section 2.0 Site Description and Supporting Information
- Section 3.0 Summary of Remedial Action Objectives and Goals
- Section 4.0 Remedial/Corrective Action Field Activities
- Section 5.0 Cleanup Verification Data Evaluation
- Section 6.0 Evaluation of Remedial Action Goal Attainment
- Section 7.0 Radionuclide Risk Information
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The main text is supported by the following appendices:

- Appendix A Summary of Verification Soil Sampling and Analytical Results
- Appendix B Data Quality Assessment
- Appendix C RESRAD Input Parameters, Calculation Brief Excerpts for the 116-N-3 Site, and the 199-N-109A Borehole Technical Memorandum

2.0 SITE DESCRIPTION AND SUPPORTING INFORMATION

2.1 SITE HISTORY

The 116-N-3 site is located in the 100-N Area. This site consists of the 1325-N Crib, 1325-N Trench, and pipeline that delivered the effluent to the crib, and a bypass structure that runs parallel to the pipeline and connects to the southwest end of the crib. The crib was constructed of concrete and measured 76 m by 73 m (250 ft by 240 ft). Concrete panels covered the crib. The trench, located on the northeast side of the crib, was 3 m (10 ft) wide, 2.1 m (7 ft) deep, and 915 m (3,000 ft) in length, and was divided into four equal sections by three earthen dams. The trench was also covered with concrete panels. The pipeline includes a 0.9-m (36-in.)-diameter pipeline that ran from the 116-N-1 Crib diversion box to the 1312-N emergency basin diversion box and to the 116-N-3 Crib. Also included is a never-used emergency bypass structure that ran parallel to the pipeline from the 1312-N diversion box to the 116-N-3 Crib (Figure 1).

The 116-N-3 Crib was built to replace the 116-N-1 Crib and first received N Reactor effluent in 1983. The 116-N-3 Trench was put into service in September 1985 to provide additional disposal capacity. Effluent reportedly never overflowed the first earthen dam in the trench. The 116-N-3 Crib then became the primary liquid disposal facility, and the 116-N-1 Crib was used only as an emergency discharge crib.

2.2 SUBSURFACE CONDITIONS

The soil column underlying the waste site and extending to groundwater consists of materials belonging to the Hanford and Ringold Formations. The shallower Hanford formation consists predominantly of medium dense to dense sand and gravel, with varying amounts of silt and cobble. The underlying Ringold Formation consists of dense, well-cemented gravels with sand and silt interbeds. The Hanford/Ringold contact is approximately 14 m to 21 m (43 ft to 69 ft) below the surface grade level. The long-term groundwater level beneath the site is estimated at elevation 117.5 m (385.5 ft) for analysis purposes, based on historical and current information from adjacent groundwater wells. Again, for analysis purposes, the depth to groundwater is estimated to be 16.7 m (54.8 ft) beneath the floor of the excavation and 21.3 m (69.9 ft) beneath surface grade level. Groundwater elevations in adjacent wells are influenced by the nearby Columbia River and other factors, such as atmospheric pressure.

2.3 CONTAMINANTS OF CONCERN

Waste site contaminants of concern (COCs) identified through process knowledge are listed in the *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout* (SAP) (DOE-RL 2002b). As specified in the SAP, COCs were added to and removed from the COC list provided in the SAP based on observation of the type/quantity of material removed from the site and associated characterization data collected during the excavation process.

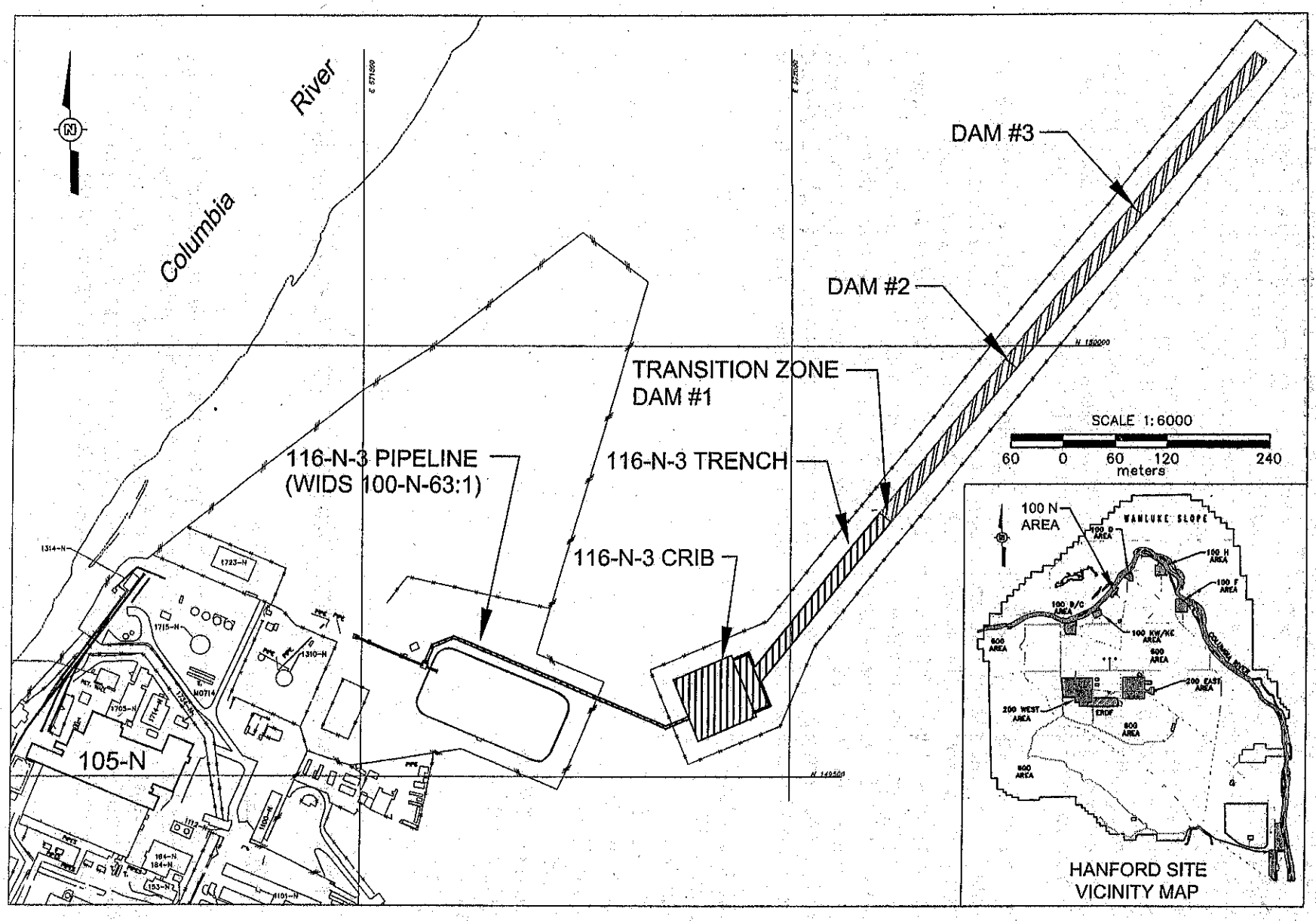


Figure 1. Hanford Site Map and 116-N-3 Site Plan.

Additions or deletions to the final list of COCs for site closeout were identified for each area by the project personnel with concurrence from the U.S. Department of Energy (DOE) and the Washington State Department of Ecology (Ecology) prior to initiating the verification sampling process. The COC list change process for the 116-N-3 site was approved at the February 28, 2002 Unit Managers' Meeting (UMM) (BHI 2002b). In this meeting, the managers agreed to add cesium-137, cobalt-60, europium-154, and europium-155 to the deep zone COC list, and to delete tritium from the shallow zone COC list. Tritium was deleted from the shallow zone COC list because none was detected in soil grab samples. If tritium were present it would have volatilized from the shallow zone. However, for conservatism, the analyte was retained as a deep zone COC. There were no changes to the SAP COC list for chemical constituents.

Mercury was eliminated from the deep zone COC list prior to the issuance of the SAP as a result of an evaluation presented in the CMS/CP (DOE-RL 2002a) that demonstrated that mercury would not reach groundwater in 1,000 years. As a consequence, this constituent was eliminated as a constituent of concern in the deep zone, but remained on the shallow zone COC list. Hexavalent chromium was eliminated as a COC during the SAP development process. Hexavalent chromium was not used in the N Reactor processes, is not detected in groundwater samples beneath the 116-N-3 site, and was not detected in soil samples that were collected in December 1998 from the 116-N-3 site. The final list of COCs for this site consists of the following:

- Americium-241
- Cesium-137
- Cobalt-60
- Europium-154
- Europium-155
- Tritium (H-3)
- Nickel-63
- Plutonium-239/240
- Strontium-90
- Mercury
- Nitrate

3.0 SUMMARY OF REMEDIAL ACTION OBJECTIVES AND GOALS

3.1 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) for the 116-N-3 site were established in the Interim Action ROD (Ecology 2000). The RAOs are narrative statements that define the extent to which the waste site requires cleanup to protect human health and the environment. For detailed discussion of the RAOs, see the *Remedial Design Report/Remedial Action Work Plan for the 100-NR-1 Treatment, Storage, and Disposal Units*

(RDR/RAWP) (DOE-RL 2000), the Interim Action ROD (Ecology 2000), and the CMS/CP (DOE-RL 2002a).

3.2 REMEDIAL ACTION GOALS

Remedial action goals (RAGs) are the specific numeric goals against which the cleanup verification data are evaluated to demonstrate attainment of the RAOs. The RAGs were developed to support a rural-residential exposure scenario. This scenario involves exposures to soils less than 4.6 m (15 ft) deep only. In the rural-residential scenario, an individual is assumed to live for 30 years in a residence built on the waste site and to spend 60% of his or her time indoors, 20% outdoors, and 20% offsite. The scenario assumes a portion of the resident's time is spent in the basement of the home. It further assumes that he or she consumes crops, meat, and milk from plants and animals raised upon the waste site, and consumes fish from a pond downgradient from the waste site. Residual (post-cleanup) contaminant concentrations in the shallow zone (i.e., depths less than 4.6 m [15 ft]) are assumed for the soils in which crops are raised and on which animals providing meat and milk are raised. Groundwater at the site is known to be contaminated beyond drinking water standards by previous discharges at the site and is assumed not to be used for any purpose. However, an evaluation of the potential of residual soil contamination to contribute to groundwater contamination was performed to demonstrate that residual soil contamination is protective of groundwater and the Columbia River. The scenario assumes institutional controls against uncontrolled drilling or digging into deep zone soils (i.e., depths below 4.6 m [15 ft]). A more detailed description of the rural-residential scenario, and how it is applied, is provided in the RDR/RAWP (DOE-RL 2000).

The contaminant-specific cleanup levels/RAGs that are applicable to the 116-N-3 site are listed in Table 1.

3.2.1 Direct Exposure RAGs

Under the rural-residential scenario, direct exposure RAGs are applicable to soils that are less than 4.6 m (15 ft) below ground surface (shallow zone soils). Direct exposure cleanup levels/RAGs are listed in Table 1 and summarized below.

- **Radionuclide COCs:** For radionuclide COCs in the shallow zone (external gamma, inhalation, plant ingestion, meat ingestion, milk ingestion, aquatic foods, and soil ingestion pathways) and in the deep zone (drinking water pathway), meet a 15 mrem/yr above background total dose rate (this cleanup level/RAG must be met for 1,000 years).

Table 1. Summary of Cleanup Levels/Remedial Action Goals.

COCs	Direct Exposure Cleanup Levels/RAG	Groundwater Protection Cleanup Levels/RAG (pCi/L)	Columbia River Protection Cleanup Levels/RAG (pCi/L)
Radionuclides			
Strontium-90[a]	15 mrem/yr (cumulative)[b]	8[c]	8[c]
Americium-241		15[d]	15[d]
Plutonium-239/240			
Nickel-63		4 mrem/yr (cumulative)[d]	4 mrem/yr (cumulative)[d]
Cesium-137			
Cobalt-60			
Europium-154			
Europium-155			
Tritium (H-3)[a]		20,000	20,000
COCs	**Direct Exposure Cleanup Levels/RAGs (mg/kg)**	**Soil Cleanup Levels/RAGs (mg/kg) for Groundwater Protection**	**Soil Cleanup Levels/RAGs (mg/kg)for Columbia River Protection**
Nonradionuclides			
Mercury	24	0.33[e]	0.33[e]
Nitrate	8,000	1,000[f]	1,000[f]

[a]Strontium-90 and tritium also contribute to the 4 mrem/yr (cumulative) RAG for groundwater and river protection.
[b]Lookup values that correspond to the 15 mrem/yr dose rate are based on a generic site model and are presented in the RDR/RAWP (DOE-RL 2000).
[c]Promulgated groundwater protection standard.
[d]Lookup values based on individual radionuclide 4 mrem/yr dose rate equivalent for beta and gamma emitters per National Drinking Water Standards as presented in the RDR/RAWP (DOE-RL 2000). Alpha emitters must meet drinking water standards for alpha emitters based on the more conservative of the 15 pCi/L maximum contaminant level or 1/25th of the derived concentration guide per DOE Order 5400.5.
[e]The "100 times groundwater cleanup" and/or "100 times dilution attenuation factor (DAF) times surface water protection" soil values were less than Hanford Site soil background concentrations; therefore, background values are used as the soil RAG.
[f]Cleanup verification samples were analyzed for nitrates as nitrogen. Therefore, the 100 times rules are applied directly to the drinking water maximum contaminant level of 10 mg/L for nitrates as nitrogen.

- **Nonradionuclide COCs:**
  - Hazard quotient of less than 1.0 for noncarcinogenic contaminants.
  - Excess cancer risk of less than 1×10^{-6} for individual carcinogenic contaminants.
  - Cumulative excess cancer risk of less than 1×10^{-5}.
  - Cleanup verification sample results pass the *Washington Administrative Code* (WAC) 173-340 (*Model Toxics Control Act* [MTCA]) three-part test.

3.2.2 Groundwater and River Protection

Groundwater and river protection cleanup levels/RAGS are applicable to all vadose zone soils (shallow and deep zones soils). For this CVP/closure report, river protection and surface water protection are synonymous, since the Columbia River is the only surface water in proximity to the Hanford Site. The term "river protection" is used throughout this CVP/closure report. The groundwater and river protection cleanup levels/RAGs are listed in Table 1 and summarized below.

- **Beta- and gamma-emitting radionuclide COCs:** Meet "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* [CFR] 141.66) dose rate

standards (4 mrem/yr total body or organ dose rate) for a period of 1,000 years starting from site cleanup. Meet individual COC cleanup levels/RAGs as applicable.

- **Alpha-emitting radionuclide COCs:** Meet drinking water standards for alpha-emitting radionuclides based on the more stringent maximum contaminant level of 15 pCi/L or 1/25th of the derived concentration guide per DOE Order 5400.5. For the 116-N-3 site there are two alpha-emitting COCs (americium-241and plutonium-239/240).

- **Nonradionuclide COCs:** Meet the individual cleanup levels/RAGs listed in Table 1 with cleanup verification sample results passing the WAC 173-340 (MTCA) three-part test, or demonstrate by site-specific modeling that residual COC levels do not pose an unacceptable threat to groundwater or surface water for 1,000 years (i.e., residual soil levels do not have the potential to exceed groundwater or river water cleanup levels/RAGs). The nonradionuclide groundwater and river protection cleanup levels/RAGs listed in Table 1 were calculated using the WAC 173-340 (MTCA) "100 times rule." The "100 times rule" has been applied to the nonradionucide COC data in accordance with the RDR/RAWP (DOE-RL 2000).

4.0 REMEDIAL/CORRECTIVE ACTION FIELD ACTIVITIES

4.1 EXCAVATION AND DISPOSAL

Remedial/corrective action at the 116-N-3 site began on July 21, 2000. Excavation of the site involved removing the overburden materials, debris, the contaminated and uncontaminated structure, and underlying contaminated soil. Based on field screening (discussed in Section 4.2), overburden materials identified as potentially clean were placed in stockpiles for potential use as backfill. Pipeline bypass trenches were excavated completely, and clean backfill was used to provide a temporary road for utilities and crossing. Contaminated materials were disposed of at the ERDF.

On December 21, 2001, the excavation was completed. Pre- and post-remediation topographic maps for the waste site are shown in Figures 2 and 3. On Figure 3, the post-remediation boundary is represented by the bold border. As shown on the trench portion of the post-remediation topographic plan, only the portion of the trench near the crib was excavated. As previously discussed, effluent in the trench percolated into the soil column before overflowing the first earthen dam. Thus, the remainder of the trench beyond the first dam was not affected by waste disposal activities and did not require remediation. The excavation for the entire 116-N-3 site was approximately 21,980 m^2 (236,590 ft^2) in area. As specified in the ROD (Ecology 2000) and CMS/CP (DOE-RL 2002a), soils were removed beneath the crib and trench to a minimum of 1.5 m (5 ft) below the engineered structures. Approximately 140,270 metric tons (154,578 tons) of material from the site were disposed of at the ERDF.

Figure 2. Pre-Rem
116-N

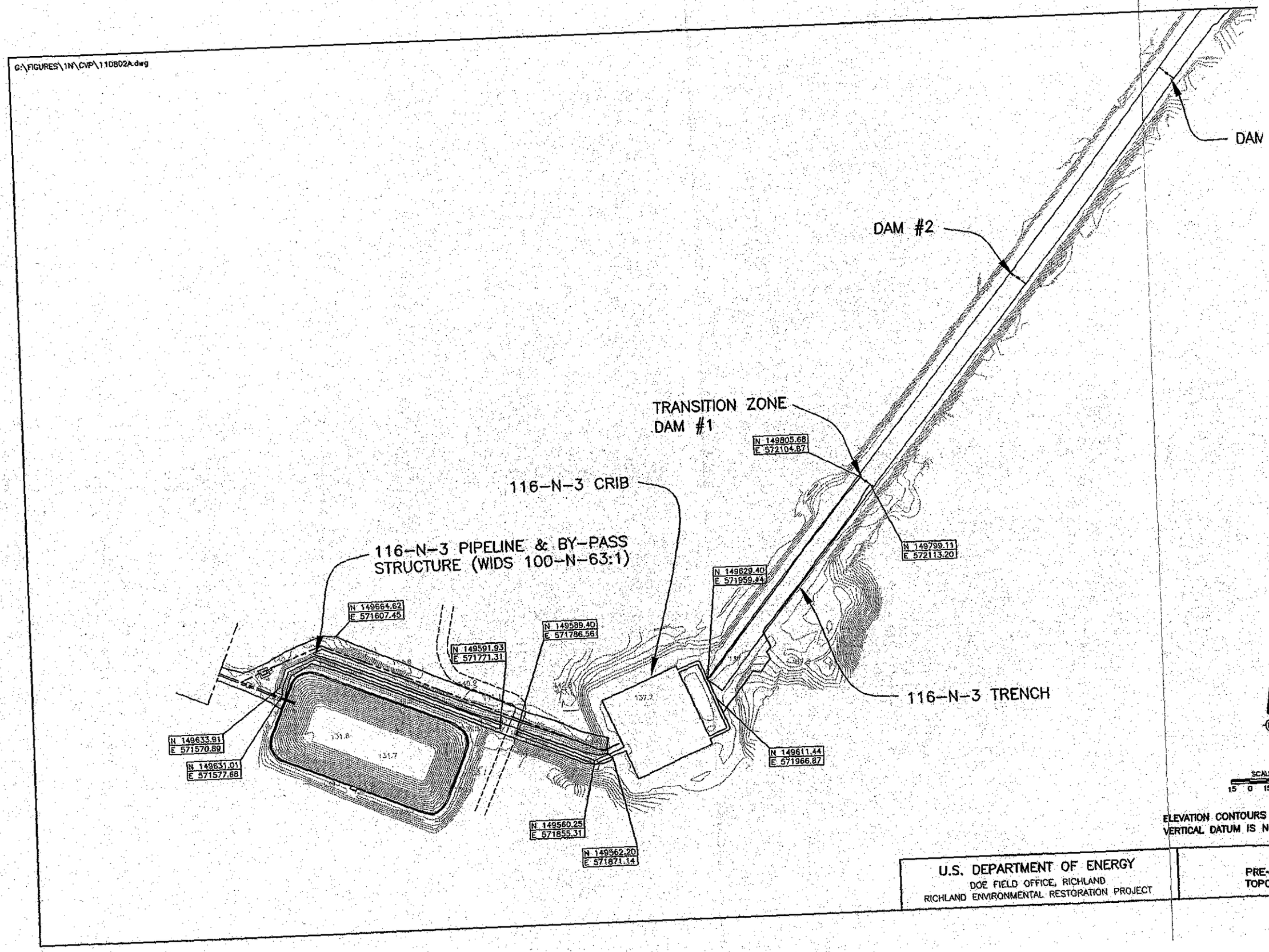
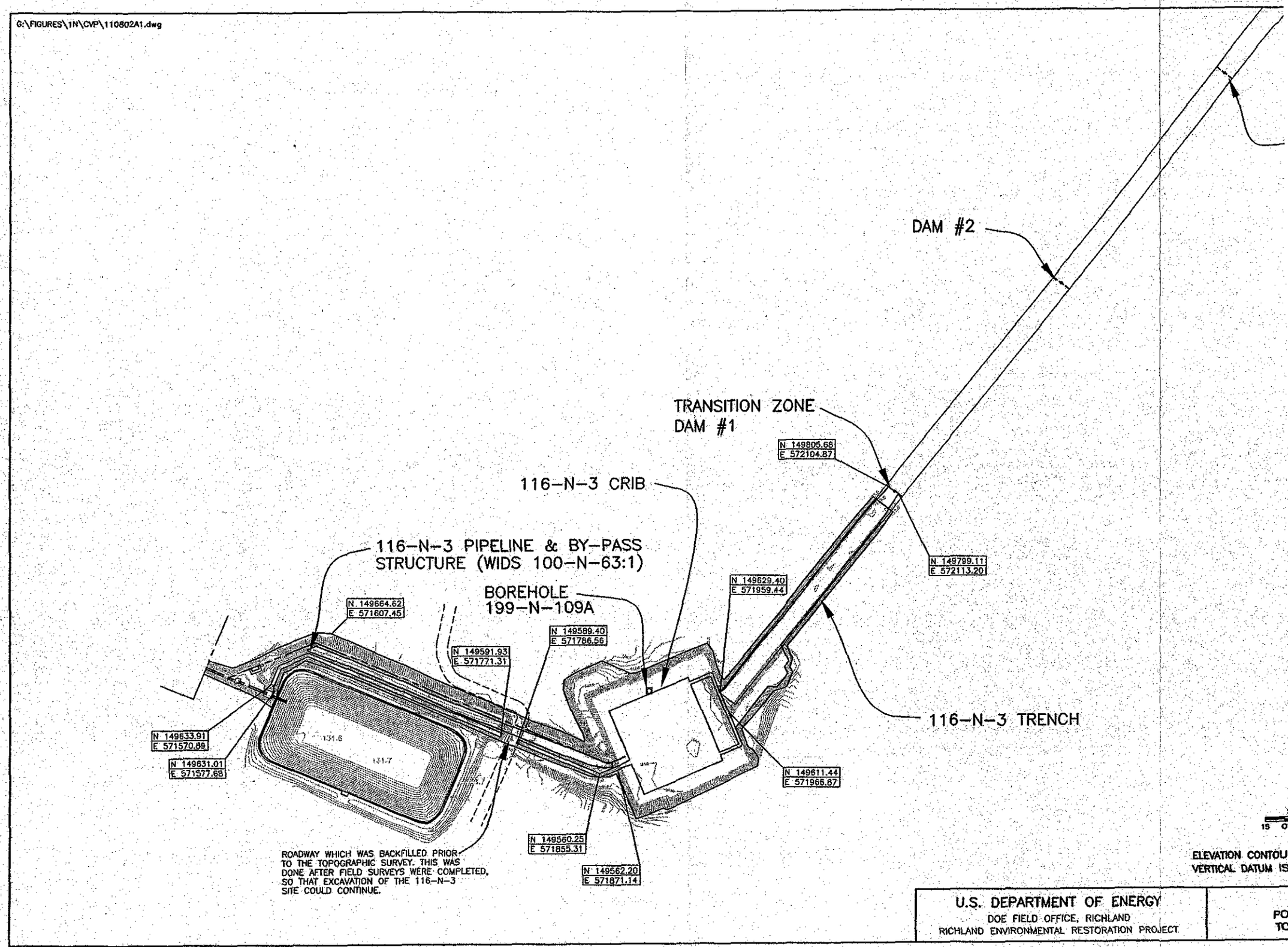


Figure 3. Post-Ren
116-N



4.2 FIELD SCREENING

Field screening was conducted during final stages of site remedial action. Field screening was used to guide the excavation, to quickly assess the presence and level of contamination, and to assess when remediation was complete. Field screening for the 116-N-3 site included using a radiological data mapping system survey, hand-held beta and gamma detectors, gamma energy analyses (GEA), and a laser-assisted ranging and data system. Although it was not required, the laser-assisted ranging and data system was used for screening the overburden piles as well as the pipelines where access permitted its use. The hand-held detectors were used to screen excavated waste material and to screen for excavation wall and floor hot spots. GEA analysis was used to support waste characterization and to corroborate the radiological mapping survey and hand-held detector data.

4.3 VARIANCE SAMPLING AND ANALYSIS

The variance analysis quantifies the variability of residual contamination. This information was used to determine the site-specific number of final cleanup verification samples to be collected. Variance sampling and testing was performed in June 2001 for the trench and in March 2002 for the crib. As specified in the SAP (DOE-RL 2002b), variance analysis was performed for the trench and crib shallow zone. Thirty variance samples were collected from the 116-N-3 Trench, and 30 variance samples were collected from the 116-N-3 Crib. Variance samples were collected in the locations shown on the trench and crib sample designs (Appendix C). Variance sampling for the pipeline was not required by the SAP (DOE-RL 2002b) and was not performed. SAP instructions state that 116-N-3 Crib variance sampling results would be used to randomly select the requisite number of sample locations for cleanup verification sampling for the 116-N-3 Pipeline.

The results of the 116-N-3 Trench variance analyses and the 116-N-3 Crib variance analyses calculated that the number of verification samples needed to be taken was less than the default number of 10 for the trench and the crib. Therefore, 10 final verification samples were collected from the trench shallow zone, and 10 samples were collected from the crib shallow zone. The results of the 116-N-3 Crib variance sampling were used to determine the number of sample locations for the cleanup verification sampling for the 116-N-3 Pipeline shallow zone and overburden. As stated above, the number of samples calculated by this variance analysis was less than the default number of 10; therefore, 10 samples were taken from the pipeline shallow zone and 10 samples were taken from the pipeline overburden. This was done per the SAP (DOE-RL 2002b).

4.4 CLEANUP VERIFICATION SAMPLING AND ANALYSIS

The division of the site excavation into decision units (e.g., shallow zone and deep zone) as shown on the sample design figures is a function of the applicable RAGs (Section 3.2, "Remedial Action Goals"). The direct exposure, groundwater protection, and river protection RAGs are applicable to soils within 4.6 m (15 ft) of the ground surface. This soil zone is referred to as the shallow zone. The overburden is a separate shallow zone decision unit. The transition zone is a separate shallow zone decision unit. The groundwater protection and river protection RAGs are applicable to soils greater than 4.6 m (15 ft) below the ground surface. This soil zone is referred to as the deep zone.

Final cleanup verification samples were collected following variance sampling, analysis, and data evaluation. With the exception of transition zone samples, each discrete verification sample was collected at 10 randomly selected locations by a process completely separate from the process used for choosing the locations of the variance samples. The same process was used for collecting samples for the trench, crib, pipeline, and overburden. The sample design methodology and sample location figures are presented in the calculation briefs for variance analysis and sample design in Appendix C.

The transition zone is a "clean" zone east of the contaminated portion of the 116-N-3 Trench. This area is shown on Figure 1. The transition zone sampling design (DOE-RL 2002b) is systematic and required collection of 12 samples east of the dam separating the clean east section from the contaminated western portion. A detailed map of the 12 sampling locations of the transition zone is presented on pages C-193/C194 of this document.

As described in Section 4.3, the required number of samples for the trench, crib, pipeline, and overburden shallow zone decision unit was less than the default number of 10 randomly selected discrete samples specified in the SAP (DOE-RL 2002b). Therefore, the default number of 10 samples were collected from each noted shallow zone decision unit (excluding the quality assurance/quality control samples). As specified in the SAP (DOE-RL 2002b), 10 randomly selected samples were collected from the trench and crib deep zones (i.e., below 4.6 m [15 ft]) in addition to quality assurance/quality control samples. There was no deep zone for the pipeline.

Because cooling water effluent never reached the full length of the 116-N-3 Trench before percolating into the soil column, a large portion of the trench has not been affected or contaminated by past waste disposal. Because of this the trench is divided into separate sections for cleanup verification sampling. Per the SAP (DOE-RL 2002b), a clean transition zone downstream of the first dam of the 116-N-3 Trench was located by systematically collecting 12 verification soil samples from the middle of the trench, below 3 cover panels. A statistical analysis was performed on the 12 samples. The GEA results indicated that the transition zone met the requirements for cleanup verification. All of the analytes with the exception of cobalt-60 were either not detected or were below Hanford Site background concentrations. The 95% upper confidence limit (UCL)

value for cobalt-60 was 0.39 pCi/L, well below the lookup value of 1.4 pCi/L corresponding to 15 mrem/yr. Therefore, based on the transition zone results the remainder of the trench downstream of the transition zone did not require remediation or additional cleanup verification sampling. Additional discussion on the transition zone is included in Sections 5.0 and 6.0. Transition zone sample results are included in Appendix A.

When sampling began for the trench, the gamma-emitting constituents (cobalt-60, cesium-137, europium-154, and europium-155) were not included on the COC list for the 116-N-3 deep zone. They were, however, included on the COC list for the shallow zone. After the deep zone verification sampling was completed, it was agreed upon by the Tri-Parties at the February 28, 2002 UMM (BHI 2002b) to add these gamma-emitting radionuclides to the deep zone COC list for the 116-N-3 site. It was understood that the verification sampling process had already begun for the 116-N-3 Trench in accordance with Rev. 0 of the SAP (DOE-RL 2002b). Because of this, it was agreed that new samples did not need to be collected a second time from the deep zone of the trench for gamma analyses. Instead, it was agreed that 30 gamma-emitting radionuclide samples that had been collected for an earlier study from the trench deep zone were to be used in calculating the 95% UCL for deep zone cleanup verification. At this UMM, it was also agreed that tritium would be deleted from the shallow zone COC list for the 116-N-3 site.

Cleanup verification sampling began in August 2001 and was finished in April 2002. The final verification samples were submitted to offsite laboratories for analysis using approved U.S. Environmental Protection Agency analytical methods, as required per the SAP (DOE-RL 2002b).

The 116-N-3 Trench and Crib consisted of both a shallow and a deep zone decision unit. The 116-N-3 Pipeline did not have a deep zone decision unit because the pipeline excavation was predominantly less than 4.6 m (15 ft) in depth, and contaminant concentrations for the entire pipeline excavation met the more stringent shallow zone criteria. Thus, the pipeline did not require a separate deep zone decision unit and separate sampling effort. The crib and trench were excavated to a depth greater than 4.6 m (15 ft) with the shallow zone consisting of the excavation sidewalls to a depth of 4.6 m (15 ft) and the deep zone consisting of the excavation sidewalls below 4.6 m (15 ft) together with the floor of the excavation. All deep zone samples were collected below a depth of 4.6 m (15 ft).

The 116-N-3 Trench, Pipeline, and Crib each had shallow zone decision units. Each unit contained 10 sampling points (trench: SZ-01 - SZ-10; pipeline: SP-01 - SP-10; crib: SZ-01 - SZ-10). Therefore, a total of 30 shallow zone verification samples were collected for the 116-N-3 shallow zone. The trench deep zone contained 10 sampling points and 30 pilot study samples that were used in the 95% UCL calculation (trench: DZ-01 – DZ-10, and trench A-1 – trench A-30). Again, the 30 pilot study samples were used for cleanup verification of the added deep zone COCs. The crib deep zone contained 10 sampling points (crib: DZ-01 – DZ-10). A total of 50 samples were

collected for the 116-N-3 deep zone. In addition, an overburden decision unit was included with this site, which included 10 sampling points (pipeline: OVB-01 – OVB-10). Also, the 116-N-3 Trench transition zone contained 12 sampling points (TZ-01 – TZ-12). Again, the transition zone was used to distinguish between the contaminated and uncontaminated portions of the trench. The sample design calculations for the 116-N-3 site are documented in the sample area and location calculation briefs included in Appendix C.

5.0 CLEANUP VERIFICATION DATA EVALUATION

This section presents the evaluation and modeling of the 116-N-3 cleanup verification data for comparison with the data quality criteria and closure performance standards/RAGs.

5.1 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-N-3 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 verified that the sample designs were sufficient for the purpose of 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.

5.2 CONTAMINANTS OF CONCERN 95% UPPER CONFIDENCE LIMIT

The primary statistical calculation used to support cleanup verification is the 95%UCL on the arithmetic mean of the data. The 95% UCL values for each COC were computed for each decision unit by combining the analytical results for the trench, crib, and pipeline verification sampling (Section 4.4) (e.g., for the shallow and deep zones, and overburden). In summary, the analytical results for the crib, trench, and pipeline shallow zones were combined to determine the 95% UCL result for the shallow zone decision unit. Likewise, the analytical results for the crib and trench deep zones were combined to determine the 95% UCL result for the deep zone decision unit. Since only the pipeline had an overburden, combining of analytical data did not take place for the overburden decision unit. During calculation of the 95% UCL, the individual sample results are reviewed and, as appropriate, duplicate sample data and nondetect data are adjusted per the SAP (DOE-RL 2002b). This process is summarized below.

Appendix C shows the 95% UCL calculation brief for the combined 116-N-3 Trench, Crib, and Pipeline. Individual 95% UCL calculation briefs were also completed for the trench, crib, and pipeline, evaluated separately. Each of these calculation briefs went through the cleanup verification calculation brief approval process, and are archived in the Environmental Restoration Contract (ERC) Project files.

Verification sampling summary statistics (95% UCL values) are listed in Table 2. Individual sample cleanup verification results are presented in Appendix A.

- **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), half of the minimum detectable activity is used in the calculation of the 95% UCL. Data flagged as estimated (i.e., "J") indicate that the associated concentration is an estimate but that the data may be used for decision-making purposes.

- **Nonradionuclides:** For data flagged with a "U" (i.e., less than detection), a value equal to one-half the practical quantitation limit is used in the calculation of the 95% UCL, as required by Washington State Department of Ecology regulations (WAC 173-340-740(7)(g)). For nonradionuclides, if greater than half of the sample results for a given COC are below detection, then the statistical value is set equal to the maximum concentration detected (i.e., versus computing a 95% UCL). Data flagged as estimated (i.e., "J") indicate that the associated concentration is an estimate but that the data may be used for decision-making purposes.

Table 2. Cleanup Verification Data.

COCs	95% UCL Statistical Values			Hanford Site Background[a]	Cleanup Verification Data Set[b]				
	Shallow Zone	Deep Zone	Overburden		Shallow Zone	Deep Zone[d]			Overburden
						Level I	Level II	Level III	
Radionuclides (pCi/g)[c]									
Americium-241	0.102	154	0.0712	NA	0.102	154	0.00438	0.00607	0.0712
Cobalt-60	0.387	5,580	0.0946	0.008	0.387	5,580	0.781	0.717	0.0946
Cesium-137	0.406	4,900	0.0856	1.1	0.406	4,900	0.211	0.0832	0 (<BG)
Europium-154	0.0603	8.7	0.0289	0.033	0.0603	8.7	0.302	0.162	0 (<BG)
Europium-155	0.0422	6.45	0.0508	0.054	0.0422	6.45	0.233	0.0929	0 (<BG)
Tritium (H-3)	NC	-0.00726	NC	NA	NC	-0.0076	-0.00726	-0.00726	NC
Nickel-63	-0.0622	1,030	-0.624	NA	-0.0622	1,030	82.6	8.12	-0.624
Plutonium 239/240	0.0282	258	0.0235	0.025	0.0282	258	0.00744	0.0103	0 (<BG)
Strontium-90	0.170	1,460	0.0139	0.18	0.170	1,460	117	11.5	0 (<BG)
Nonradionuclides (mg/kg)									
Mercury	0.0200	NC	0.0200	0.33	0.0200	NC			0.0200
Nitrate	1.24	3.0	11.8	52	1.24	3.0			11.8

[a]Represents the 90th percentile of the lognormal distribution (DOE-RL 1995).
[b]The statistical value above background is used as the input value for RESidual RADioactivity (RESRAD) modeling. For overburden, background is subtracted from all radionuclides. Refer to Appendix C for additional details on determination of statistical values.
[c]Laboratory data including the minimum detectable activity or practical quantitation limit for the individual cleanup verification samples are included in Appendix A and the 95% UCL calculation brief.
[d]The cleanup verification model comprises four depth intervals: (1) shallow zone, (2) deep zone – level I, (3) deep zone – level II, and (4) deep zone – level III. A schematic cross section of the site-specific verification model is included in the *116-N-3 Combined Trench, Crib, and Pipeline RESRAD Calculation* calculation brief included in Appendix C. Level II and III radionuclide concentrations are based on a borehole (199-N-109A) completed at the 116-N-3 site. Borehole results are included in Appendix C.

BG = Background.
NA = Not available.
NC = Not a COC for this zone.

Statistical calculations are presented in the *116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification 95% UCL Calculations* calculation brief (Appendix C). The columns on the left side of Table 2 are the 95% UCL statistical values before subtraction of background, if appropriate. The columns on the right side of the table present statistical values adjusted for background; it is these values that constitute the cleanup verification data set and are used for RESidual RADioactivity (RESRAD) modeling. For overburden, background is subtracted from the statistical value for all radionuclides when background values are available.

5.3 SITE-SPECIFIC CLEANUP VERIFICATION MODEL

The summary of statistical values presented in Table 2 were evaluated and used along with radionuclide data from Borehole 199-N-109A drilled at the 116-N-3 Crib to develop a site-specific cleanup verification model. The location of this borehole is shown on Figure 3. The borehole is within the remediation area of the 116-N-3 site. The summary results for Borehole 199-N-109A are included in a January 30, 2001 technical memorandum included in Appendix C (BHI 2002a). Table 3 summarizes the 116-N-3 site borehole (199-N-109A) data.

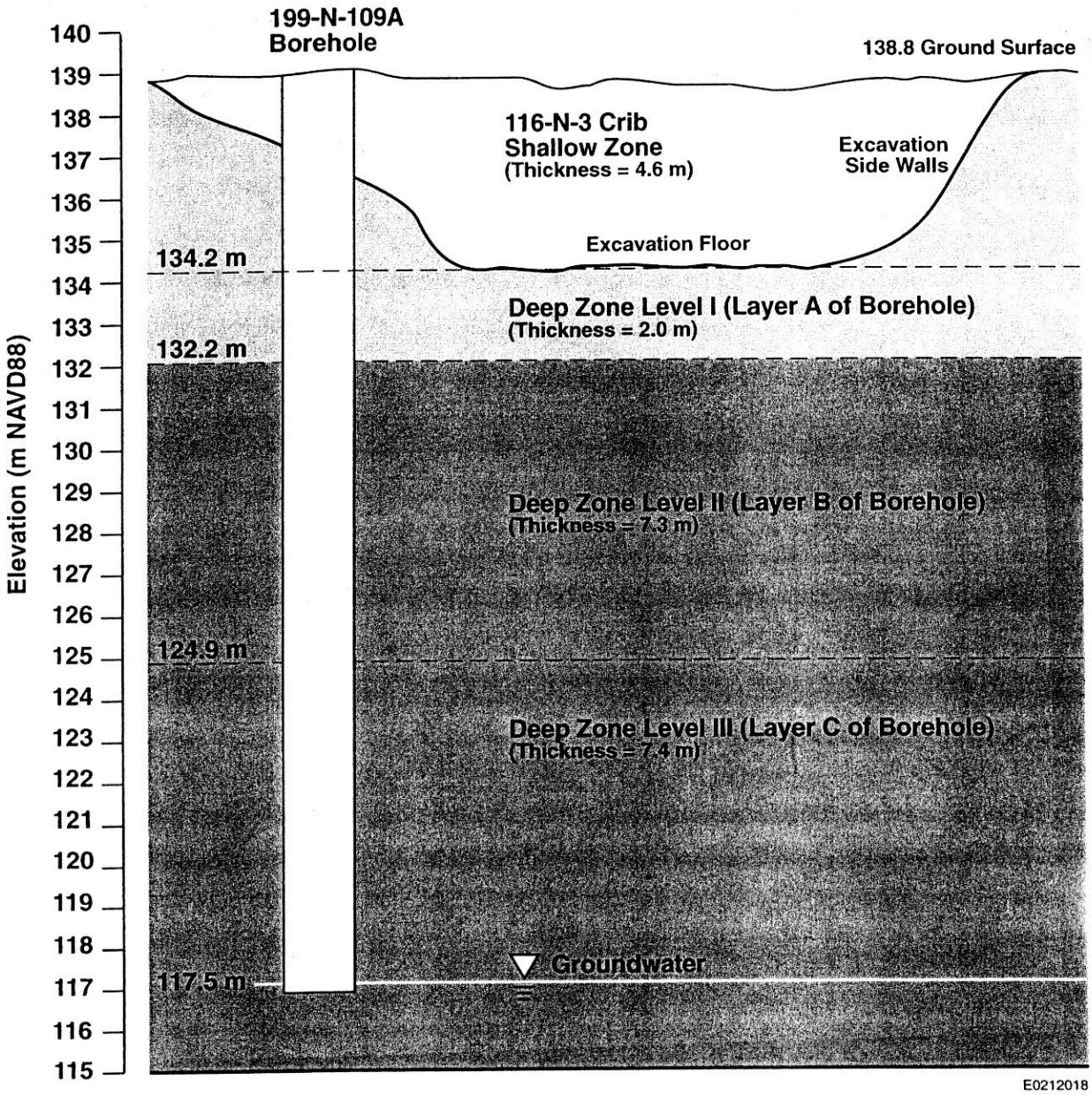
Table 3. Summary of Borehole 199-N-109A Data by Layer.

Isotope	116-N-3 Deep Zone Level II (Layer B) (pCi/g)	116-N-3 Deep Zone Level III (Layer C) (pCi/g)
Cs-137	0.211	0.0832
Co-60	0.781	0.717
Eu-152	0.767	0.00144
Eu-154	0.302	0.162
Eu-155	0.233	0.0929
Pu-238	0.00373	0.00566
Pu-239/240	0.00744	0.0103
Sr-90	177	11.5
U-235	0.00677	0.0291
U-238	0.489	0.418

Modeling was done because initial RESRAD runs showed that based on the conservative assumption outlined in the RDR/RAWP (DOE-RL 2000), the Deep Zone Level I contaminant statistical value concentrations would extend uniformly to groundwater. Based on this, RESRAD predicted that the concentrations of americium-241, cobalt-60, cesium-137, nickel-63, plutonium-239, plutonium-240, and strontium-90 in Deep Zone Level I would result in groundwater concentrations that exceeded the groundwater RAGs. Because the assumption that the Deep Zone Level I contaminant concentrations extend uniformly to groundwater is too conservative in the case of these contaminants, contaminant depth distributions were obtained using the

data reported from Borehole 199-N-109A. The borehole data was used to construct a three-layer model providing RESRAD concentration inputs. Figure 4 illustrates the relationship between the borehole layers A, B, and C and Deep Zone Levels I, II, and III of the 116-N-3 site. Layer A was based on the 95% UCL of verification samples collected at the excavation floor of the crib and trench. Layer B (middle layer of the deep zone), and Layer C (bottom layer of the deep zone) were based on Borehole 199-N-109A values. These three layers are referred to as Deep Zone Levels I, II, and III in the RESRAD modeling for the 116-N-3 site.

Figure 4. Borehole 199-N-109A.



5.4 RESRAD MODELING

For the purpose of RESRAD modeling, the 100-N Area is represented by an individual resident in a rural-residential setting. The resident is assumed to consume crops raised in a backyard garden; consume animals products, such as meat and milk from locally raised livestock or meat from game animals (including fish); and live in a residence on the waste site. The exposure pathways considered in estimating dose from radionuclides in soil are inhalation; soil ingestion; ingestion of crops, meat, fish, and milk; and external gamma exposure. It is assumed that contaminated groundwater would not be used for drinking, irrigation, or any other use (DOE-RL 2000). This individual is conservatively assumed to spend 80% of his or her lifetime on site.

The individual radionuclide cleanup verification statistical values (Table 2) were entered into the RESRAD computer code, Version 6.1 (ANL 2001), to estimate the dose rate and the impact on groundwater and the river from residual 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 soil contamination and the basement walls.

Details of the RESRAD modeling methodologies, results, input values, and the site-specific cleanup verification model are included in the RESRAD calculation brief (Appendix C) and are described in detail in the RDR/RAWP (DOE-RL 2000). The drinking water dose rate calculations based on the RESRAD estimated groundwater radionuclide concentrations are shown in the comparison to drinking water standards calculation brief (Appendix C). Specific results from the calculations are discussed in Section 6.0.

6.0 EVALUATION OF REMEDIAL ACTION GOAL ATTAINMENT

This section demonstrates that remedial actions at the 116-N-3 site meet the applicable RAGs. Sections 6.1, 6.2, and 6.3 address attainment of direct exposure RAGs, groundwater protection RAGs, and Columbia River protection RAGs, respectively. Section 6.4 documents application of the WAC 173-340 (MTCA) three-part test. This test is required for nonradionuclide COCs only, and is based on the most restrictive RAG for each zone.

6.1 DIRECT EXPOSURE SOIL REMEDIAL ACTION GOALS/ PERFORMANCE STANDARDS ATTAINED

6.1.1 Radionuclides

The results of the RESRAD dose rate estimates for the shallow and deep zones for the site and all-pathways scenarios are presented in Figure 5. The results for the overburden are presented in Figure 6. These dose rates represent the dose contributions from soils at relevant time periods. The dose is largest at present (year 2002), 5.95 mrem/yr and 1.11 mrem/yr from the site and overburden, respectively, and decreases to 1.58×10^{-02} mrem/yr and 5.60×10^{-03} mrem/yr in 1,000 years from the site and overburden, respectively. The estimated dose rate in the year 2018 from the site is 2.22 mrem/yr and 1.80×10^{-01} mrem/yr from overburden.

Figure 5. RESRAD Analysis – All Radionuclides, All-Pathways Dose Rate Estimate (Shallow and Deep Zones).

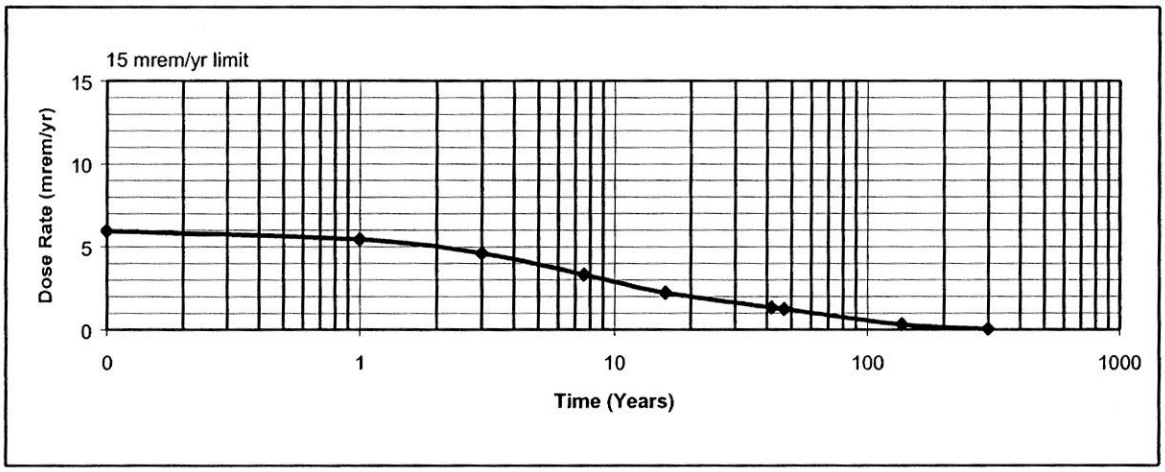
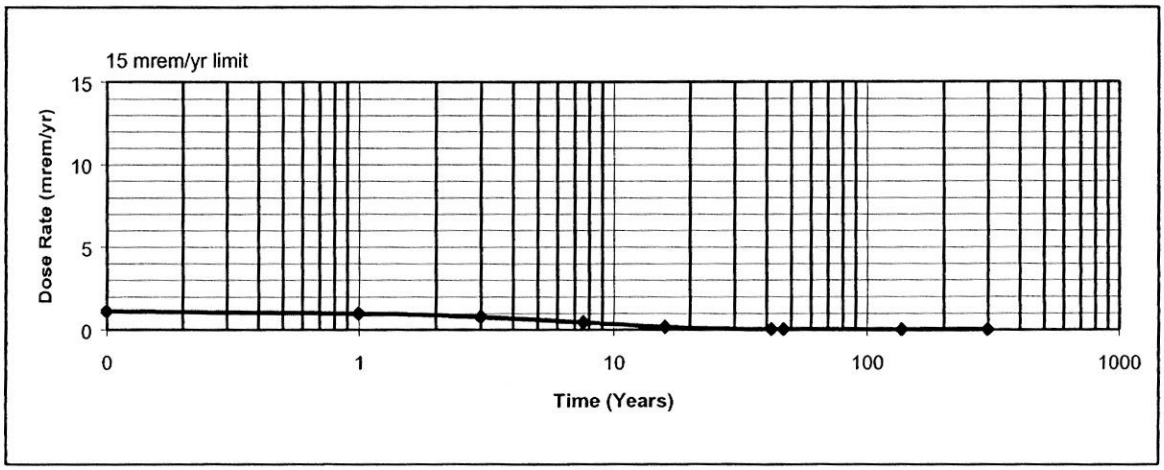


Figure 6. RESRAD Analysis – All Radionuclides, All-Pathways Dose Rate Estimate (Overburden).



The 2018 date corresponds to the 30-year site cleanup schedule of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1998). All dose rate estimates are less than the 15 mrem/yr RAG/cleanup level. The RESRAD computations are presented in detail in the referenced calculation briefs summarized in Appendix C. Additional supportive information for individual data sets from each of the components of the 116-N-3 site (i.e., trench, crib, and pipeline) were input into RESRAD and run. Each of the individual site component doses is less than the 15 mrem/yr RAG. Calculation briefs for each of the site components are included in Appendix C.

6.1.2 Nonradionuclides

6.1.2.1 Direct Comparison to RAGs. Table 4 compares the cleanup verification statistical values presented in Table 2 to the direct exposure RAGs/cleanup levels presented in Table 1.

Table 4. Attainment of Nonradionuclide Direct Exposure Standards.

Nonradionuclides	Direct Exposure RAG (mg/kg)	Shallow Zone Statistical Value (mg/kg)	Overburden Statistical Value (mg/kg)	Direct Exposure RAGs Attained?[a]
Mercury	24	0.0200	0.0200	Yes
Nitrate	8,000	1.24	11.8	Yes

[a]Criterion is comparison to the cleanup criteria (RAG). The SAP refers to these as preliminary action levels (PALs).

6.1.2.2 Noncarcinogenic Hazard Quotient RAG Attained. For noncarcinogenic COCs, WAC 173-340 (MTCA) specifies the evaluation of the hazard quotient, which is given as daily intake divided by a reference dose (DOE-RL 1995). For cleanup actions under the ROD (Ecology 2000), a comparable conservative approach is used to demonstrate attainment of the noncarcinogenic risk requirements.

The COCs with noncarcinogenic effects at this site are mercury and nitrate. The sum of the individual COC quotients for the shallow zone soils is below the limit of 1.0. Therefore, the noncarcinogenic risk requirements have been attained. This is shown in the 95% UCL calculation brief (Appendix C).

6.1.2.3 Carcinogenic Risk RAG Attained. For individual nonradionuclide carcinogenic COCs, the WAC 173-340 (MTCA) Method B cleanup limits are based on an incremental cancer risk of 1×10^{-6}. For nonradionuclide carcinogenic COCs, the total excess cancer risk must be less than 1×10^{-5} (EPA et al. 1998).

There are no nonradionuclide carcinogenic COCs at this site. Therefore, the carcinogenic risk standards have been attained.

6.2 GROUNDWATER REMEDIAL ACTION GOALS ATTAINED

6.2.1 Radionuclides

The estimated groundwater concentrations for all of the radionuclide COCs contributed by the site soils are shown in the RESRAD calculation brief (Appendix C). Table 5 shows the total peak concentration predicted for each radionuclide COC and provides the individual RAGs for comparison. No COC is predicted to exceed the RAGs; therefore, the RAGs are attained.

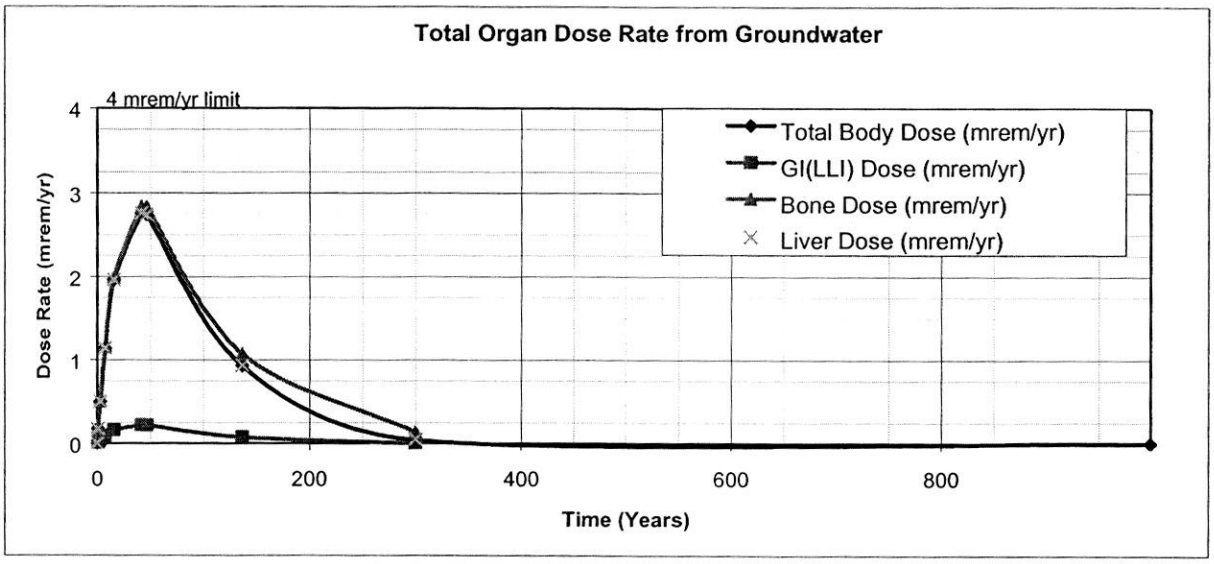
Table 5. Estimated Peak Radionuclide Groundwater Concentrations (Summing Shallow and Deep Zone Impacts) Compared to RAGs.

Radionuclide	Peak Concentration (pCi/L)	RAG (pCi/L)	RAGS Attained? (Yes/No)
116-N-3 Site			
Americium-241	[a]	15[c]	Yes
Cobalt-60	[a]	100[b]	Yes
Cesium-137	[a]	60[b]	Yes
Europium-154	[a]	60[b]	Yes
Europium-155	[a]	600[b]	Yes
Tritium (H-3)[d]	[a]	20,000[d]	Yes
Nickel-63	1.76[f]	50[b]	Yes
Plutonium-239/240	[a]	15[e]	Yes
Strontium-90	5.51[f]	8[e]	Yes
Overburden Soil			
Americium-241	[a]	15[c]	Yes
Cobalt-60	[a]	100[b]	Yes
Cesium-137	[a]	60[b]	Yes
Europium-154	[a]	60[b]	Yes
Europium-155	[a]	600[b]	Yes
Tritium[d]	[a]	20,000[d]	Yes
Nickel-63	[a]	50[b]	Yes
Plutonium-239/240	[a]	15[c]	Yes
Strontium-90	[a]	8[e]	Yes

[a]Based on RESRAD modeling, these radionuclides do not reach groundwater in 1,000 years.
[b]Lookup value corresponding to a dose rate of 4 mrem/yr.
[c]Alpha emitters must meet drinking water standards based on the more stringent of the 15 pCi/L maximum contaminant level or 1/25th of the derived concentration guide per DOE Order 5400.5.
[d]The tritium 95% UCL statistical value was negative and therefore was not input into RESRAD. Tritium is a COC for the deep zone decision unit only.
[e]U.S. Environmental Protection Agency drinking water promulgated RAG (40 CFR 141.55).
[f] The peak concentration values are located in calculation brief number 0100N-CA-V0059, Table 6. The nickel-63 concentration is expected to occur at year 137, and the strontium-90 concentration is expected to occur at year 42. This calculation brief is located in Appendix C of this document.

Figure 7 shows the individual organ dose rates for beta- and gamma-emitting radionuclides predicted over 1,000 years, as shown in the *116-N-3 Combined Trench, Crib, and Pipeline Comparison to Drinking Water Standards* calculation brief (Appendix C). None of the organ dose rates are predicted to exceed the 4 mrem/yr standard over 1,000 years. On the individual site component basis (i.e., 116-N-3 Crib, Trench, and Pipeline), none of the individual site components exceed the RAGs. Individual site component groundwater peaks can be found in the individual calculation briefs that were completed for the trench, crib, and pipeline. These briefs are referenced in Section 9.0.

Figure 7. Dose Rates to Organs from Groundwater.



6.2.2 Nonradionuclides

Table 6 illustrates the comparison of cleanup verification statistical values to the groundwater protection RAGs. The listed RAGs are based on background or the "100 times groundwater cleanup rule." The results of meeting the listed RAGs demonstrate that the groundwater protection RAG has been attained.

6.3 COLUMBIA RIVER REMEDIAL ACTION GOALS ATTAINED

6.3.1 Radionuclides

The river protection RAGs for radionuclides are identical to the groundwater protection RAGs. The RESRAD modeling results were compared to the groundwater protection RAGs in Table 5.

Table 6. Attainment of Nonradionuclide Remedial Action Goals for Protection of Groundwater and the Columbia River.

Nonradio-nuclides	Soil RAG for Groundwater Protection (mg/kg)	Soil RAG for Columbia River Protection (mg/kg)	Statistical Cleanup Verification Data Value (mg/kg)	Groundwater and/or River Protection RAGs Exceeded?	RAGs Attained? (Yes/No)
Shallow Zone					
Mercury	0.33	0.33	0.02	No	Yes
Nitrate	1,000[a]	2,000	1.24	No	Yes
Deep Zone					
Mercury	Not a deep zone COC				
Nitrate	1,000[a]	2,000	3.0	No	Yes
Overburden					
Mercury	0.33	0.33	0.02	No	Yes
Nitrate	1,000[a]	2,000	11.8	No	Yes

[a]Cleanup verification samples were analyzed for nitrates as nitrogen. Therefore, the 100 times rules are applied directly to the drinking water maximum contaminant level of 10 mg/L for nitrates as nitrogen.

The results indicated that radionuclides are not predicted to reach groundwater in 1,000 years (and, by extension, not predicted to reach the Columbia River) at levels above 4 mrem/yr; therefore, the Columbia River protection RAGs/performance standards have been attained.

6.3.2 Nonradionuclides

Table 6 illustrates the comparison of cleanup verification statistical values to the Columbia River protection RAGs. The listed RAGs are based on background or the "100 times dilution attenuation factor (DAF) times surface water quality rule." The results of meeting the listed RAGs/performance standards demonstrate that the RAGs have been attained.

6.4 WAC 173-340 (MTCA) THREE-PART TEST

Sections 6.1, 6.2, and 6.3 looked separately at attainment of the direct exposure RAGs, groundwater protection RAGs, and Columbia River protection RAGs. Section 6.4 documents application of the WAC 173-340 (MTCA) three-part test for nonradionuclides using the most restrictive RAGs. The most restrictive RAG is defined as the lowest of the direct exposure, groundwater protection, and river protection RAGs. The direct exposure, groundwater protection, and river protection RAGs are applicable to the shallow zone. Groundwater and river protection RAGs are applicable to the deep zone. The WAC 173-340 (MTCA) three-part test consists of the following criteria: (1) the cleanup verification statistical value must be less than the cleanup level, (2) no single

detection can exceed two times the cleanup criteria, and (3) the percentage of samples exceeding the cleanup criteria must be less than 10%.

Table 7 summarizes the results of the WAC 173-340 (MTCA) three-part test (WAC 173-340-740(7)) for the shallow and deep zone sample data sets. For each nonradionuclide COC, the table lists the most restrictive applicable RAG (selected from the RAGs in Table 1), the maximum detected value, the total number of samples collected, and the number of samples exceeding the most restrictive RAG. The final column of the table describes the result of applying the three WAC 173-340 (MTCA) criteria using the values listed in the preceding columns.

Table 7 shows that all nonradionuclide COCs pass the WAC 173-340 (MTCA) three-part test.

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

Nonradionuclides	Most Stringent Applicable RAG (mg/kg)	Statistical Value (mg/kg)[a]	Maximum Detected (mg/kg)[b]	Total Number of Samples[c]	Number Exceeding Criteria[d]	RAGs Attained? (Yes/No)
Shallow Zone						
Mercury	0.33	0.02[e]	ND	33	0	Yes
Nitrate	1,000[f]	1.24	7.6	33	0	Yes
Deep Zone						
Mercury	Mercury is not a deep zone COC					
Nitrate	1,000[f]	3.0	14.8	22	0	Yes
Overburden						
Mercury	0.33	0.02[e]	ND	11	0	Yes
Nitrate	1,000[f]	11.8	11.2	11	0	Yes

[a]Criterion is comparison to the cleanup RAG.
[b]Criterion is no single detection can exceed two times the cleanup criteria.
[c]The total number of samples includes field duplicate samples, which are included in the evaluation as separate samples.
[d]Criterion is the percentage of samples exceeding the cleanup criteria must be less than 10%.
[e]This value is the practical quantitation limit (PQL) for this analyte. Analyte concentrations for this test were below detection limits of this method.
[f]Cleanup verification samples were analyzed for nitrates as nitrogen. Therefore, the 100 times rules are applied directly to the drinking water maximum contaminant level of 10 mg/L for nitrates as nitrogen.
ND = Not detected. Analyte concentration is below detection limits of the method and/or instruments used.

7.0 RADIONUCLIDE RISK INFORMATION

The radionuclide RAG for direct exposure is derived from the ROD (Ecology 2000) 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. The "National Oil and Hazardous Substances Pollution Contingency Plan" (40 CFR 300) presents a target range for residual risk of 10^{-4} to 10^{-6}. Figures 8 and 9 illustrate excess lifetime cancer risk as estimated using the RESRAD model. Because of radioactive decay, the risk decreases over time. The estimated risk is largest, 5.81 x 10^{-05} from the site and 7.16 x 10^{-06} in the overburden at present (year 2002), and decreases to 3.53 x 10^{-08} from the site and 1.37 x 10^{-08} from the overburden in 1,000 years. The estimated risk in the year 2018 is 2.99 x 10^{-05} from the site and 1.13 x 10^{-06} from the overburden. Figures 10 and 11 plot the radiation dose rate above background, similar to Figure 5, and show the corresponding radionuclide excess cancer risk at present and in the year 2018.

Figure 8 . RESRAD Analysis – Radionuclide Excess Cancer Risk, All Pathways (Shallow and Deep Zones).

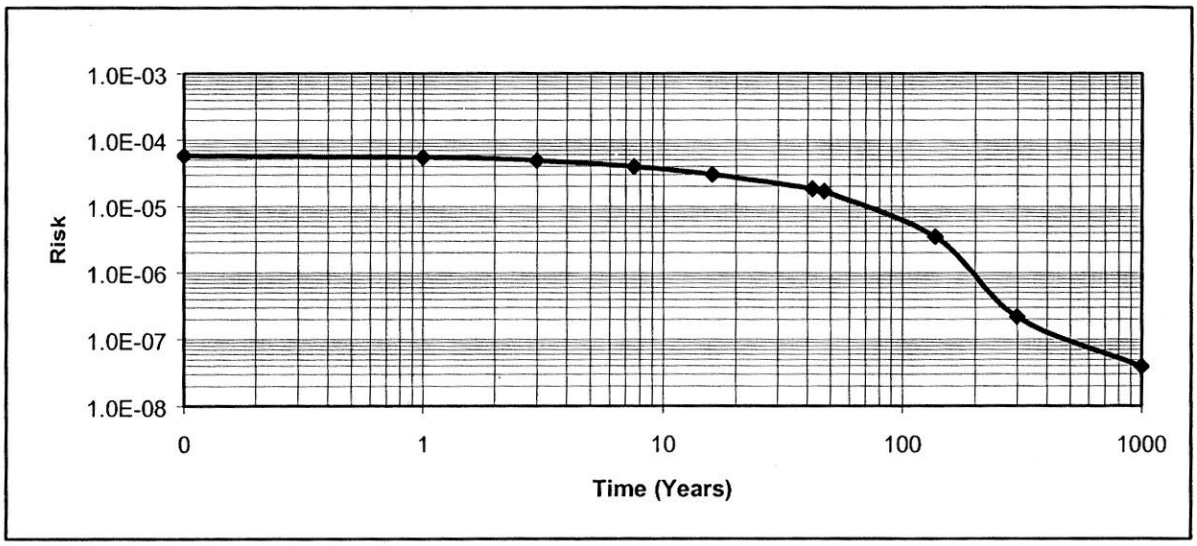


Figure 9. RESRAD Analysis – Radionuclide Excess Cancer Risk, All Pathways (Overburden).

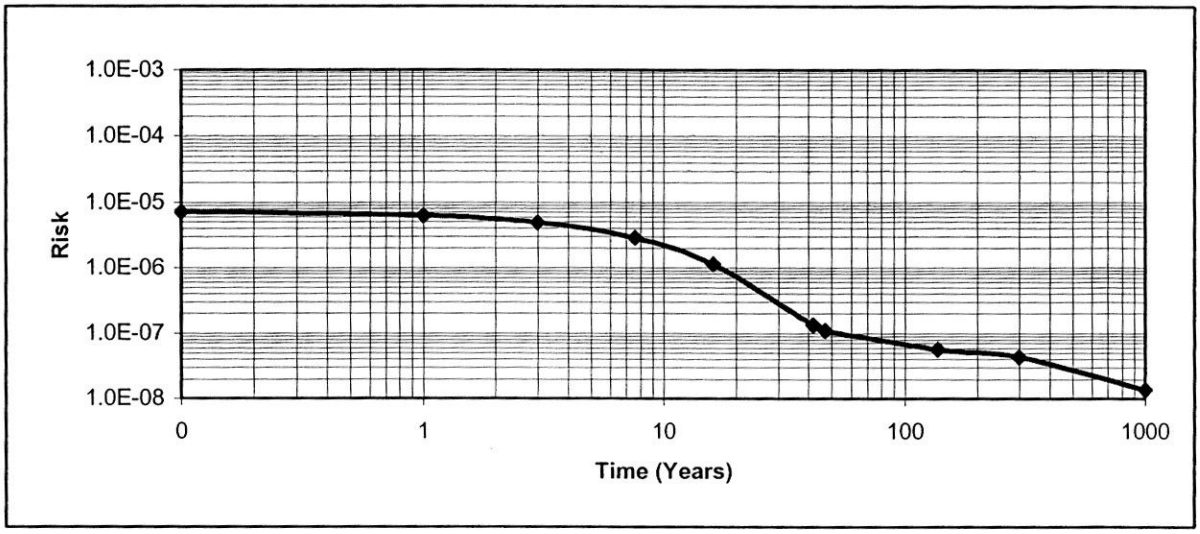


Figure 10. RESRAD Analysis – Radionuclide Dose Rate, All Pathways, With Corresponding Excess Cancer Risk Values (Shallow and Deep Zones).

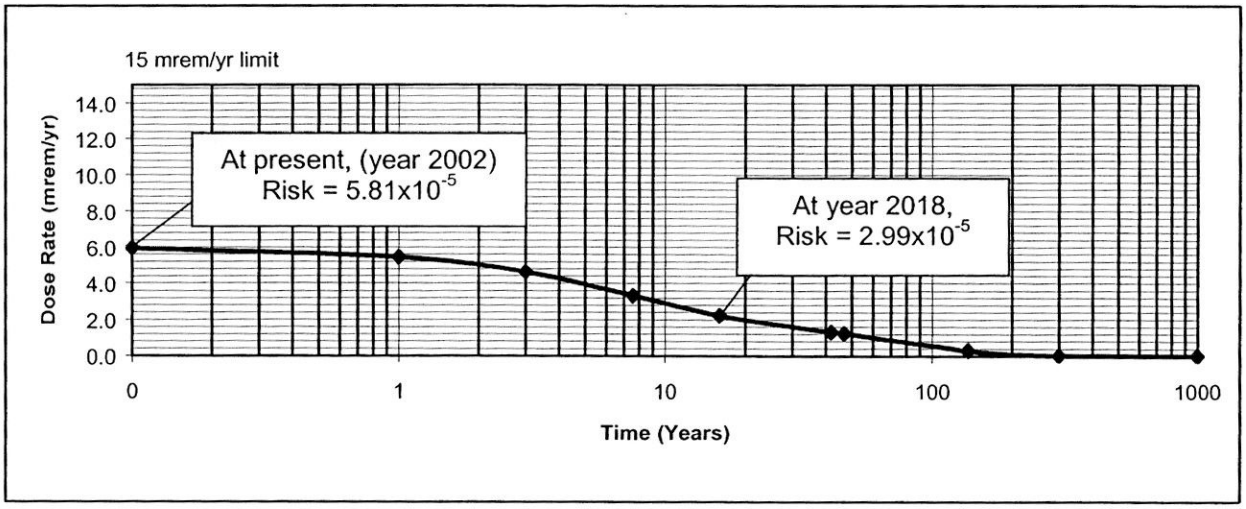
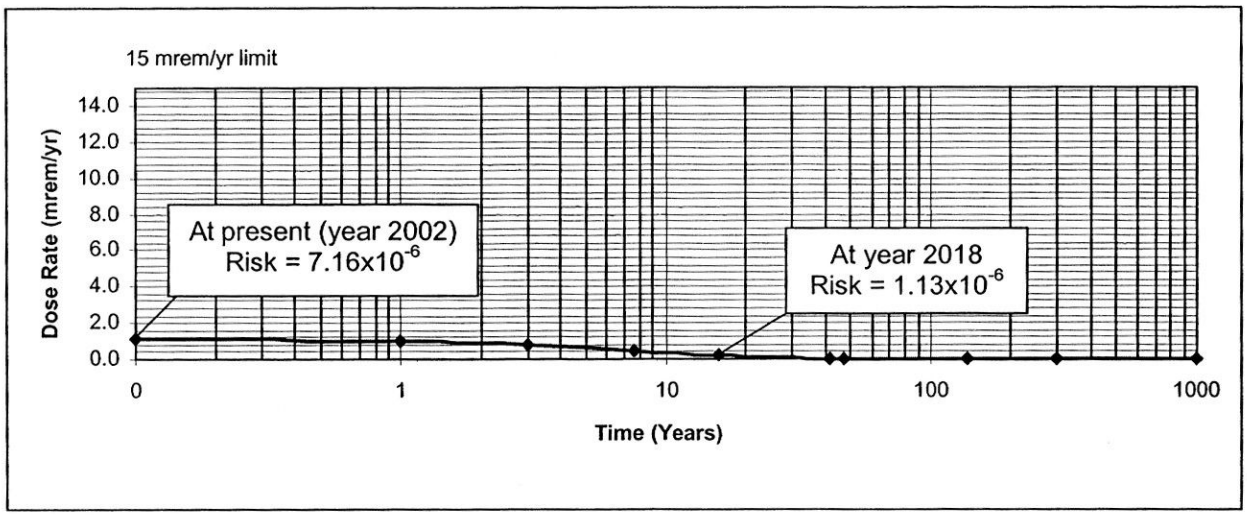


Figure 11. RESRAD Analysis – Radionuclide Dose Rate, All Pathways, With Corresponding Excess Cancer Risk Values (Overburden).



8.0 STATEMENT OF PROTECTIVENESS

This CVP/closure report demonstrates that remedial action at the 116-N-3 site has achieved the RAOs and corresponding RAGs established in the approved Interim Action ROD (Ecology 2000) and RDR/RAWP (DOE-RL 2000). The remaining soils at the 116-N-3 site including overburden soils have been sampled, analyzed, and modeled. The results of this effort indicate that the materials from the 116-N-3 site containing COCs at concentrations exceeding RAGs have been excavated and disposed of at the ERDF. These results also indicate that residual concentrations in the shallow zone and overburden soil will support future land uses that can be represented (or bounded) by a rural-residential scenario, and that residual concentrations throughout the site including overburden soils are protective of groundwater and the Columbia River. The acceptability of unrestricted direct exposure to deep zone soils has not been demonstrated; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone (i.e., below 4.6 m [15 ft]) are required. The 116-N-3 site has been remediated in accordance with the ROD (Ecology 2000) and may be backfilled. Overburden soils are suitable for use as backfill. In accordance with the *100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan* (DOE-RL 2002a) and *the Remedial Design Report/Remedial Plan for the 100-NR-1 Treatment, Storage, and Disposal Units* (DOE-RL 2000), it is assumed that contaminated groundwater would not be used for drinking, irrigation, or any other use.

9.0 REFERENCES

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*, as amended.

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*, as amended.

ANL, 2001, *RESRAD for Windows*, Version 6.1, Argonne National Laboratory, Environmental Assessment Division, Argonne, Illinois.

BHI, 2002a, *100-NR-1 Subsurface Contaminant Layers*, CCN 085935, 100-N Remedial Action Project Technical Memorandum from C. A. Kahler-Royer to J. D. Fancher, January 30, 2002, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2002b, *Unit Managers' Meeting Minutes, 100 Area Remedial Action and Waste Disposal Units/Source Operable Unit*, February 28, 2002, CCN097790, Bechtel Hanford, Inc., Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601, as amended.

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, Washington, D.C.

DOE-RL, 1995, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes,* DOE/RL-92-24, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1998, *Tri-Party Agreement Handbook Management Procedures,* RL-TPA-90-0001, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000, *Remedial Design Report/Remedial Action Work Plan for the 100-NR-1 Treatment, Storage, and Disposal Units*, DOE/RL-2000-16, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2002a, *100-NR-1 Treatment, Storage, and Disposal Units Corrective Measures Study/Closure Plan*, DOE/RL-96-39, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2002b, *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout*, DOE/RL-2000-07, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 1994, *Hanford Facility RCRA Permit*, Permit No. WA7890008967, Washington State Department of Ecology, Olympia, Washington.

Ecology, 2000, *100-NR-1 Interim Remedial Action Record of Decision* (ROD), Washington State Department of Ecology, Olympia, Washington.

Ecology, EPA, and DOE, 1998, *Hanford Federal Facility Agreement and Consent Order,* 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

EPA, Ecology, and RL, 1998, *Environmental Restoration Contractor Meeting Minutes - Remedial Action and Waste Disposal Unit Managers' Meeting -- 100 Area*, Draft, dated July 6, 1998, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq.

WAC 173-340-740(7)(g), "Model Toxics Control Act – Cleanup, Soil Cleanup Standards," *Washington Administrative Code*, as amended, 1996.

116-N-3 Trench Cleanup Verification 95% UCL Calculations, Calculation No. 0100N-CA-V0045, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

116-N-3 Pipeline Cleanup Verification 95% UCL Calculations, Calculation No. 0100N-Ca-V0050, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

116-N-3 Crib Cleanup Verification 95% UCL Calculations, Calculation No. 0100N-CA-V0054, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

116-N-3 Trench RESRAD Calculation, Calculation No. 0100N-CA-V0046, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

116-N-3 Pipeline RESRAD Calculation, Calculation No. 0100-N-CA-V0051, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

116-N-3 Crib RESRAD Calculation, Calculation No. 0100N-CA-V0055, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

116-N-3 Trench Comparison to Drinking Water Standards, Calculation No. 0100N-CA-V0047, Rev. 0, Bechtel Hanford, Inc., Richland, Washington

116-N-3 Pipeline Comparison to Drinking Water Standards, Calculation No. 0100N-CA-V0052, Rev. 0, Bechtel Hanford, Inc., Richland, Washington

116-N-3 Crib Comparison to Drinking Water Standards, Calculation No. 0100N-CA-V0056, Rev. 0, Bechtel Hanford, Inc., Richland, Washington

10.0 BIBLIOGRAPHY

65 FR 76708, "National Primary Drinking Water Regulations; Radionuclides; Final Rule", *Federal Register*, Vol. 65, No. 236, page 76708, December 7, 2000.

BHI-DE-01, *Design Engineering Procedures*, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 1996, *Hanford Site Background: Part 2, Soil Background for Radioactive Analytes,* DOE/RL-96-12, Rev. 0., U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 1986, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, SW-846, Third Edition, as revised, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1997, *Establishment of Cleanup Level for CERCLA Sites with Radioactive Contamination*, OSWER Directive No. 9200-4-18, August 22, 1997, U.S. Environmental Protection Agency, Washington, D.C.

WAC 173-340-740(e), "Model Toxics Control Action Cleanup Regulation," *Washington Administrative Code*.

WDOH, 1997, *Hanford Guidance for Radiological Cleanup*, WDOH/320-015, Rev. 1, Division of Radiation Protection, Washington Department of Health, Olympia, Washington.

WHC, 1991, *Geology and Hydrology of the Hanford Site*, WHC-SD-ER-TI-003, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

SUMMARY OF VERIFICATION SOIL SAMPLING AND ANALYTICAL RESULTS

Table A-1. Shallow Zone Cleanup Verification Data (8/24/01, 8/27/01, 11/15/01, 11/16/01, 1/07/02, 1/30/02, and 4/02/02). (Sheet 1 of 4)

Sample Point	HEIS Number	Sample Date	Am-241[b]			Cs-137			Co-60			Eu-154			Eu-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Trench SZ-04	B12P75	8/27/2001	0.00E+00	U	1.60E+00	3.30E-02	[a]	1.50E-02	3.70E-02	[a]	1.50E-02	4.30E-02	U	4.30E-02	3.70E-02	U	3.70E-02
Trench duplicate of B12P75	B12P76	8/27/2001	3.24E-01	U	1.60E+00	3.20E-02	[a]	1.90E-02	4.40E-02	[a]	2.00E-02	5.80E-02	U	5.80E-02	4.10E-02	U	4.10E-02
Trench split of B12P75	B12PD7	8/27/2001	8.18E-03	U	2.03E-02	2.34E-02		1.83E-02	4.40E-02	U	2.68E-02	-8.69E-03	U	6.05E-02	3.22E-02	U	4.36E-02
Trench SZ-01	B12P81	8/24/2001	-1.30E-01	U	9.90E-01	3.30E-02	U	3.30E-02	6.20E-02		3.60E-02	1.50E-01	U	1.50E-01	6.70E-02	U	6.70E-02
Trench SZ-02	B13CF6	11/15/2001	-2.80E-02	U	2.20E-01	3.30E-02	U	3.30E-02	4.00E-02	U	4.00E-02	1.10E-01	U	1.10E-01	5.70E-02	U	5.70E-02
Trench SZ-03	B12P74	8/24/2001	3.87E-01	U	1.70E+00	1.10E-02	U	1.10E-02	1.20E-02	U	1.20E-02	3.60E-02	U	3.60E-02	4.70E-02	U	4.70E-02
Trench SZ-05	B13CF7	11/16/2001	1.26E-01	U	1.90E-01	4.00E-02	U	4.00E-02	4.70E-02	U	4.70E-02	1.30E-01	U	1.30E-01	5.90E-02	U	7.30E-02
Trench SZ-06	B12P78	8/27/2001	-1.29E-01	U	4.80E-01	1.51E-01		1.90E-02	2.65E-01		2.00E-02	5.20E-02	U	5.20E-02	7.20E-02	U	7.20E-02
Trench SZ-07	B12P79	8/27/2001	-5.30E-02	U	4.30E-01	1.10E-02	U	1.10E-02	3.30E-02	[a]	1.30E-02	4.10E-02	U	4.10E-02	3.80E-02	U	3.80E-02
Trench SZ-08	B12P80	8/24/2001	2.60E-01	U	1.00E+00	2.50E-02	U	2.50E-02	1.30E-02	U	1.50E-02	4.20E-02	U	4.20E-02	2.80E-02	U	2.80E-02
Trench SZ-09	B12P84	8/24/2001	1.21E-01	U	9.30E-01	2.20E-02	U	2.20E-02	2.50E-02	U	2.50E-02	8.00E-02	U	8.00E-02	5.10E-02	U	5.10E-02
Trench SZ-10	B12P85	8/24/2001	3.12E-01	U	6.00E-01	2.00E-01		4.40E-02	2.05E-01		4.60E-02	1.30E-01	U	1.30E-01	6.70E-02	U	6.70E-02
Crib SZ-01	B14CL2	4/02/2002	1.40E-01	U	1.40E-01	4.80E-02	[a]	4.30E-02	4.20E-02	U	4.20E-02	1.40E-01	U	1.40E-01	1.00E-01	U	1.00E-01
Crib duplicate of B14CL2	B14CL3	4/02/2002	7.10E-02	U	7.10E-02	1.65E-01		1.90E-02	4.00E-02	[a]	1.80E-02	5.50E-02	U	5.50E-02	5.20E-02	U	5.20E-02
Crib split of B14CL2	B10059A	4/02/2002	6.87E-03	U	3.74E-02	2.29E-02		1.56E-02	8.37E-03	U	1.65E-02	2.38E-02	U	4.80E-02	1.47E-02	U	3.89E-02
Crib SZ-02	B14CL5	4/02/2002	3.00E-02	U	3.00E-02	8.40E-02	[a]	2.60E-02	5.40E-02		2.60E-02	7.70E-02	U	7.70E-02	9.20E-02	U	9.20E-02
Crib SZ-03	B14CL6	4/02/2002	1.40E-01	U	1.80E-01	6.60E-02	[a]	5.60E-02	2.10E-01	U	2.10E-01	1.80E-01	U	1.80E-01	1.30E-01	U	1.30E-01
Crib SZ-04	B14CL7	4/02/2002	9.10E-02	U	9.10E-02	2.50E-02	U	2.50E-02	2.70E-02	U	2.70E-02	7.50E-02	U	7.50E-02	6.70E-02	U	6.70E-02
Crib SZ-05	B14CL8	4/02/2002	2.00E-01	U	2.00E-01	2.40E-02	U	2.40E-02	2.90E-02	U	2.90E-02	1.00E-01	U	1.00E-01	9.40E-02	U	9.40E-02
Crib SZ-06	B14CL9	4/02/2002	2.90E-02	U	2.90E-02	2.00E-02	U	2.00E-02	2.10E-02	U	2.10E-02	7.70E-02	U	7.70E-02	5.00E-02	U	5.00E-02
Crib SZ-07	B14CM0	4/02/2002	1.80E-02	U	1.80E-02	1.73E-01		1.80E-02	9.20E-02		1.90E-02	5.50E-02	U	5.50E-02	2.90E-02	U	2.90E-02
Crib SZ-08	B14CM1	4/02/2002	5.80E-02	U	5.80E-02	1.60E-02	U	1.60E-02	1.70E-02	U	1.70E-02	5.80E-02	U	5.80E-02	4.20E-02	U	4.20E-02
Crib SZ-09	B14CM2	4/02/2002	3.60E-02	U	3.60E-02	9.00E-03	U	9.00E-03	9.00E-03	U	9.00E-03	3.00E-02	U	3.00E-02	3.30E-02	U	3.30E-02
Crib SZ-10	B14CM3	4/02/2002	1.00E-01	U	1.00E-01	1.27E+00		1.40E-02	7.96E-01		1.70E-02	4.50E-02	U	4.50E-02	4.70E-02	U	4.70E-02

[a] Because of laboratory reporting conventions, these data were given a nonrelevant "J" qualifier that appears in the Hanford Environmental Information System (HEIS) database and in analytical data. The data quality assessment (Appendix B) further discusses the "J" qualifiers applied during validation.
[b] For Am-241, GAMMA_GS results are reported for the crib and pipeline, and isotopic results are reported for the trench. Both methods are equally suitable.
U = Analyte is below detection limits of the method and instruments used (not detected).
In some cases, the laboratory reports no value but provides a minimum detectable activity (MDA). In these cases, the MDA has been used as the sample result.

Table A-1. Shallow Zone Cleanup Verification Data (8/24/01, 8/27/01, 11/15/01, 11/16/01, 1/07/02, 1/30/02, and 4/02/02). (Sheet 2 of 4)

Sample Point	HEIS Number	Sample Date	Am-241[b]			Cs-137			Co-60			Eu-154			Eu-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Pipeline SP-02	B13P83	1/07/2002	1.20E-01	U	1.20E-01	9.16E-01		7.50E-02	3.04E-01		6.40E-02	1.70E-01	U	1.70E-01	1.20E-01	U	1.20E-01
Pipeline duplicate of B13P83	B13TF3	1/07/2002	2.60E-01	U	2.60E-01	1.24E+00		4.70E-02	6.98E-01		4.10E-02	1.20E-01	U	1.20E-01	1.10E-01	U	1.10E-01
Pipeline split of B13P83	B13TF5	1/07/2002	2.13E-01		1.69E-02	7.30E-01		1.93E-02	3.01E-01		1.83E-02	2.40E-02	U	6.27E-02	1.90E-02	U	5.77E-02
Pipeline SP-01	B13P82	1/07/2002	4.30E-02	U	4.30E-02	3.30E-02	U	3.30E-02	3.40E-02	U	3.40E-02	1.10E-01	U	1.10E-01	7.20E-02	U	7.20E-02
Pipeline SP-03	B13TD5	1/07/2002	2.60E-01	U	2.60E-01	4.30E-02	U	4.30E-02	1.50E-01	U	1.50E-01	1.40E-01	U	1.40E-01	1.20E-01	U	1.20E-01
Pipeline SP-04	B13TD6	1/07/2002	7.90E-02	U	7.90E-02	8.97E-01		9.30E-02	2.80E-01		9.70E-02	2.70E-01	U	2.70E-01	1.70E-01	U	1.70E-01
Pipeline SP-05	B13TD7	1/07/2002	5.90E-02	U	5.90E-02	2.09E-01		5.00E-02	1.66E-01		7.10E-02	2.00E-01	U	2.00E-01	8.70E-02	U	8.70E-02
Pipeline SP-06	B13TD8	1/07/2002	9.30E-02	U	9.30E-02	4.90E-02	U	4.90E-02	1.00E-01	U	1.00E-01	1.30E-01	U	1.30E-01	8.80E-02	U	8.80E-02
Pipeline SP-07	B13TD9	1/07/2002	1.30E-01	U	1.30E-01	1.82E+00		4.70E-02	2.50E+00		4.10E-02	1.20E-01	U	1.20E-01	9.20E-02	U	9.20E-02
Pipeline SP-08	B13TF0	1/07/2002	2.70E-01	U	2.70E-01	9.10E-02	[a]	4.10E-02	4.70E-02	U	4.70E-02	1.30E-01	U	1.30E-01	1.20E-01	U	1.20E-01
Pipeline SP-09	B13TF1	1/07/2002	1.00E-01	U	1.00E-01	1.09E+00		3.80E-02	1.23E+00		3.10E-02	9.70E-02	U	9.70E-02	7.40E-02	U	7.40E-02
Pipeline SP-10	B13TF2	1/30/2002	5.00E-02	U	5.00E-02	4.87E-01		4.80E-02	3.94E-01		3.90E-02	1.60E-01	U	1.60E-01	7.20E-02	U	7.20E-02

[a] Because of laboratory reporting conventions, these data were given a nonrelevant "J" qualifier that appears in the Hanford Environmental Information System (HEIS) database and in analytical data. The data quality assessment (Appendix B) further discusses the "J" qualifiers applied during validation.
[b] For Am-241, GAMMA_GS results are reported for the crib and pipeline, and isotopic results are reported for the trench. Both methods are equally suitable.
U = Analyte is below detection limits of the method and instruments used (not detected).
In some cases, the laboratory reports no value but provides a minimum detectable activity (MDA). In these cases, the MDA has been used as the sample result.

Table A-1. Shallow Zone Cleanup Verification Data (8/24/01, 8/27/01, 11/15/01, 11/16/01, 1/07/02, 1/30/02, and 4/02/02). (Sheet 3 of 4)

Sample Point	HEIS Number	Sample Date	Ni-63			Pu-239/240			Sr-90			Nitrate			Hg		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL
Trench SZ-04	B12P75	8/27/2001	-2.69E+00	U	1.00E+01	1.37E-01	U	1.00E+00	3.68E-01	[a]	1.80E-01	1.80E-01		1.70E-01	2.00E-02	U	2.00E-02
Trench duplicate of B12P75	B12P76	8/27/2001	-3.08E+00	U	9.80E+00	9.70E-02	U	7.50E-01	4.20E-02	U	1.60E-01	2.00E-01	U	2.00E-01	2.00E-02	U	2.00E-02
Trench split of B12P75	B12PD7	8/27/2001	3.15E+00	U	6.55E+00	1.42E-02	U	1.96E-02	2.29E-02	U	1.45E-01	3.60E-02	U	~~	9.10E-03	B	~~
Trench SZ-01	B12P81	8/24/2001	-4.26E+00	U	9.70E+00	0.00E+00	U	8.60E-01	4.60E-02	U	5.10E-01	2.00E-01	U	2.00E-01	2.00E-02	U	2.00E-02
Trench SZ-02	B13CF6	11/15/2001	1.25E-01	U	3.00E+00	0.00E+00	U	1.90E-01	-1.00E-03	U	2.20E-01	8.10E-01		2.00E-01	2.00E-02	U	2.00E-02
Trench SZ-03	B12P74	8/24/2001	-1.67E+00	U	1.20E+01	-1.14E-01	U	8.70E-01	-7.10E-02	U	1.70E-01	2.00E-01	U	2.00E-01	2.00E-02	U	2.00E-02
Trench SZ-05	B13CF7	11/16/2001	0.00E+00	U	2.70E+00	2.50E-02	U	1.90E-01	-8.90E-02	U	2.20E-01	2.00E-01	U	2.00E-01	2.00E-02	U	2.00E-02
Trench SZ-06	B12P78	8/27/2001	-1.80E+00	U	9.90E+00	0.00E+00	U	8.80E-01	-1.00E-03	U	1.80E-01	5.90E-01		2.00E-01	2.00E-02	U	2.00E-02
Trench SZ-07	B12P79	8/27/2001	-1.07E+00	U	9.30E+00	0.00E+00	U	7.70E-01	-5.60E-02	U	1.80E-01	2.00E-01	U	2.00E-01	2.00E-02	U	2.00E-02
Trench SZ-08	B12P80	8/24/2001	-1.60E+00	U	9.30E+00	-1.11E-01	U	8.50E-01	1.70E-02	U	1.70E-01	5.60E-01		1.80E-01	1.00E-02	U	1.00E-02
Trench SZ-09	B12P84	8/24/2001	4.75E-01	U	9.90E+00	-9.10E-02	U	7.00E-01	1.00E-01	U	6.90E-01	1.90E-01	U	1.90E-01	1.00E-02	U	1.00E-02
Trench SZ-10	B12P85	8/24/2001	-2.14E+00	U	9.70E+00	0.00E+00	U	8.70E-01	1.14E+00		6.30E-01	1.90E-01	U	1.90E-01	2.00E-02	U	2.00E-02
Crib SZ-01	B14CL2	4/02/2002	7.40E-01	U	2.10E+00	0.00E+00	U	1.10E-01	-8.50E-02	U	2.50E-01	1.80E-01	U	1.80E-01	2.00E-02	U	2.00E-02
Crib duplicate of B14CL2	B14CL3	4/02/2002	3.13E-01	U	2.20E+00	0.00E+00	U	1.20E-01	-6.80E-02	U	2.50E-01	2.10E-01		1.50E-01	2.00E-02	U	2.00E-02
Crib split of B14CL2	B10059-A[a]	4/02/2002	7.38E-01	U	5.10E+00	1.43E-02	U	1.30E-02	-3.50E-02	U	2.80E-01	3.70E-02	U	5.20E-01	2.00E-02	U	2.00E-02
Crib SZ-02	B14CL5	4/02/2002	5.73E-01	U	2.10E+00	0.00E+00	U	2.50E-01	-4.40E-02	U	2.50E-01	2.10E+00		2.00E-01	2.00E-02	U	2.00E-02
Crib SZ-03	B14CL6	4/02/2002	8.56E-01	U	2.10E+00	0.00E+00	U	2.60E-01	5.00E-02	U	2.50E-01	7.50E-01		2.00E-01	2.00E-02	U	2.00E-02
Crib SZ-04	B14CL7	4/02/2002	4.20E-01	U	2.10E+00	3.30E-02	U	2.50E-01	-7.80E-02	U	2.30E-01	1.10E+00		1.80E-01	1.00E-02	U	1.00E-02
Crib SZ-05	B14CL8	4/02/2002	2.37E-01	U	2.10E+00	3.00E-02	U	2.30E-01	-4.00E-03	U	2.60E-01	1.80E-01	U	1.80E-01	2.00E-02	U	2.00E-02
Crib SZ-06	B14CL9	4/02/2002	8.35E-01	U	2.10E+00	3.10E-02	U	2.40E-01	2.50E-02	U	2.40E-01	1.80E-01	U	1.80E-01	1.00E-02	U	1.00E-02
Crib SZ-07	B14CM0	4/02/2002	6.88E-01	U	2.10E+00	2.90E-02	U	2.20E-01	1.58E-01	U	2.80E-01	2.00E-01	U	2.00E-01	2.00E-02	U	2.00E-02
Crib SZ-08	B14CM1	4/02/2002	3.38E-01	U	2.20E+00	1.50E-02	U	3.70E-02	-4.50E-02	U	2.50E-01	1.60E-01	U	1.60E-01	1.00E-02	U	1.00E-02
Crib SZ-09	B14CM2	4/02/2002	1.68E-01	U	2.10E+00	6.70E-02	U	5.10E-01	-1.19E-01	U	2.70E-01	5.40E-01		1.80E-01	2.00E-02	U	2.00E-02
Crib SZ-10	B14CM3	4/02/2002	5.51E-01	U	2.10E+00	0.00E+00	U	4.30E-01	7.12E-01	[a]	2.20E-01	2.00E-01		1.80E-01	2.00E-02	U	2.00E-02

[a] Because of laboratory reporting conventions, these data were given a nonrelevant "J" qualifier that appears in the Hanford Environmental Information System (HEIS) database and in analytical data. The data quality assessment (Appendix B) further discusses the "J" qualifiers applied during validation.
U = Analyte is below detection limits of the method and instruments used (not detected).
Strontium-90 is the COC identified in the SAP. The values reported here are for total radioactive strontium.
In some cases, the laboratory reports no value but provides a minimum detectable activity (MDA). In these cases, the MDA has been used as the sample result.
~~ Indicates that the laboratory did not return MDAs/practical quantitation limits (PQLs) for these analyses.

Table A-1. Shallow Zone Cleanup Verification Data (8/24/01, 8/27/01, 11/15/01, 11/16/01, 1/07/02, 1/30/02, and 4/02/02). (Sheet 4 of 4)

Sample Point	HEIS Number	Sample Date	Ni-63			Pu-239/240			Sr-90			Nitrate			Hg		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL
Pipeline SP-02	B13P83	1/07/2002	1.21E-01	U	2.20E+00	6.10E-02	U	2.30E-01	1.59E-01	U	2.10E-01	6.10E-01		2.20E-01	2.00E-02	U	2.00E-02
Pipeline duplicate of B13P83	B13TF3	1/07/2002	-1.04E+00	U	2.20E+00	0.00E+00	U	2.70E-01	2.23E-01	[a]	1.90E-01	5.30E-01		2.00E-01	2.00E-02	U	2.00E-02
Pipeline split of B13P83	B13TF5	1/07/2002	6.53E+00		5.97E+00	2.37E-01		2.01E-02	2.99E+00		1.59E-01	1.50E+00		3.80E-02	1.90E-03	U	2.00E-02
Pipeline SP-01	B13P82	1/07/2002	-3.58E-01	U	2.00E+00	0.00E+00	U	2.30E-01	-2.40E-02	U	2.20E-01	1.30E+00		2.20E-01	2.00E-02	U	2.00E-02
Pipeline SP-03	B13TD5	1/07/2002	-7.20E-01	U	2.00E+00	0.00E+00	U	2.60E-01	2.30E-02	U	2.40E-01	6.50E-01		2.20E-01	2.00E-02	U	2.00E-02
Pipeline SP-04	B13TD6	1/07/2002	-3.56E-01	U	2.10E+00	0.00E+00	U	3.90E-01	2.61E-01	[a]	2.10E-01	4.00E-01		2.10E-01	2.00E-02	U	2.00E-02
Pipeline SP-05	B13TD7	1/07/2002	-1.72E-01	U	2.10E+00	7.00E-03	U	3.30E-02	-3.00E-03	U	2.20E-01	2.40E-01		2.20E-01	2.00E-02	U	2.00E-02
Pipeline SP-06	B13TD8	1/07/2002	-6.97E-01	U	2.20E+00	2.50E-02	U	1.90E-01	-4.60E-02	U	2.10E-01	6.70E-01		2.20E-01	1.00E-02	U	1.00E-02
Pipeline SP-07	B13TD9	1/07/2002	-7.70E-02	U	2.10E+00	2.18E-01	[a]	2.10E-01	-1.00E-03	U	2.00E-01	2.40E-01		2.10E-01	2.00E-02	U	2.00E-02
Pipeline SP-08	B13TF0	1/07/2002	2.34E-01	U	2.10E+00	0.00E+00	U	2.30E-01	8.50E-02	U	2.10E-01	2.70E+00		2.40E-01	2.00E-02	U	2.00E-02
Pipeline SP-09	B13TF1	1/07/2002	3.73E-01	U	2.10E+00	0.00E+00	U	2.10E-01	3.21E-01	[a]	2.10E-01	3.40E-01		2.20E-01	2.00E-02	U	2.00E-02
Pipeline SP-10	B13TF2	1/30/2002	-8.68E-01	U	2.80E+00	0.00E+00	U	2.40E-01	1.06E-01	U	2.50E-01	7.60E+00		2.10E-01	2.00E-02	U	2.00E-02

[a] Because of laboratory reporting conventions, these data were given a nonrelevant "J" qualifier that appears in the Hanford Environmental Information System (HEIS) database and in analytical data. The data quality assessment (Appendix B) further discusses the "J" qualifiers applied during validation.
U = Analyte is below detection limits of the method and instruments used (not detected).
Strontium-90 is the COC identified in the SAP. The values reported here are for total radioactive strontium.
In some cases, the laboratory reports no value but provides a minimum detectable activity (MDA). In these cases, the MDA has been used as the sample result.
PQL = practical quantitation limit

Table A-2. Deep Zone Cleanup Verification Data (8/24/01, 8/27/01, 4/08/02, and 10/19/00). (Sheet 1 of 3)

Sample Point	HEIS Number	Sample Date	Am-241[b]			H-3			Ni-63			Pu-239/240			Sr-90			Nitrate		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL
Trench DZ-04	B12P89	8/27/2001	3.84E+00		9.80E-01	3.10E-02	U	3.60E-01	5.36E+01		1.00E+01	7.13E+00		1.00E+00	7.25E+01		2.00E+00	5.90E+00		1.90E-01
Trench duplicate of B12P89	B12P90	8/27/2001	2.51E+00		9.60E-01	1.09E-01	U	3.40E-01	5.00E+01		1.00E+01	8.55E+00		9.50E-01	7.00E+01		1.60E+00	6.00E+00		1.90E-01
Trench split of B12P89	B12PD8	8/27/2001	6.29E+00		1.86E-01	1.46E+00	U	8.37E+01	1.79E+02		1.19E+01	1.24E+01		9.07E-02	7.80E+01		4.17E+00	3.60E-02	U	~~
Trench DZ-01	B12P86	8/24/2001	2.07E-01	a	2.00E-01	-4.00E-03	U	9.10E-02	2.18E+00	U	1.10E+01	1.99E-01	U	3.00E-01	1.07E+02		1.70E-01	1.90E-01	U	1.90E-01
Trench DZ-02	B12P87	8/27/2001	2.12E+01		9.60E-01	-2.60E-02	U	3.50E-01	2.27E+02		1.00E+01	2.61E+01		1.10E+00	2.92E+02		1.70E+00	6.50E-01		1.90E-01
Trench DZ-03	B12P88	8/24/2001	2.22E-01	a	1.90E-01	2.70E-02	U	8.20E-02	5.26E+00	U	1.00E+01	1.72E-01	U	1.90E-01	6.92E+01		8.00E-01	1.90E-01	U	1.90E-01
Trench DZ-05	B12P94	8/24/2001	6.51E+00		1.50E+00	-1.20E-02	U	3.70E-01	4.38E+01		1.00E+01	1.18E+01		1.00E+00	4.99E+02		1.90E+00	2.50E-01		2.00E-01
Trench DZ-06	B12P91	8/27/2001	1.01E+01		1.10E+00	1.29E-01	U	3.10E-01	1.12E+02		1.00E+01	1.50E+01		9.70E-01	2.37E+02		1.90E+00	1.48E+01		4.10E-01
Trench DZ-07	B12P95	8/24/2001	3.94E-01	a	1.40E-01	-2.20E-02	U	8.60E-02	3.06E+00	U	1.00E+01	2.30E-01	a	2.00E-01	3.86E+02		3.60E-01	1.80E-01	U	1.80E-01
Trench DZ-08	B12P92	8/24/2001	8.00E-02	U	1.20E-01	3.20E-02	U	8.60E-02	5.35E+00	U	1.00E+01	8.20E-02	U	2.10E-01	6.04E+01		1.60E-01	2.00E-01	U	2.00E-01
Trench DZ-09	B12P93	8/27/2001	1.80E+01		1.50E+00	-9.10E-02	U	2.80E-01	2.79E+02		1.00E+01	2.92E+01		6.50E-01	8.34E+01		1.80E+00	7.60E+00		1.80E-01
Trench DZ-10	B12P96	8/24/2001	-2.40E-02	U	1.80E-01	6.90E-02	U	8.90E-02	-2.69E+01	U	1.10E+01	4.70E-02	U	1.80E-01	-1.38E-01	U	3.80E-01	1.90E-01	U	1.90E-01
Crib DZ-02	B14CM4	4/08/2002	1.40E+00	U	1.40E+00	-3.66E-01	U	6.10E-01	-5.73E-01	U	1.00E+01	1.50E+00		1.10E+00	2.13E+03		3.90E+00	2.00E-01	U	2.00E-01
Crib duplicate of B14CM4	B14CN4	4/08/2002	1.40E+00	U	1.40E+00	-2.09E-01	U	6.50E-01	-8.54E-01	U	1.00E+01	3.36E-01	U	1.30E+00	1.90E+03		3.80E+00	2.10E-01		1.90E-01
Crib split of B14CM4	B14CX7	4/08/2002	1.42E+00		4.79E-01	2.57E+00	U	6.65E+00	1.30E+01	U	1.56E+01	3.17E+00		2.86E-01	3.16E+03		7.02E+00	3.60E-02	U	3.60E-02
Crib DZ-01	B14CM9	4/08/2002	1.44E+02		6.20E+00	-3.20E-02	U	1.60E+00	5.13E+02		5.00E+01	2.28E+02		8.00E+00	2.15E+03		1.30E+01	8.00E-01		3.60E-02
Crib DZ-03	B14CN0	4/08/2002	3.90E+02	U	3.90E+02	-3.20E-02	U	1.60E+00	2.60E+03		1.00E+02	2.00E+02		9.60E+00	2.68E+03		2.60E+01	7.50E-01		3.70E-02
Crib DZ-04	B14CM5	4/08/2002	5.50E+00	U	5.50E+00	-1.55E-01	U	3.20E-01	2.64E+01		1.00E+01	1.12E+01		1.20E+00	1.97E+03		4.10E+00	2.60E-01		2.00E-01
Crib DZ-05	B14CN1	4/08/2002	2.26E+01		4.40E+00	-8.30E-02	U	6.40E-01	1.26E+02		1.00E+01	3.55E+01		1.50E+00	2.06E+03		4.00E+00	3.00E-01		1.80E-01
Crib DZ-06	B14CN2	4/08/2002	2.15E+00		4.30E-01	-4.40E-02	U	3.40E-01	2.52E+01		1.00E+01	3.41E+00		1.20E+00	8.01E+02		4.00E+00	4.00E-01		2.10E-01
Crib DZ-07	B14CM6	4/08/2002	7.90E+00	U	7.90E+00	-3.33E-01	U	6.60E-01	5.14E+00		1.00E+01	9.65E+00		1.60E+00	1.74E+03		4.00E+00	1.90E-01	U	1.90E-01
Crib DZ-08	B14CN3	4/08/2002	9.99E+02		3.10E+01	-4.97E-01	U	1.60E+00	6.04E+03		2.00E+02	1.73E+03		1.70E+01	3.71E+03		4.20E+01	3.70E-02	U	3.70E-02
Crib DZ-09	B14CM7	4/08/2002	5.80E+00	U	5.80E+00	1.23E-01	U	6.10E-01	6.80E+00		1.00E+01	4.78E+00		1.30E+00	1.94E+03		3.70E+00	2.00E-01	U	2.00E-01
Crib DZ-10	B14CM8	4/08/2002	1.48E+00		1.80E-01	-1.21E-01	U	3.40E-01	8.49E+00		1.10E+01	2.17E+00		1.30E+00	7.72E+01		2.60E+00	2.00E-01	U	2.00E-01

[a] Because of laboratory reporting conventions, these data were given a nonrelevant "J" qualifier that appears in the Hanford Environmental Information System (HEIS) database and in analytical data. The data quality assessment (Appendix B) further discusses the "J" qualifiers applied during validation.
[b] For Am-241, GAMMA_GS results are reported for the crib and pipeline, and isotopic results are reported for the trench. Both methods are equally suitable.
U = Analyte is below detection limits of the method and instruments used (not detected).
Strontium-90 is the COC identified in the SAP. The values reported here are for total radioactive strontium.
In some cases, the laboratory reports no value but provides a minimum detectable activity (MDA). In these cases, the MDA has been used as the sample result.
~~ Indicates that the laboratory did not return MDAs/practical quantitation limits (PQLs) for these analyses.

Table A-2. Deep Zone Cleanup Verification Data (8/24/01, 8/27/01, 11/15/01, 11/16/01, 1/07/02, 4/02/02, and 1/30/02). (Sheet 2 of 3)

Sample Point	HEIS Number	Sample Date	Co-60			Cs-137			Eu-154			Eu-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Trench A-1	B10642	10/19/2000	6.11E+02		2.50E+00	1.19E+03		4.50E+00	5.20E+00	U	5.20E+00	6.70E+00	U	6.70E+00
Trench A-10	B10641	10/19/2000	1.51E+01		8.40E-02	3.68E-01		1.00E-01	2.00E-01	U	2.00E-01	3.30E-01	U	3.30E-01
Trench A-11	B10653	10/19/2000	3.60E-02	U	3.60E-02	3.50E-02	U	3.50E-02	1.30E-01	U	1.30E-01	6.70E-02	U	6.70E-02
Trench A-12	B10648	10/19/2000	3.43E+02		3.80E-01	1.11E+02		6.30E-01	9.10E-01	U	9.10E-01	6.70E-01	U	6.70E-01
Trench A-13	B10639	10/19/2000	2.94E+00		7.90E-02	8.84E-01		9.20E-02	1.60E-01	U	1.60E-01	2.70E-01	U	2.70E-01
Trench A-14	B10645	10/19/2000	4.48E+03		9.80E+00	8.06E+03		1.40E+01	1.70E+01	U	1.70E+01	1.90E+01	U	1.90E+01
Trench A-15	B10637	10/19/2000	5.76E+01		1.70E-01	1.65E+02		2.90E-01	3.70E-01	U	3.70E-01	7.60E-01	U	7.60E-01
Trench A-16	B10650	10/19/2000	6.12E+00		4.10E-02	3.40E-01		5.40E-02	1.00E-01	U	1.00E-01	1.90E-01	U	1.90E-01
Trench A-17	B10643	10/19/2000	1.36E+03		3.50E+00	2.00E+03		5.60E+00	6.90E+00	U	6.90E+00	7.70E+00	U	7.70E+00
Trench A-18	B10657	10/19/2000	2.50E-02	U	2.50E-02	2.30E-02	U	2.30E-02	7.80E-02	U	7.80E-02	5.10E-02	U	5.10E-02
Trench A-19	B10660	10/19/2000	3.46E+01		7.50E-02	6.69E+01		1.30E-01	1.70E-01	U	1.70E-01	2.90E-01	U	2.90E-01
Trench A-2	B10658	10/19/2000	1.39E+00		4.30E-02	4.40E-02	U	4.40E-02	1.20E-01	U	1.20E-01	8.30E-02	U	8.30E-02
Trench A-20	B10647	10/19/2000	6.11E+00		2.30E-02	2.64E+00		2.20E-02	4.70E-02	U	4.70E-02	3.40E-02	U	3.40E-02
Trench A-21	B10633	10/19/2000	1.25E+00		2.30E-02	1.30E-01		3.10E-02	6.80E-02	U	6.80E-02	8.60E-02	U	8.60E-02
Trench A-22	B10632	10/19/2000	8.10E-02		2.90E-02	3.00E-02	U	3.00E-02	1.10E-02	U	1.10E-02	8.00E-02	U	8.00E-02
Trench A-23	B10655	10/19/2000	3.44E+01		9.20E-02	2.50E+02		2.00E-01	2.60E-01	U	2.60E-01	4.70E-01	U	4.70E-01
Trench A-24	B10656	10/19/2000	3.20E-02	U	3.20E-02	2.70E-02	U	2.70E-02	9.70E-02	U	9.70E-02	1.00E-01	U	1.00E-01
Trench A-25	B10636	10/19/2000	6.20E-02		2.00E-02	1.80E-02	U	1.80E-02	6.80E-02	U	6.80E-02	5.30E-02	U	5.30E-02
Trench A-26	B10646	10/19/2000	1.22E+04		1.50E+01	6.54E+03		1.70E+01	2.40E+01	U	2.40E+01	1.90E+01	U	1.90E+01
Trench A-27	B10638	10/19/2000	8.52E+00		5.60E-02	5.07E+00		6.70E-02	1.20E-01	U	1.20E-01	1.20E-01	U	1.20E-01
Trench A-28	B10644	10/19/2000	5.87E+02		2.60E+00	1.98E+03		4.60E+00	5.10E+00	U	5.10E+00	7.50E+00	U	7.50E+00
Trench A-29	B10652	10/19/2000	3.23E+01		9.60E-02	3.88E+02		2.20E-01	2.11E-01		2.10E-01	3.70E-01	U	3.70E-01
Trench A-3	B10661	10/19/2000	1.77E+00		3.60E-02	1.38E-01		4.50E-02	1.10E-01	U	1.10E-01	3.00E-01	U	3.00E-01
Trench A-30	B10640	10/19/2000	1.66E+00		2.80E-02	1.50E-01		3.20E-02	7.20E-02	U	7.20E-02	7.90E-02	U	7.90E-02
Trench A-4	B10659	10/19/2000	3.01E+03		6.20E+00	5.60E+03		9.30E+00	1.10E+01	U	1.10E+01	1.30E+01	U	1.30E+01
Trench A-5	B10634	10/19/2000	8.07E-01		2.80E-02	2.42E-01		2.70E-02	6.30E-02	U	6.30E-02	4.40E-02	U	4.40E-02
Trench A-6	B10635	10/19/2000	3.76E-01		5.70E-02	4.50E-02	U	4.50E-02	1.30E-01	U	1.30E-01	1.80E-01	U	1.80E-01
Trench A-7	B10654	10/19/2000	7.11E+00		8.70E-02	6.90E-02	U	8.90E-02	2.20E-01	U	2.20E-01	1.50E-01	U	1.50E-01
Trench A-8	B10651	10/19/2000	2.43E-01		3.20E-02	9.20E-01		3.60E-02	9.40E-02	U	9.40E-02	1.00E-01	U	1.00E-01
Trench A-9	B10649	10/19/2000	1.59E+01		1.20E-01	1.61E-01		1.30E-01	2.60E-01	U	2.60E-01	2.50E-01	U	2.50E-01

[a] Because of laboratory reporting conventions, these data were given a nonrelevant "J" qualifier that appears in the Hanford Environmental Information System (HEIS) database and in analytical data. The data quality assessment (Appendix B) further discusses the "J" qualifiers applied during validation.
U = Analyte is below detection limits of the method and instruments used (not detected).
Strontium-90 is the COC identified in the SAP. The values reported here are for total radioactive strontium.
In some cases, the laboratory reports no value but provides a minimum detectable activity (MDA). In these cases, the MDA has been used as the sample result.

Table A-2. Deep Zone Cleanup Verification Data (8/24/01, 8/27/01, 11/15/01, 11/16/01, 1/07/02, 4/02/02, and 1/30/02). (Sheet 3 of 3)

Sample Point	HEIS Number	Sample Date	Co-60			Cs-137			Eu-154			Eu-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Crib DZ-02	B14CM4	4/08/2002	1.59E+01		1.90E-01	1.44E+02		2.70E-01	4.20E-01	U	4.20E-01	7.80E-01	U	7.80E-01
Crib Duplicate of B14CM4	B14CN4	4/08/2002	1.60E+01		2.80E-01	1.07E+02		5.30E-01	6.80E-01	U	6.80E-01	8.00E-01	U	8.00E-01
Crib Split of B14CM4	B14CX7	4/08/2002	1.37E+01		7.05E-02	1.82E+02		1.43E-01	1.49E-01	U	2.28E-01	3.00E-01	U	6.21E-01
Crib DZ-01	B14CM9	4/08/2002	6.97E+03		2.90E+00	1.53E+04		3.60E+00	2.91E+01		5.90E+00	1.30E+01	U	1.30E+01
Crib DZ-03	B14CN0	4/08/2002	2.07E+04		3.00E+01	2.23E+04		6.80E+01	1.70E+02	U	1.70E+02	5.50E+01	U	5.50E+01
Crib DZ-04	B14CM5	4/08/2002	2.39E+02		7.20E-01	7.98E+02		1.00E+00	2.50E+00	U	2.50E+00	1.10E+00	U	1.10E+00
Crib DZ-05	B14CN1	4/08/2002	1.24E+03		1.90E+00	2.29E+03		2.40E+00	4.10E+00	U	4.10E+00	3.00E+00	U	3.00E+00
Crib DZ-06	B14CN2	4/08/2002	1.55E+02		3.50E-01	1.95E+02		5.00E-01	9.60E-01	U	9.60E-01	5.90E-01	U	5.90E-01
Crib DZ-07	B14CM6	4/08/2002	1.30E+02		6.70E-01	5.69E+02		1.10E+00	1.50E+00	U	1.50E+00	1.20E+00	U	1.20E+00
Crib DZ-08	B14CN3	4/08/2002	6.24E+04		2.80E+01	4.31E+04		5.80E+01	2.30E+02	U	7.10E+01	1.30E+02	U	1.30E+02
Crib DZ-09	B14CM7	4/08/2002	1.00E+02		7.70E-01	2.59E+03		2.10E+00	2.10E+00	U	2.10E+00	2.90E+00	U	2.90E+00
Crib DZ-10	B14CM8	4/08/2002	8.84E+01		1.70E-01	1.51E+02		2.50E-01	8.60E-01	U	8.60E-01	2.50E-01	U	2.50E-01

[a] Because of laboratory reporting conventions, these data were given a nonrelevant "J" qualifier that appears in the Hanford Environmental Information System (HEIS) database and in analytical data. The data quality assessment (Appendix B) further discusses the "J" qualifiers applied during validation.
U = Analyte is below detection limits of the method and instruments used (not detected).
Strontium-90 is the COC identified in the SAP. The values reported here are for total radioactive strontium.
In some cases, the laboratory reports no value but provides a minimum detectable activity (MDA). In these cases, the MDA has been used as the sample result.

Table A-3. Overburden Cleanup Verification Data (3/04/02). (Sheet 1 of 2)

Sample Point	HEIS Number	Sample Date	Am-241			Cs-137			Co-60			Eu-154			Eu-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
OVB-02	B14501	3/04/2002	2.70E-01	U	2.70E-01	4.00E-02	[a]	3.00E-02	4.90E-02	[a]	3.90E-02	1.20E-01	U	1.20E-01	1.10E-01	U	1.10E-01
Duplicate of B14501	B14510	3/04/2002	2.60E-01	U	2.60E-01	3.60E-02	[a]	3.30E-02	9.80E-02		3.50E-02	1.20E-01	U	1.20E-01	1.10E-01	U	1.10E-01
Split of B14501	B14512	3/04/2002	1.72E-02	U	2.36E-02	3.62E-02		2.27E-02	8.46E-02		2.24E-02	-1.73E-02	U	7.03E-02	3.76E-03	U	7.57E-02
OVB-01	B14500	3/04/2002	8.40E-02	U	8.40E-02	7.10E-02	[a]	2.80E-02	8.00E-02		3.00E-02	8.60E-02	U	8.60E-02	6.90E-02	U	6.90E-02
OVB-03	B14502	3/04/2002	4.00E-02	U	4.00E-02	6.20E-02	[a]	3.70E-02	1.03E-01		4.00E-02	1.10E-01	U	1.10E-01	1.80E-01	U	1.80E-01
OVB-04	B14503	3/04/2002	2.20E-02	U	2.20E-02	2.60E-02	[a]	1.80E-02	2.30E-02	U	2.30E-02	6.60E-02	U	6.60E-02	3.00E-02	U	3.00E-02
OVB-05	B14504	3/04/2002	2.00E-01	U	2.00E-01	1.47E-01		2.90E-02	2.28E-01		2.90E-02	8.20E-02	U	8.20E-02	7.90E-02	U	7.90E-02
OVB-06	B14505	3/04/2002	1.10E-01	U	1.10E-01	7.70E-02	[a]	3.90E-02	5.30E-02		4.70E-02	1.20E-01	U	1.20E-01	7.80E-02	U	7.80E-02
OVB-07	B14506	3/04/2002	2.70E-02	U	2.70E-02	3.90E-02	[a]	2.00E-02	3.60E-02	U	3.60E-02	6.30E-02	U	6.30E-02	4.10E-02	U	4.10E-02
OVB-08	B14507	3/04/2002	5.20E-02	U	5.20E-02	1.00E-01		1.90E-02	5.10E-02		2.00E-02	5.80E-02	U	5.80E-02	4.50E-02	U	4.50E-02
OVB-09	B14508	3/04/2002	1.40E-01	U	1.40E-01	4.70E-02	U	4.70E-02	5.70E-02	U	5.70E-02	1.60E-01	U	1.60E-01	9.90E-02	U	9.90E-02
OVB-10	B14509	3/04/2002	6.90E-02	U	6.90E-02	7.60E-02	[a]	2.30E-02	5.60E-02		2.40E-02	7.60E-02	U	7.60E-02	5.90E-02	U	5.90E-02

[a] Because of laboratory reporting conventions, these data were given a nonrelevant "J" qualifier that appears in the Hanford Environmental Information System (HEIS) database and in analytical data. The data quality assessment (Appendix B) further discusses the "J" qualifiers applied during validation.
U = Analyte is below detection limits of the method and instruments used (not detected).
In some cases, the laboratory reports no value but provides a minimum detectable activity (MDA). In these cases, the MDA has been used as the sample result.

Table A-3. Overburden Cleanup Verification Data (3/04/02). (Sheet 2 of 2)

Sample Point	HEIS Number	Sample Date	Ni-63			Pu-239/240			Sr-90			Nitrate			Hg		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL
OVB-02	B14501	3/04/2002	-8.28E-01	U	2.70E+00	0.00E+00	U	2.30E-01	-7.30E-02	U	2.30E-01	1.01E+01		3.90E-01	2.00E-02	U	2.00E-02
Duplicate of B14501	B14510	3/04/2002	-1.72E+00	U	2.60E+00	9.70E-02	U	1.90E-01	1.70E-02	U	2.20E-01	1.12E+01		4.10E-01	2.00E-02	U	2.00E-02
Split of B14501	B14512	3/04/2002	1.16E+00	U	6.45E+00	-3.60E-04	U	1.81E-02	4.02E-01		2.91E-01	8.90E+00		2.00E-01	8.20E-03	U	2.00E-02
OVB-01	B14500	3/04/2002	-1.38E+00	U	2.70E+00	0.00E+00	U	2.40E-01	7.00E-02	U	2.80E-01	1.90E+00		2.00E-01	2.00E-02	U	2.00E-02
OVB-03	B14502	3/04/2002	-5.22E-01	U	2.70E+00	1.00E-02	U	2.60E-02	-7.60E-02	U	2.60E-01	5.80E-01		2.20E-01	2.00E-02	U	2.00E-02
OVB-04	B14503	3/04/2002	-6.79E-01	U	2.70E+00	-8.00E-03	U	3.10E-02	2.00E-03	U	2.50E-01	9.90E-01		2.20E-01	2.00E-02	U	2.00E-02
OVB-05	B14504	3/04/2002	-1.38E+00	U	2.70E+00	1.90E-02	U	3.70E-02	1.20E-02	U	2.60E-01	1.40E+00		2.20E-01	2.00E-02	U	2.00E-02
OVB-06	B14505	3/04/2002	4.02E-01	U	2.70E+00	-4.00E-03	U	3.60E-02	-2.60E-02	U	2.10E-01	4.70E+00		2.10E-01	2.00E-02	U	2.00E-02
OVB-07	B14506	3/04/2002	-1.36E+00	U	2.80E+00	0.00E+00	U	1.90E-01	-3.00E-02	U	2.00E-01	5.30E+00		2.20E-01	2.00E-02	U	2.00E-02
OVB-08	B14507	3/04/2002	-4.87E-01	U	3.20E+00	1.70E-02	U	4.10E-02	-3.00E-03	U	2.00E-01	1.00E+00		2.10E-01	2.00E-02	U	2.00E-02
OVB-09	B14508	3/04/2002	-1.04E+00	U	2.60E+00	4.70E-02	U	1.80E-01	-3.10E-02	U	2.20E-01	9.70E+00		2.00E-01	2.00E-02	U	2.00E-02
OVB-10	B14509	3/04/2002	-2.23E+00	U	2.70E+00	0.00E+00	U	2.00E-01	3.70E-02	U	2.00E-01	2.40E+00		2.10E-01	2.00E-02	U	2.00E-02

U = Analyte is below detection limits of the method and instruments used (not detected).
Strontium-90 is the COC identified in the SAP. The values reported here are for total radioactive strontium.
In some cases, the laboratory reports no value but provides a minimum detectable activity (MDA). In these cases, the MDA has been used as the sample result.
PQL = practical quantitation limit

Table A-4. Transition Zone Cleanup Verification Data (5/18/01 and 6/11/01 and 6/27/01).

Sampling Area	HEIS Number	Sample Date	Co-60			Cs-137			Eu-154			Eu-155		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
TZ-02	B125P2	6/11/2001	7.46E-01		3.80E-02	1.27E-01		2.90E-02	8.30E-02	U	8.30E-02	7.30E-02	U	7.30E-02
Duplicate of B125P2	B125P3	6/11/2001	1.17E+00		6.30E-02	1.19E-01		5.60E-02	1.30E-01	U	1.30E-01	9.70E-02	U	9.70E-02
TZ-01	B121J6	5/18/2001	1.86E-01		3.90E-02	4.00E-02	[a]	3.60E-02	1.30E-01	U	1.30E-01	5.80E-02	U	5.80E-02
TZ-03	B121J8	5/18/2001	3.89E-01		2.40E-02	1.06E-01		2.30E-02	6.30E-02	U	6.30E-02	5.40E-02	U	5.40E-02
TZ-04	B121J9	5/18/2001	1.07E-01		3.10E-02	5.10E-02	[a]	2.90E-02	8.30E-02	U	8.30E-02	9.50E-02	U	9.50E-02
TZ-05	B121K0	5/18/2001	1.47E-01		3.00E-02	7.60E-02	[a]	2.90E-02	7.30E-02	U	7.30E-02	4.80E-02	U	4.80E-02
TZ-06	B121K1	5/18/2001	4.50E-02	U	4.50E-02	3.50E-02	U	3.50E-02	1.30E-01	U	1.30E-01	8.50E-02	U	8.50E-02
TZ-07	B121K2	5/18/2001	4.40E-02	[a]	2.70E-02	2.50E-02	U	2.50E-02	7.60E-02	U	7.60E-02	8.00E-02	U	8.00E-02
TZ-08	B121K3	5/18/2001	1.34E-01		2.60E-02	5.80E-02	[a]	2.60E-02	6.60E-02	U	6.60E-02	4.40E-02	U	4.40E-02
TZ-09	B121K4	5/18/2001	1.73E-01		3.90E-02	5.90E-02	[a]	2.70E-02	1.10E-01	U	1.10E-02	7.30E-02	U	7.30E-02
TZ-10	B121K5	5/18/2001	9.00E-02		2.50E-02	2.70E-02	U	2.70E-02	7.50E-02	U	7.50E-02	8.10E-02	U	8.10E-02
TZ-11	B121K6	5/18/2001	4.10E-02	[a]	1.10E-02	1.50E-02	[a]	1.30E-02	3.60E-02	U	3.60E-02	3.90E-02	[a]	2.80E-02
TZ-12	B121K7	5/18/2001	2.05E-01		1.00E-02	8.90E-02	[a]	1.10E-02	2.90E-02	U	2.90E-02	2.50E-02	U	2.50E-02
Post-remediation sample of B125P2	B129K9	6/27/2001	9.70E-02	U	9.70E-02	3.80E-02	U	3.80E-02	1.20E-01	U	1.20E-01	1.10E-01	U	1.10E-01

[a] Because of laboratory reporting conventions, these data were given a nonrelevant "J" qualifier that appears in the Hanford Environmental Information System (HEIS) database and in analytical data. The data quality assessment (Appendix B) further discusses the "J" qualifiers applied during validation.

U = Analyte is below detection limits of the method and instruments used (not detected).

Strontium-90 is the COC identified in the SAP. The values reported here are for total radioactive strontium.

In some cases, the laboratory reports no value but provides a minimum detectable activity (MDA). In these cases, the MDA has been used as the sample result.

APPENDIX B

DATA QUALITY ASSESSMENT

B1.0 DATA QUALITY ASSESSMENT FOR THE 116-N-3 SITE

B1.1 OVERVIEW

This data quality assessment (DQA) was 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 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 (i.e., closeout decisions [EPA 1996]). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process.

This DQA was performed in accordance with BHI-EE-01, *Environmental Investigations Procedures.* Specific data quality objectives for the site are found in the *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout* (SAP) (DOE-RL 2002). 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 (DOE-RL 2002) and the *Remedial Design Report/Remedial Action Work Plan for the 100-NR-1 Treatment, Storage, and Disposal Units* (DOE-RL 2000).

Prior to performing statistical tests, all of the analytical data are evaluated and a portion are validated for compliance with quality assurance project plan requirements (DOE-RL 2002). 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 test is performed on the adjusted raw analytical data (see calculation briefs in Appendix C) to determine statistical values for each contaminant. The number of samples collected for cleanup verification is then evaluated to confirm assumptions concerning contaminant variability.

The DQA for the 116-N-3 site determined that the data are of the right type, quality, and quantity to support site cleanup verification decisions within specified error tolerances. All analytical data were found to be acceptable for decision-making purposes. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. Additional quality requirements of the quality assurance project plan included data acquisition requirements. The cleanup verification sample analytical data are stored in the Hanford Environmental Information System and are summarized in Appendix A.

The following subsections describe the DQA results for the 116-N-3 site, including formal data validation, supplementary data evaluation, and field quality assurance (QA)/quality control (QC) program results. The statistical evaluation of the data is provided in the calculation brief excerpts included in Appendix C.

B1.2 DATA VALIDATION

B1.2.1 Laboratory QA/QC Analysis

All verification samples are subject to laboratory-specific QA requirements, including instrument procurement, maintenance, calibration, and operation. Additional laboratory requirements for internal QC checks are performed as appropriate for the analytical method at a rate of 1 per sample delivery group (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 [MS]) 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.

Verification sample laboratories are also subject to periodic and random assessments of the laboratory performance, systems, and overall program. These assessments are performed by the Bechtel Hanford, Inc. Quality Assurance group to ensure that the laboratories are performing to meet laboratory contract requirements.

B1.2.2 Data Validation Results

After sampling was completed, all of the fixed-base laboratory data from one SDG, H1488, were validated to Level C per BHI-EE-01, *Environmental Investigations Procedures*, Procedure 2.5, "Data Package Validation Process." Level C validation procedures are specified in *Data Validation Procedure for Radiochemical Analysis* (BHI 2000a) and *Data Validation Procedure for Chemical Analysis* (BHI 2000b). Validation was performed by Tech Law, Inc. (Tech Law 2001a, 2001b, 2001c).

Under the Level C validation procedure, the following items were reviewed, as appropriate, for each analytical method:

- Sample holding times
- Method blanks
- MS recovery
- Surrogate recovery
- MS/matrix spike duplicate results
- Sample replicates
- Associated batch laboratory control sample results
- Data package completeness.

Data flagged as estimated (i.e., "J") indicate that the associated concentration is an estimate but that the data may be used for decision-making purposes. All data in Appendix A that were flagged as being "J" qualified have been footnoted with the following: "Because of laboratory reporting conventions, these data were given a nonrelevant "J" qualifier that appears in the Hanford Environmental Information System (HEIS) database and in analytical data. The data quality assessment (Appendix B) further discusses the "J" qualifiers applied during validation." 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 as 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 target detection limits pursuant to the SAP (DOE-RL 2002). 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 target detection limit (TDL) with the respective MDA or PQL is discussed in Section B1.3.

A summary of deficiencies noted during validation of SDG H1488 follows.

Inorganics. The DQA noted no major and no minor deficiencies and qualified no data. The following items were noted in the validation report:

- All holding times were acceptable.
- All preparation blank results were acceptable.
- All MS recovery results were acceptable.
- All laboratory duplicate results were acceptable.
- All field duplicate results were acceptable.
- All reported detection limits met the analyte-specific TDL.
- The completion percentage was 100%. Data package completeness is based on the percentage of data determined to be valid (i.e., not rejected).

Wet Chemistry. The DQA noted no major deficiencies. Minor deficiencies noted during validation include the following:

- Analytical holding times for all analytes are assessed to ascertain whether the holding time requirements were met by the laboratory. The holding time requirements for the wet chemistry method is as follows: 28 days for nitrate/nitrite.

  Because of holding times being missed (30 and 33 days), all nitrate results were qualified as estimates and flagged "J". Data flagged as estimated (i.e., "J") indicate that the associated concentration is an estimate but that the data may be used for decision-making purposes.

- All preparation blank results were acceptable.
- All MS recovery results were acceptable.
- All laboratory duplicate results were acceptable.
- All field duplicate results were acceptable.
- Reported analytical detection levels are compared against the SAP TDLs (DOE-RL 2002) to ensure that laboratory detection levels meet the required criteria. No detection limit was established for nitrate.
- The completion percentage was 100%. Data package completeness is based on the percentage of data determined to be valid (i.e., not rejected).

Radiochemistry. The DQA noted no major or minor deficiencies. The following items are noted in the validation report:

- All holding times were acceptable.
- All preparation blank results were acceptable.
- All accuracy results were acceptable.
- All laboratory duplicate results were acceptable.
- All field duplicate results were acceptable.
- All field duplicate results were acceptable.
- Reported analytical detection levels are compared against the SAP TDLs (DOE-RL 2002) to ensure that laboratory detection levels meet the required criteria. TDLs are detection limit requirements that have been pre-established for each analytical method. The SAP no longer refers to these limits as TDLs, but instead refers to them as minimum detectable levels (MDLs) and practical quantitation limits (PQLs). The term TDL, however, was used in this cleanup verification package and 95% upper confidence limit calculation briefs to avoid any confusion between the method PQLs and the sample-specific PQLs that were reported for individual sample results. Out of 304 analytes, 70 were reported above the TDL. Under the Bechtel Hanford, Inc. statement of work, no qualification is required. All other reported laboratory MDAs were at or below the analyte-specific TDL.
- The completion percentage was 100%. Data package completeness is based on the percentage of data determined to be valid (i.e., not rejected).

B1.3 DATA EVALUATION

The formal data validation described in the previous section included evaluation of only one SDG; however, DQA is required for all SDGs. Therefore, supplementary data evaluation was performed on the remaining SDGs. The following paragraphs include the results of the data evaluation of all SDGs.

To ensure adequate data quality, DQA investigators reviewed the study objectives in the SAP (DOE-RL 2002) to determine the context for assessing the data. The context for assessing the data includes evaluating the sample data using the statistical methodology of the SAP (included in the calculation brief excerpts in Appendix C) and a comparison of analytical results to the PARCC (precision, accuracy, representativeness, completeness, and comparability) parameters as specified in the SAP (DOE-RL 2002). This section summarizes the results of the PARCC parameter comparison and presents an evaluation of the affected data.

- TDL Comparison: Reported analytical detection levels were compared to the TDLs specified in the SAP (DOE-RL 2002). When detected results are obtained, evaluation of detection limits is not performed. The data validation and supplemental data evaluation noted any analyses in which the detection limit (MDA or PQL) was above the SAP TDLs for nondetected analytes.

  The reported MDA was above the TDL for the following contaminants of concern (COCs):

  - Americium-241: 45 of 52 nondetect results
  - Cesium-137: 1 of 23 nondetect results
  - Cobalt-60: 16 of 22 nondetect results
  - Europium-154: 52 of 83 nondetect results
  - Europium-155: 22 of 84 nondetect results
  - Nickel-63: 30 of 51 nondetect results
  - Plutonium-239/240: 42 of 48 nondetect results
  - Strontium-90: 29 of 40 nondetect results
  - Mercury: 38 of 44 nondetect results.

Because all the reported values for the MDA and the TDLs for the nondetects for these contaminants of concern were much less than the applicable remedial action goals (RAGs), the associated data are of sufficient quality for decision-making purposes (DOE-RL 2002).

All other nondetected analyses had detection limits below the TDL.

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

The RPDs for laboratory duplicates were within acceptable limits for all COCs.

The RPD for the laboratory splits were within acceptable limits for all COCs.

Also for americium-241 the laboratories generally use two analytical methods. The two methods include gamma spectroscopy identified in HEIS with the "GAMMA_GS" method name and an americium isotopic method identified in HEIS with the "AMCMISO_IE_PLATE_AEA" method name. When an americium-241 analysis is requested for a site in conjunction with a gamma-emitting radionuclide analysis, results from both methods are provided by the laboratory for americium-241. Both methods are equally suitable for analysis of americium-241. Because gamma-emitting COCs were identified for the 116-N-3 Trench deep zone at a later date (discussed in the body of the cleanup verification package), there are only deep zone americium-241 results from the isotopic method. To be consistent within the trench, all americium-241 results used for cleanup verification of the trench are from the isotopic method. For the 116-N-3 Crib

and Pipeline, americium-241 results from the gamma specification method were used for cleanup verification. Results from both methods are consistent and indicate very low levels of americium-241.

B1.4 FIELD QA/QC

Field QA/QC measures were used to assess potential sources of error and cross-contamination of soil samples that could bias results.

For the 116-N-3 Trench, field QA/QC samples included one equipment blank (B12P77); one field duplicate sample (B12P76), which was a duplicate of shallow zone sample B12P75; duplicate (B12P90), which was a duplicate of deep zone sample B12P89; one field split sample (B12PD7), which was a split of shallow zone sample B12P75; and one split sample (B12PD8), which was a split of deep zone sample B12P89.

For the 116-N-3 Crib, field QA/QC samples included one equipment blank (B14CL4); one field duplicate sample (B14CL3), which was a duplicate of shallow zone sample B14CL2; duplicate (B14CN4), which was a duplicate of deep zone sample B14CM4; one field split sample (B10059A), which was a split of shallow zone sample B14CL2; and one split sample (B14CX7), which was a split of deep zone sample B14CM4.

For the 116-N-3 Pipeline, field QA/QC samples included two equipment blanks, shallow zone (B13TF4) and overburden(B14511); one field duplicate sample (B13TF3), which was a duplicate of shallow zone sample B13P83; one field split sample (B13TF5), which was a split of shallow zone sample B13P83; and split sample (B14512), which was a split of overburden sample B14501.

All main and QA/QC sample results are presented in Appendix A.

B1.4.1 Equipment Blank Samples

Field blank samples were collected as part of the QA/QC measures for the 116-N-3 Trench, Crib, and Pipeline. The blank sample results for this site were less than detection for all COCs.

B1.4.2 Field Duplicate Samples

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 target detection limits for both the main and duplicate samples are compared.

For field duplicate samples B13TF3 and B12P90, two of the RPDs were greater than the control limit of 30%. B13TF3 exceeded this limit for cobalt-60, and B12P90

exceeded the limit for americium-241. B13TF3 is the only shallow zone sample that had an RPD greater than 30%. Difficulty in producing truly homogeneous mixtures of soils is well known, and the lack of homogenous samples often times results in high RPDs. It is likely that more essentially inert material (e.g., larger size rocks or cobble) was present in one sample. The duplicate RPD for cobalt-60 is also consistent with the higher average and range of residual concentrations of cobalt-60 in both the variance samples and the verification samples. The 95% upper confidence limit value for cobalt-60 is acceptable, and these data are acceptable for the intended use of the data. As all values were below the RAGs by a larger amount than the potential nonhomogeneity in the samples, this does not affect the usability of the data.

Sample B12P90 was a deep zone duplicate that had an RPD that exceeded the limit of 30%. The deep zone RPDS above 30% are to be expected with the higher residual levels of the COCs in the deep zone. An alternate statistics-based test was applied to the americium-241 results for samples B12P90 and B12P89. This test evaluates the overall uncertainty of the reported values relative to the result and may be used to determine if the two values are statistically distinguishable. This test shows the americium-241 result is within the error bounds of the analysis and should not be considered different. Again, the measured results are sufficiently below the RAGs and the potential variability does not affect the usability of the results. Variance analysis (Appendix C) indicates that the number of samples taken is sufficient for site verification. The use of statistical values described in Section 5.0 is used to compensate for COC variance at the site and ensure that decisions are made within acceptable error tolerance. All other duplicates that required RPD calculation were within the acceptable limit of +/-30% range.

B1.4.3 Field Split Samples

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 TDLs or contract required detection limit for both the main and split sample were compared.

For deep zone field split samples B12PD8 and B14CX7, two of the RPDs were greater than the control limit of +/-30%. B12PD8 exceeded this limit for americium-241, nickel-63, and plutonium-239/240. B14CX7 exceeded the limit for plutonium-239/240 and strontium-90. Application of the statistics-based test as noted in Section B1.4.2 for these two result pairs indicates that these results are not likely actually different. All other split RPDs were within the +/-30% range.

Field QA/QC sample results tend to suggest a limited degree of heterogeneity that is consistent for higher levels of residual contaminant concentrations, particularly in the

deep zone with regard to the COCs of interest. Actinides are typically present as alpha-emitting particles that have a natural tendency to accumulate in discrete portions of the matrix. Even distribution of the contaminants throughout the matrix is not likely to occur in nature and is difficult to achieve in prepared standard materials. The possibility of getting an actinide hot spot in a subfraction of a sample is significant, even in prepared standard materials. Variance analysis (Appendix C) indicates that the number of samples taken is sufficient for site verification. The use of statistical values described in Section 5.0 is used to compensate for COC variance at the site and ensure that decisions are made within acceptable error tolerance.

B1.4.4 Regulator Split Samples

In addition to the field split samples described above, Washington State Department of Ecology (Ecology) and Washington Department of Health (WDOH) split samples were collected for the 116-N-3 Trench and Crib.

The trench had Ecology splits for B12P75, B12P80, and B12P84. They were WDOE-N3T-SZ04, WDOE-N3T-SZ08, and WDOE-N3T-SZ09, respectively. Only one WDOH split was done for the trench. It was for B12P75, and its sample number was N3T-SZ04.

The crib had Ecology splits for B14CL2, B14CL9, and B14CM0. They were WDOE-N3C-SZ01, WDOE-N3C-SZ06, and WDOE-N3C-SZ07, respectively. The same three splits were also analyzed by the WDOH. The WDOH sample numbers were WDOH-N3C-SZ01, WDOH-N3C-SZ06, and WDOH-N3C-SZ07, respectively.

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. Three criteria are described in these guidelines:

1. If **both** main and split results are below detection, no further analysis is required.

2. If **both** main and split results are greater than five times the TDL, the RPD was computed. This RPD is compared to +/-35%.

3. If **either** the main or split result is greater than five times the TDL, then the difference is computed. This difference is compared to two times the TDL.

All Ecology and WDOH split results reported were below detection limits; therefore, the difference and RPD for regulator splits were not calculated.

B1.5 SUITABILITY OF DATA

The conclusion of the DQA is that the data are of the right type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and SDG completeness were analyzed to determine if any analytical results should be rejected as a result of QA/QC deficiencies. All COC analytical data were found to be acceptable for decision-making purposes, and the raw data are acceptable for calculating the required statistical values.

B2.0 REFERENCES

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

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

BHI-EE-01, *Environmental Investigations Procedures*, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 2000, *Remedial Design Report/Remedial Action Work Plan for the 100-NR-1 Treatment, Storage, and Disposal Units*, DOE/RL-2000-16, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2002, *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout*, DOE/RL-2000-07, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1996, *Guidance for Data Quality Assessment*, EPA QA/G-9, U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C.

Tech Law, 2001a, *Inorganics - Data Package No. H1488-RLN (SDG No. H1488)*, Tech Law, Inc., Richland, Washington.

Tech Law, 2001b, *Radionuclides - Data Package No. H1488-TR (SDG No. H1488)*, Tech Law, Inc., Richland, Washington.

Tech Law, 2001c, *Wet Chemistry - Data Package No. H1488-TR (SDG No. H1488)*, Tech Law, Inc., Richland, Washington.

APPENDIX C

RESRAD INPUT PARAMETERS, CALCULATION BRIEF EXCERPTS, AND THE 199-N-109A BOREHOLE TECHNICAL MEMORANDUM

RESRAD INPUT PARAMETERS FOR THE SHALLOW ZONE

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Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.RAD

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

0 Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	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-154	2.860E-04	2.860E-04	DCF2(5)
B-1	Eu-155	4.140E-05	4.140E-05	DCF2(6)
B-1	Ni-63	6.290E-06	6.290E-06	DCF2(7)
B-1	Np-237+D	5.400E-01	5.400E-01	DCF2(8)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(9)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(10)
B-1	Pu-240	4.290E-01	4.290E-01	DCF2(11)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(12)
B-1	Sr-90+D	1.310E-03	1.310E-03	DCF2(13)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(14)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(15)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(16)
B-1	U-233	1.350E-01	1.350E-01	DCF2(17)
B-1	U-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	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	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-154	9.550E-06	9.550E-06	DCF3(5)
D-1	Eu-155	1.530E-06	1.530E-06	DCF3(6)
D-1	Ni-63	5.770E-07	5.770E-07	DCF3(7)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(8)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(9)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(10)
D-1	Pu-240	3.540E-03	3.540E-03	DCF3(11)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(12)
D-1	Sr-90+D	1.530E-04	1.530E-04	DCF3(13)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(14)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(15)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(16)
D-1	U-233	2.890E-04	2.890E-04	DCF3(17)
D-1	U-235+D	2.670E-04	2.670E-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	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
D-34				

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

0 Menu	Parameter	Current Value	Default	Parameter Name
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)
D-34				
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-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	Eu-155 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	Eu-155 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(6,2)
D-34	Eu-155 , 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	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(8,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(8,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(9,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(9,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(9,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(10,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(10,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(10,3)
D-34				
D-34	Pu-240 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(11,1)
D-34	Pu-240 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(11,2)
D-34	Pu-240 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(11,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(12,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(12,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(12,3)
D-34				
D-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(13,1)
D-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(13,2)
D-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(13,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(14,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(14,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(14,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(15,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(15,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(15,3)

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

0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(16,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(16,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(16,3)
D-34				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(17,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(17,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(17,3)
D-34				
D-34	U-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	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	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-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	Eu-155 , fish	5.000E+01	5.000E+01	BIOFAC(6,1)
D-5	Eu-155 , 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	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(8,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(8,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(9,2)
D-5				
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(10,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(10,2)
D-5				
D-5	Pu-240 , fish	3.000E+01	3.000E+01	BIOFAC(11,1)
D-5	Pu-240 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(11,2)
D-5				

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

0 Menu	Parameter	Current Value	Default	Parameter Name
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(12,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(12,2)
D-5				
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(13,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(13,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(14,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(14,2)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(15,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(15,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(16,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(16,2)
D-5				
D-5	U-233 , fish	1.000E+01	1.000E+01	BIOFAC(17,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(17,2)
D-5				
D-5	U-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)

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Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.RAD

Site-Specific Parameter Summary

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	2.198E+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)	7.500E+01	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)	7.600E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.600E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	4.200E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	4.700E+01	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.370E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	3.000E+02	0.000E+00	---	T(9)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	1.020E-01	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Co-60	3.870E-01	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Cs-137	4.060E-01	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Eu-154	6.030E-02	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Eu-155	4.220E-02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Pu-239	2.280E-02	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): Pu-240	5.440E-03	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.700E-01	0.000E+00	---	S1(13)
R012	Concentration in groundwater (pCi/L): Am-241	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-154	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Eu-155	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): Pu-240	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W1(13)
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)	2.000E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.500E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.500E+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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Density of saturated zone (g/cm**3)	2.000E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	3.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-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)	1.670E+01	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	2.000E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	3.000E-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	2.500E-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 Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.341E-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	1.733E-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	1.733E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
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	4.341E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)

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-155				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.341E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.341E-05	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for Pu-240				
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	4.341E-05	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	1.500E+01	3.000E+01	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	1.500E+01	3.000E+01	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	1.500E+01	3.000E+01	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.743E-04	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
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	4.316E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter 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	2.884E-04	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for daughter Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.373E-05	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)

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 Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.733E-04	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	1.000E+02	7.000E+01	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	7.000E+01	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	1.000E+02	7.000E+01	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.676E-05	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(14,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.341E-05	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for daughter Th-229				
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	4.341E-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	4.341E-05	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	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	4.088E-03	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	4.088E-03	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)

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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 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	4.088E-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
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)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	0.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	0.000E+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	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	0.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	0.000E+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)	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):				

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	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	suppressed
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

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IRESRAD, Version 6.1      T« Limit = 0.5 year        08/05/2002  09:48  Page  13
 Summary : 116-N-3 Shallow Zone (Run #1)            File: 116-N-3 Shallow Zone.RAD

      Contaminated Zone Dimensions          Initial Soil Concentrations, pCi/g
      ÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃ          ÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃ
        Area:  21980.00 square meters              Am-241      1.020E-01
   Thickness:      4.60 meters                     Co-60       3.870E-01
 Cover Depth:      0.00 meters                     Cs-137      4.060E-01
                                                   Eu-154      6.030E-02
                                                   Eu-155      4.220E-02
                                                   Pu-239      2.280E-02
                                                   Pu-240      5.440E-03
                                                   Sr-90       1.700E-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)
                        ÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃ
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1RESRAD, Version 6.1 T* Limit = 0.5 year 08/05/2002 09:48 Page 14
Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.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)

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.
Am-241	2.958E-03	0.0005	1.982E-03	0.0003	0.000E+00	0.0000	2.092E-02	0.0035	3.795E-04	0.0001	4.119E-05	0.0000	1.083E-02	0.0018
Co-60	3.793E+00	0.6378	3.477E-06	0.0000	0.000E+00	0.0000	4.397E-02	0.0074	4.172E-02	0.0070	9.560E-03	0.0016	2.848E-04	0.0000
Cs-137	8.799E-01	0.1480	5.606E-07	0.0000	0.000E+00	0.0000	4.523E-02	0.0076	6.979E-02	0.0117	4.335E-02	0.0073	5.859E-04	0.0001
Eu-154	2.877E-01	0.0484	7.262E-07	0.0000	0.000E+00	0.0000	7.804E-05	0.0000	2.672E-05	0.0000	7.063E-07	0.0000	1.617E-05	0.0000
Eu-155	4.739E-03	0.0008	7.140E-08	0.0000	0.000E+00	0.0000	8.491E-06	0.0000	2.908E-06	0.0000	7.685E-08	0.0000	1.759E-06	0.0000
Pu-239	4.424E-06	0.0000	4.283E-04	0.0001	0.000E+00	0.0000	4.552E-03	0.0008	1.651E-04	0.0000	4.481E-06	0.0000	2.357E-03	0.0004
Pu-240	5.390E-07	0.0000	1.022E-04	0.0000	0.000E+00	0.0000	1.086E-03	0.0002	3.939E-05	0.0000	1.069E-06	0.0000	5.623E-04	0.0001
Sr-90	2.809E-03	0.0005	9.634E-06	0.0000	0.000E+00	0.0000	4.344E-01	0.0731	1.547E-01	0.0260	8.737E-02	0.0147	7.503E-04	0.0001
Total	4.971E+00	0.8360	2.527E-03	0.0004	0.000E+00	0.0000	5.502E-01	0.0925	2.668E-01	0.0449	1.403E-01	0.0236	1.539E-02	0.0026

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

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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.711E-02	0.0062
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	3.888E+00	0.6539
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	1.039E+00	0.1747
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	2.878E-01	0.0484
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.753E-03	0.0008
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	7.511E-03	0.0013
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	1.791E-03	0.0003
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	6.800E-01	0.1144
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	5.946E+00	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.1 T½ Limit = 0.5 year 08/05/2002 09:48 Page 15
_Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.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-	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.
Am-241	2.953E-03	0.0005	1.978E-03	0.0004	0.000E+00	0.0000	2.089E-02	0.0039	3.789E-04	0.0001	4.113E-05	0.0000	1.081E-02	0.0020
Co-60	3.325E+00	0.6153	3.048E-06	0.0000	0.000E+00	0.0000	3.855E-02	0.0071	3.657E-02	0.0068	8.380E-03	0.0016	2.497E-04	0.0000
Cs-137	8.597E-01	0.1591	5.477E-07	0.0000	0.000E+00	0.0000	4.419E-02	0.0082	6.818E-02	0.0126	4.235E-02	0.0078	5.724E-04	0.0001
Eu-154	2.659E-01	0.0492	6.712E-07	0.0000	0.000E+00	0.0000	7.212E-05	0.0000	2.470E-05	0.0000	6.528E-07	0.0000	1.494E-05	0.0000
Eu-155	4.121E-03	0.0008	6.209E-08	0.0000	0.000E+00	0.0000	7.384E-06	0.0000	2.529E-06	0.0000	6.683E-08	0.0000	1.530E-06	0.0000
Pu-239	4.424E-06	0.0000	4.283E-04	0.0001	0.000E+00	0.0000	4.551E-03	0.0008	1.651E-04	0.0000	4.481E-06	0.0000	2.357E-03	0.0004
Pu-240	5.390E-07	0.0000	1.022E-04	0.0000	0.000E+00	0.0000	1.086E-03	0.0002	3.939E-05	0.0000	1.069E-06	0.0000	5.622E-04	0.0001
Sr-90	2.742E-03	0.0005	9.402E-06	0.0000	0.000E+00	0.0000	4.239E-01	0.0785	1.510E-01	0.0279	8.527E-02	0.0158	7.322E-04	0.0001
Total	4.460E+00	0.8254	2.523E-03	0.0005	0.000E+00	0.0000	5.333E-01	0.0987	2.563E-01	0.0474	1.360E-01	0.0252	1.530E-02	0.0028

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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.705E-02	0.0069
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	3.408E+00	0.6308
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	1.015E+00	0.1878
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	2.660E-01	0.0492
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.133E-03	0.0008
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	7.510E-03	0.0014
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	1.791E-03	0.0003
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	6.636E-01	0.1228
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	5.404E+00	1.0000

*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.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.
Am-241	2.944E-03	0.0007	1.972E-03	0.0004	0.000E+00	0.0000	2.082E-02	0.0046	3.776E-04	0.0001	4.099E-05	0.0000	1.078E-02	0.0024
Co-60	2.555E+00	0.5682	2.343E-06	0.0000	0.000E+00	0.0000	2.962E-02	0.0066	2.810E-02	0.0062	6.440E-03	0.0014	1.919E-04	0.0000
Cs-137	8.206E-01	0.1825	5.228E-07	0.0000	0.000E+00	0.0000	4.218E-02	0.0094	6.508E-02	0.0145	4.042E-02	0.0090	5.464E-04	0.0001
Eu-154	2.271E-01	0.0505	5.733E-07	0.0000	0.000E+00	0.0000	6.160E-05	0.0000	2.110E-05	0.0000	5.576E-07	0.0000	1.277E-05	0.0000
Eu-155	3.116E-03	0.0007	4.694E-08	0.0000	0.000E+00	0.0000	5.583E-06	0.0000	1.912E-06	0.0000	5.053E-08	0.0000	1.157E-06	0.0000
Pu-239	4.423E-06	0.0000	4.282E-04	0.0001	0.000E+00	0.0000	4.551E-03	0.0010	1.651E-04	0.0000	4.480E-06	0.0000	2.356E-03	0.0005
Pu-240	5.388E-07	0.0000	1.021E-04	0.0000	0.000E+00	0.0000	1.085E-03	0.0002	3.938E-05	0.0000	1.069E-06	0.0000	5.620E-04	0.0001
Sr-90	2.611E-03	0.0006	8.955E-06	0.0000	0.000E+00	0.0000	4.038E-01	0.0898	1.438E-01	0.0320	8.121E-02	0.0181	6.974E-04	0.0002
Total	3.611E+00	0.8031	2.515E-03	0.0006	0.000E+00	0.0000	5.021E-01	0.1117	2.376E-01	0.0528	1.281E-01	0.0285	1.515E-02	0.0034

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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.693E-02	0.0082
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	2.619E+00	0.5825
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	9.688E-01	0.2154
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	2.272E-01	0.0505
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.125E-03	0.0007
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	7.509E-03	0.0017
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	1.791E-03	0.0004
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	6.321E-01	0.1406
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	4.497E+00	1.0000

*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.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 = 7.600E+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.
Am-241	2.922E-03	0.0010	1.957E-03	0.0006	0.000E+00	0.0000	2.066E-02	0.0067	3.748E-04	0.0001	4.068E-05	0.0000	1.070E-02	0.0035
Co-60	1.394E+00	0.4541	1.278E-06	0.0000	0.000E+00	0.0000	1.616E-02	0.0053	1.534E-02	0.0050	3.514E-03	0.0011	1.047E-04	0.0000
Cs-137	7.373E-01	0.2401	4.697E-07	0.0000	0.000E+00	0.0000	3.790E-02	0.0123	5.847E-02	0.0190	3.632E-02	0.0118	4.909E-04	0.0002
Eu-154	1.581E-01	0.0515	3.990E-07	0.0000	0.000E+00	0.0000	4.287E-05	0.0000	1.468E-05	0.0000	3.880E-07	0.0000	8.883E-06	0.0000
Eu-155	1.638E-03	0.0005	2.468E-08	0.0000	0.000E+00	0.0000	2.935E-06	0.0000	1.005E-06	0.0000	2.656E-08	0.0000	6.081E-07	0.0000
Pu-239	4.422E-06	0.0000	4.281E-04	0.0001	0.000E+00	0.0000	4.549E-03	0.0015	1.650E-04	0.0001	4.479E-06	0.0000	2.355E-03	0.0008
Pu-240	5.384E-07	0.0000	1.021E-04	0.0000	0.000E+00	0.0000	1.085E-03	0.0004	3.935E-05	0.0000	1.068E-06	0.0000	5.616E-04	0.0002
Sr-90	2.334E-03	0.0008	8.005E-06	0.0000	0.000E+00	0.0000	3.609E-01	0.1175	1.285E-01	0.0419	7.260E-02	0.0236	6.234E-04	0.0002
Total	2.296E+00	0.7479	2.497E-03	0.0008	0.000E+00	0.0000	4.413E-01	0.1437	2.029E-01	0.0661	1.125E-01	0.0366	1.484E-02	0.0048

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 = 7.600E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.665E-02	0.0119
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	1.429E+00	0.4655
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	8.704E-01	0.2835
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	1.581E-01	0.0515
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.643E-03	0.0005
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	7.507E-03	0.0024
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	1.789E-03	0.0006
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	5.650E-01	0.1840
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	3.071E+00	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.1 T* Limit = 0.5 year 08/05/2002 09:48 Page 18
Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.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 = 1.600E+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.
Am-241	2.882E-03	0.0016	1.930E-03	0.0011	0.000E+00	0.0000	2.038E-02	0.0115	3.698E-04	0.0002	4.012E-05	0.0000	1.055E-02	0.0059
Co-60	4.613E-01	0.2596	4.230E-07	0.0000	0.000E+00	0.0000	5.348E-03	0.0030	5.074E-03	0.0029	1.163E-03	0.0007	3.464E-05	0.0000
Cs-137	6.063E-01	0.3413	3.863E-07	0.0000	0.000E+00	0.0000	3.116E-02	0.0175	4.809E-02	0.0271	2.987E-02	0.0168	4.037E-04	0.0002
Eu-154	8.153E-02	0.0459	2.058E-07	0.0000	0.000E+00	0.0000	2.211E-05	0.0000	7.573E-06	0.0000	2.001E-07	0.0000	4.582E-06	0.0000
Eu-155	5.062E-04	0.0003	7.627E-09	0.0000	0.000E+00	0.0000	9.070E-07	0.0000	3.106E-07	0.0000	8.209E-09	0.0000	1.879E-07	0.0000
Pu-239	4.419E-06	0.0000	4.278E-04	0.0002	0.000E+00	0.0000	4.546E-03	0.0026	1.649E-04	0.0001	4.476E-06	0.0000	2.354E-03	0.0013
Pu-240	5.378E-07	0.0000	1.019E-04	0.0001	0.000E+00	0.0000	1.083E-03	0.0006	3.930E-05	0.0000	1.067E-06	0.0000	5.609E-04	0.0003
Sr-90	1.902E-03	0.0011	6.523E-06	0.0000	0.000E+00	0.0000	2.941E-01	0.1655	1.047E-01	0.0589	5.915E-02	0.0333	5.080E-04	0.0003
Total	1.154E+00	0.6498	2.467E-03	0.0014	0.000E+00	0.0000	3.566E-01	0.2007	1.585E-01	0.0892	9.023E-02	0.0508	1.442E-02	0.0081

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.600E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.615E-02	0.0203
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	4.729E-01	0.2662
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	7.158E-01	0.4029
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	8.156E-02	0.0459
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.077E-04	0.0003
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	7.502E-03	0.0042
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	1.787E-03	0.0010
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	4.604E-01	0.2591
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	1.777E+00	1.0000

*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.1 T½ Limit = 0.5 year 08/05/2002 09:48 Page 19
Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.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 = 4.200E+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.
Am-241	2.762E-03	0.0039	1.849E-03	0.0026	0.000E+00	0.0000	1.953E-02	0.0277	3.545E-04	0.0005	3.845E-05	0.0001	1.011E-02	0.0143
Co-60	1.504E-02	0.0213	1.379E-08	0.0000	0.000E+00	0.0000	1.743E-04	0.0002	1.654E-04	0.0002	3.790E-05	0.0001	1.129E-06	0.0000
Cs-137	3.310E-01	0.4696	2.109E-07	0.0000	0.000E+00	0.0000	1.701E-02	0.0241	2.625E-02	0.0372	1.631E-02	0.0231	2.204E-04	0.0003
Eu-154	1.051E-02	0.0149	2.652E-08	0.0000	0.000E+00	0.0000	2.850E-06	0.0000	9.758E-07	0.0000	2.579E-08	0.0000	5.904E-07	0.0000
Eu-155	1.336E-05	0.0000	2.013E-10	0.0000	0.000E+00	0.0000	2.394E-08	0.0000	8.199E-09	0.0000	2.167E-10	0.0000	4.961E-09	0.0000
Pu-239	4.411E-06	0.0000	4.270E-04	0.0006	0.000E+00	0.0000	4.538E-03	0.0064	1.646E-04	0.0002	4.468E-06	0.0000	2.350E-03	0.0033
Pu-240	5.357E-07	0.0000	1.016E-04	0.0001	0.000E+00	0.0000	1.079E-03	0.0015	3.915E-05	0.0001	1.063E-06	0.0000	5.588E-04	0.0008
Sr-90	1.009E-03	0.0014	3.461E-06	0.0000	0.000E+00	0.0000	1.560E-01	0.2214	5.556E-02	0.0788	3.138E-02	0.0445	2.695E-04	0.0004
Total	3.603E-01	0.5112	2.381E-03	0.0034	0.000E+00	0.0000	1.984E-01	0.2814	8.254E-02	0.1171	4.777E-02	0.0678	1.351E-02	0.0192

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.200E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.464E-02	0.0491
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	1.541E-02	0.0219
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	3.908E-01	0.5544
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	1.051E-02	0.0149
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.340E-05	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	7.488E-03	0.0106
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	1.780E-03	0.0025
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	2.443E-01	0.3465
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	7.049E-01	1.0000

*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.1 T½ Limit = 0.5 year 08/05/2002 09:48 Page 20
Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.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 = 4.700E+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.
Am-241	2.739E-03	0.0044	1.834E-03	0.0029	0.000E+00	0.0000	1.937E-02	0.0311	3.516E-04	0.0006	3.813E-05	0.0001	1.003E-02	0.0161
Co-60	7.784E-03	0.0125	7.137E-09	0.0000	0.000E+00	0.0000	9.025E-05	0.0001	8.562E-05	0.0001	1.962E-05	0.0000	5.846E-07	0.0000
Cs-137	2.946E-01	0.4731	1.877E-07	0.0000	0.000E+00	0.0000	1.514E-02	0.0243	2.337E-02	0.0375	1.451E-02	0.0233	1.962E-04	0.0003
Eu-154	7.084E-03	0.0114	1.788E-08	0.0000	0.000E+00	0.0000	1.921E-06	0.0000	6.580E-07	0.0000	1.739E-08	0.0000	3.981E-07	0.0000
Eu-155	6.643E-06	0.0000	1.001E-10	0.0000	0.000E+00	0.0000	1.190E-08	0.0000	4.076E-09	0.0000	1.077E-10	0.0000	2.466E-09	0.0000
Pu-239	4.410E-06	0.0000	4.269E-04	0.0007	0.000E+00	0.0000	4.536E-03	0.0073	1.646E-04	0.0003	4.466E-06	0.0000	2.349E-03	0.0038
Pu-240	5.353E-07	0.0000	1.015E-04	0.0002	0.000E+00	0.0000	1.078E-03	0.0017	3.912E-05	0.0001	1.062E-06	0.0000	5.583E-04	0.0009
Sr-90	8.933E-04	0.0014	3.064E-06	0.0000	0.000E+00	0.0000	1.381E-01	0.2218	4.919E-02	0.0790	2.778E-02	0.0446	2.386E-04	0.0004
Total	3.132E-01	0.5028	2.366E-03	0.0038	0.000E+00	0.0000	1.784E-01	0.2864	7.320E-02	0.1175	4.236E-02	0.0680	1.337E-02	0.0215

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 = 4.700E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.436E-02	0.0552
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	7.980E-03	0.0128
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	3.479E-01	0.5586
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	7.087E-03	0.0114
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.661E-06	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	7.485E-03	0.0120
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	1.779E-03	0.0029
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	2.162E-01	0.3472
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	6.228E-01	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.1 T½ Limit = 0.5 year 08/05/2002 09:48 Page 21
Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.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 = 1.370E+02 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.
Am-241	2.364E-03	0.0223	1.581E-03	0.0150	0.000E+00	0.0000	1.672E-02	0.1581	3.040E-04	0.0029	3.289E-05	0.0003	8.645E-03	0.0817
Co-60	5.552E-08	0.0000	5.091E-14	0.0000	0.000E+00	0.0000	6.437E-10	0.0000	6.108E-10	0.0000	1.400E-10	0.0000	4.170E-12	0.0000
Cs-137	3.626E-02	0.3429	2.310E-08	0.0000	0.000E+00	0.0000	1.864E-03	0.0176	2.876E-03	0.0272	1.786E-03	0.0169	2.414E-05	0.0002
Eu-154	5.887E-06	0.0001	1.486E-11	0.0000	0.000E+00	0.0000	1.597E-09	0.0000	5.468E-10	0.0000	1.445E-11	0.0000	3.308E-10	0.0000
Eu-155	2.282E-11	0.0000	3.439E-16	0.0000	0.000E+00	0.0000	4.089E-14	0.0000	1.400E-14	0.0000	3.701E-16	0.0000	8.474E-15	0.0000
Pu-239	4.382E-06	0.0000	4.241E-04	0.0040	0.000E+00	0.0000	4.507E-03	0.0426	1.635E-04	0.0015	4.437E-06	0.0000	2.334E-03	0.0221
Pu-240	5.281E-07	0.0000	1.001E-04	0.0009	0.000E+00	0.0000	1.064E-03	0.0101	3.860E-05	0.0004	1.048E-06	0.0000	5.509E-04	0.0052
Sr-90	9.958E-05	0.0009	3.415E-07	0.0000	0.000E+00	0.0000	1.540E-02	0.1456	5.483E-03	0.0518	3.097E-03	0.0293	2.660E-05	0.0003
Total	3.873E-02	0.3663	2.106E-03	0.0199	0.000E+00	0.0000	3.955E-02	0.3740	8.865E-03	0.0838	4.922E-03	0.0465	1.158E-02	0.1095

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.370E+02 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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.964E-02	0.2803
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	5.692E-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	4.281E-02	0.4048
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	5.889E-06	0.0001
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.289E-11	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	7.437E-03	0.0703
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	1.755E-03	0.0166
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	2.410E-02	0.2279
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	1.058E-01	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.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
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.
Am-241	1.810E-03	0.0546	1.209E-03	0.0365	0.000E+00	0.0000	1.280E-02	0.3860	2.338E-04	0.0070	2.516E-05	0.0008	6.610E-03	0.1993
Co-60	2.650E-17	0.0000	2.429E-23	0.0000	0.000E+00	0.0000	3.072E-19	0.0000	2.915E-19	0.0000	6.678E-20	0.0000	1.990E-21	0.0000
Cs-137	8.158E-04	0.0246	5.197E-10	0.0000	0.000E+00	0.0000	4.193E-05	0.0013	6.470E-05	0.0020	4.019E-05	0.0012	5.432E-07	0.0000
Eu-154	1.552E-11	0.0000	3.918E-17	0.0000	0.000E+00	0.0000	4.210E-15	0.0000	1.442E-15	0.0000	3.810E-17	0.0000	8.723E-16	0.0000
Eu-155	2.901E-21	0.0000	4.371E-26	0.0000	0.000E+00	0.0000	5.198E-24	0.0000	1.780E-24	0.0000	4.705E-26	0.0000	1.077E-24	0.0000
Pu-239	4.331E-06	0.0001	4.191E-04	0.0126	0.000E+00	0.0000	4.454E-03	0.1343	1.616E-04	0.0049	4.385E-06	0.0001	2.306E-03	0.0695
Pu-240	5.154E-07	0.0000	9.771E-05	0.0029	0.000E+00	0.0000	1.038E-03	0.0313	3.767E-05	0.0011	1.023E-06	0.0000	5.376E-04	0.0162
Sr-90	1.873E-06	0.0001	6.423E-09	0.0000	0.000E+00	0.0000	2.896E-04	0.0087	1.031E-04	0.0031	5.825E-05	0.0018	5.002E-07	0.0000
Total	2.633E-03	0.0794	1.726E-03	0.0520	0.000E+00	0.0000	1.863E-02	0.5616	6.009E-04	0.0181	1.290E-04	0.0039	9.455E-03	0.2850

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
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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.269E-02	0.6841
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	2.716E-17	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	9.631E-04	0.0290
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	1.553E-11	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.910E-21	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	7.350E-03	0.2216
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	1.713E-03	0.0516
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	4.533E-04	0.0137
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	3.317E-02	1.0000

*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.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.
Am-241	5.811E-04	0.0368	3.820E-04	0.0242	0.000E+00	0.0000	4.109E-03	0.2604	7.780E-05	0.0049	7.990E-06	0.0005	2.088E-03	0.1324
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	6.837E-11	0.0000	4.356E-17	0.0000	0.000E+00	0.0000	3.514E-12	0.0000	5.422E-12	0.0000	3.368E-12	0.0000	4.552E-14	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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	4.118E-06	0.0003	3.985E-04	0.0253	0.000E+00	0.0000	4.235E-03	0.2684	1.536E-04	0.0097	4.169E-06	0.0003	2.193E-03	0.1390
Pu-240	4.642E-07	0.0000	8.801E-05	0.0056	0.000E+00	0.0000	9.352E-04	0.0593	3.393E-05	0.0022	9.211E-07	0.0001	4.842E-04	0.0307
Sr-90	7.271E-14	0.0000	2.494E-16	0.0000	0.000E+00	0.0000	1.124E-11	0.0000	4.004E-12	0.0000	2.261E-12	0.0000	1.942E-14	0.0000
Total	5.857E-04	0.0371	8.685E-04	0.0551	0.000E+00	0.0000	9.278E-03	0.5881	2.653E-04	0.0168	1.308E-05	0.0008	4.765E-03	0.3020

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.
Am-241	0.000E+00	0.0000	7.214E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.246E-03	0.4593
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	8.072E-11	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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	1.076E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.987E-03	0.4429
Pu-240	0.000E+00	0.0000	7.272E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.543E-03	0.0978
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	1.760E-11	0.0000
Total	0.000E+00	0.0000	9.069E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.578E-02	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	3.639E-01	3.633E-01	3.621E-01	3.593E-01	3.544E-01	3.395E-01	3.368E-01	2.904E-01	2.220E-01	7.008E-02
Am-241	Np-237	1.000E+00	9.385E-07	2.924E-06	6.907E-06	1.602E-05	3.247E-05	8.195E-05	9.122E-05	2.454E-04	4.713E-04	9.595E-04
Am-241	U-233	1.000E+00	2.505E-14	1.431E-13	6.710E-13	3.340E-12	1.330E-11	8.272E-11	1.022E-10	7.206E-10	2.573E-09	1.690E-08
Am-241	Th-229	1.000E+00	8.814E-18	1.271E-16	1.458E-15	1.756E-14	1.459E-13	2.395E-12	3.319E-12	7.075E-11	5.911E-10	9.638E-09
Am-241	ãDSR(j)		3.639E-01	3.633E-01	3.621E-01	3.594E-01	3.544E-01	3.396E-01	3.369E-01	2.906E-01	2.225E-01	7.104E-02
0Co-60	Co-60	1.000E+00	1.005E+01	8.807E+00	6.768E+00	3.693E+00	1.222E+00	3.983E-02	2.062E-02	1.471E-07	7.019E-17	0.000E+00
0Cs-137	Cs-137	1.000E+00	2.559E+00	2.500E+00	2.386E+00	2.144E+00	1.763E+00	9.626E-01	8.568E-01	1.054E-01	2.372E-03	1.988E-10
0Eu-154	Eu-154	1.000E+00	4.773E+00	4.412E+00	3.768E+00	2.622E+00	1.353E+00	1.743E-01	1.175E-01	9.767E-05	2.575E-10	2.831E-34
0Eu-155	Eu-155	1.000E+00	1.126E-01	9.793E-02	7.404E-02	3.892E-02	1.203E-02	3.175E-04	1.578E-04	5.424E-10	6.895E-20	0.000E+00
0Pu-239	Pu-239	1.000E+00	3.294E-01	3.294E-01	3.293E-01	3.292E-01	3.290E-01	3.284E-01	3.283E-01	3.262E-01	3.224E-01	3.065E-01
Pu-239	U-235	1.000E+00	2.732E-10	8.200E-10	1.907E-09	4.373E-09	8.757E-09	2.139E-08	2.367E-08	5.746E-08	9.379E-08	1.695E-07
Pu-239	Pa-231	1.000E+00	2.646E-14	1.993E-13	1.086E-12	5.833E-12	2.403E-11	1.541E-10	1.912E-10	1.418E-09	5.504E-09	3.050E-08
Pu-239	Ac-227	1.000E+00	1.506E-16	1.982E-15	2.101E-14	2.358E-13	1.816E-12	2.481E-11	3.330E-11	4.454E-10	2.178E-09	1.615E-08
Pu-239	ãDSR(j)		3.294E-01	3.294E-01	3.293E-01	3.292E-01	3.290E-01	3.284E-01	3.283E-01	3.262E-01	3.224E-01	3.065E-01
0Pu-240	Pu-240	1.000E+00	3.293E-01	3.293E-01	3.292E-01	3.289E-01	3.285E-01	3.272E-01	3.270E-01	3.226E-01	3.149E-01	2.836E-01
Pu-240	U-236	1.000E+00	9.145E-10	2.793E-09	6.535E-09	1.502E-08	3.010E-08	7.351E-08	8.132E-08	1.967E-07	3.185E-07	1.742E-06
Pu-240	Th-232	1.000E+00	8.252E-20	5.519E-19	2.847E-18	1.492E-17	6.087E-17	3.884E-16	4.817E-16	3.573E-15	1.392E-14	8.600E-14
Pu-240	Ra-228	1.000E+00	5.041E-20	7.705E-19	8.687E-18	9.414E-17	6.437E-16	6.582E-15	8.480E-15	7.863E-14	3.271E-13	1.910E-12
Pu-240	Th-228	1.000E+00	3.434E-21	9.632E-20	2.024E-18	3.867E-17	3.759E-16	4.961E-15	6.503E-15	6.601E-14	2.811E-13	1.660E-12
Pu-240	ãDSR(j)		3.293E-01	3.293E-01	3.292E-01	3.289E-01	3.285E-01	3.272E-01	3.270E-01	3.226E-01	3.149E-01	2.836E-01
0Sr-90	Sr-90	1.000E+00	4.000E+00	3.904E+00	3.718E+00	3.324E+00	2.708E+00	1.437E+00	1.272E+00	1.418E-01	2.667E-03	1.035E-10

*Branch Fraction is the cumulative factor for the j'th principal radionuclide daughter: COMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life 6 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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	4.122E+01	4.129E+01	4.143E+01	4.174E+01	4.232E+01	4.417E+01	4.453E+01	5.162E+01	6.743E+01	2.112E+02
Co-60	1.493E+00	1.703E+00	2.216E+00	4.061E+00	1.228E+01	3.766E+02	7.274E+02	1.020E+08	*1.131E+15	*1.131E+15
Cs-137	5.862E+00	6.000E+00	6.286E+00	6.996E+00	8.507E+00	1.558E+01	1.751E+01	1.423E+02	6.323E+03	7.545E+10
Eu-154	3.143E+00	3.400E+00	3.981E+00	5.720E+00	1.109E+01	8.606E+01	1.276E+02	1.536E+05	5.825E+10	*2.639E+14
Eu-155	1.332E+02	1.532E+02	2.026E+02	3.854E+02	1.247E+03	4.724E+04	9.503E+04	2.766E+10	*4.651E+14	*4.651E+14
Pu-239	4.554E+01	4.554E+01	4.554E+01	4.556E+01	4.559E+01	4.567E+01	4.569E+01	4.599E+01	4.653E+01	4.894E+01
Pu-240	4.555E+01	4.556E+01	4.557E+01	4.560E+01	4.566E+01	4.584E+01	4.587E+01	4.649E+01	4.764E+01	5.289E+01
Sr-90	3.750E+00	3.842E+00	4.034E+00	4.513E+00	5.539E+00	1.044E+01	1.179E+01	1.058E+02	5.625E+03	1.449E+11

*At specific activity limit

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)
Am-241	1.020E-01	0.000E+00	3.639E-01	4.122E+01	3.639E-01	4.122E+01
Co-60	3.870E-01	0.000E+00	1.005E+01	1.493E+00	1.005E+01	1.493E+00
Cs-137	4.060E-01	0.000E+00	2.559E+00	5.862E+00	2.559E+00	5.862E+00
Eu-154	6.030E-02	0.000E+00	4.773E+00	3.143E+00	4.773E+00	3.143E+00
Eu-155	4.220E-02	0.000E+00	1.126E-01	1.332E+02	1.126E-01	1.332E+02
Pu-239	2.280E-02	0.000E+00	3.294E-01	4.554E+01	3.294E-01	4.554E+01
Pu-240	5.440E-03	0.000E+00	3.293E-01	4.555E+01	3.293E-01	4.555E+01
Sr-90	1.700E-01	0.000E+00	4.000E+00	3.750E+00	4.000E+00	3.750E+00

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Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	3.711E-02	3.705E-02	3.693E-02	3.665E-02	3.615E-02	3.463E-02	3.435E-02	2.962E-02	2.264E-02	7.148E-03
0Np-237	Am-241	1.000E+00	9.572E-08	2.983E-07	7.045E-07	1.634E-06	3.312E-06	8.359E-06	9.305E-06	2.503E-05	4.807E-05	9.787E-05
0U-233	Am-241	1.000E+00	2.555E-15	1.460E-14	6.844E-14	3.407E-13	1.356E-12	8.437E-12	1.043E-11	7.351E-11	2.624E-10	1.724E-09
0Th-229	Am-241	1.000E+00	8.990E-19	1.296E-17	1.487E-16	1.791E-15	1.488E-14	2.443E-13	3.385E-13	7.217E-12	6.029E-11	9.831E-10
0Co-60	Co-60	1.000E+00	3.888E+00	3.408E+00	2.619E+00	1.429E+00	4.729E-01	1.541E-02	7.980E-03	5.692E-08	2.716E-17	0.000E+00
0Cs-137	Cs-137	1.000E+00	1.039E+00	1.015E+00	9.688E-01	8.704E-01	7.158E-01	3.908E-01	3.479E-01	4.281E-02	9.631E-04	8.072E-11
0Eu-154	Eu-154	1.000E+00	2.878E-01	2.660E-01	2.272E-01	1.581E-01	8.156E-02	1.051E-02	7.087E-03	5.889E-06	1.553E-11	0.000E+00
0Eu-155	Eu-155	1.000E+00	4.753E-03	4.133E-03	3.125E-03	1.643E-03	5.077E-04	1.340E-05	6.661E-06	2.289E-11	2.910E-21	0.000E+00
0Pu-239	Pu-239	1.000E+00	7.511E-03	7.510E-03	7.509E-03	7.507E-03	7.502E-03	7.488E-03	7.485E-03	7.437E-03	7.350E-03	6.987E-03
0U-235	Pu-239	1.000E+00	6.230E-12	1.870E-11	4.348E-11	9.971E-11	1.997E-10	4.877E-10	5.396E-10	1.310E-09	2.138E-09	3.864E-09
0Pa-231	Pu-239	1.000E+00	6.033E-16	4.544E-15	2.476E-14	1.330E-13	5.479E-13	3.514E-12	4.359E-12	3.232E-11	1.255E-10	6.953E-10
0Ac-227	Pu-239	1.000E+00	3.433E-18	4.518E-17	4.790E-16	5.377E-15	4.139E-14	5.656E-13	7.592E-13	1.016E-11	4.966E-11	3.682E-10
0Pu-240	Pu-240	1.000E+00	1.791E-03	1.791E-03	1.791E-03	1.789E-03	1.787E-03	1.780E-03	1.779E-03	1.755E-03	1.713E-03	1.543E-03
0U-236	Pu-240	1.000E+00	4.975E-12	1.519E-11	3.555E-11	8.173E-11	1.638E-10	3.999E-10	4.424E-10	1.070E-09	1.733E-09	9.477E-09
0Th-232	Pu-240	1.000E+00	4.489E-22	3.002E-21	1.549E-20	8.116E-20	3.312E-19	2.113E-18	2.621E-18	1.943E-17	7.575E-17	4.679E-16
0Ra-228	Pu-240	1.000E+00	2.743E-22	4.191E-21	4.726E-20	5.121E-19	3.502E-18	3.581E-17	4.613E-17	4.277E-16	1.780E-15	1.039E-14
0Th-228	Pu-240	1.000E+00	1.868E-23	5.240E-22	1.101E-20	2.104E-19	2.045E-18	2.699E-17	3.538E-17	3.591E-16	1.529E-15	9.032E-15
0Sr-90	Sr-90	1.000E+00	6.800E-01	6.636E-01	6.321E-01	5.650E-01	4.604E-01	2.443E-01	2.162E-01	2.410E-02	4.533E-04	1.760E-11

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

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Summary : 116-N-3 Shallow Zone (Run #1) File: 116-N-3 Shallow Zone.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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	1.020E-01	1.018E-01	1.015E-01	1.007E-01	9.935E-02	9.518E-02	9.440E-02	8.139E-02	6.223E-02	1.964E-02
0Np-237	Am-241	1.000E+00	0.000E+00	3.301E-08	9.886E-08	2.495E-07	5.216E-07	1.340E-06	1.493E-06	4.042E-06	7.778E-06	1.585E-05
0U-233	Am-241	1.000E+00	0.000E+00	7.210E-14	6.464E-13	4.112E-12	1.793E-11	1.176E-10	1.459E-10	1.048E-09	3.764E-09	1.452E-08
0Th-229	Am-241	1.000E+00	0.000E+00	2.271E-18	6.113E-17	9.871E-16	9.097E-15	1.584E-13	2.204E-13	4.799E-12	4.034E-11	6.552E-10
0Co-60	Co-60	1.000E+00	3.870E-01	3.393E-01	2.607E-01	1.423E-01	4.707E-02	1.534E-03	7.943E-04	5.666E-09	2.704E-18	0.000E+00
0Cs-137	Cs-137	1.000E+00	4.060E-01	3.967E-01	3.786E-01	3.402E-01	2.798E-01	1.527E-01	1.359E-01	1.673E-02	3.764E-04	3.154E-11
0Eu-154	Eu-154	1.000E+00	6.030E-02	5.573E-02	4.760E-02	3.313E-02	1.709E-02	2.202E-03	1.485E-03	1.234E-06	3.253E-12	3.577E-36
0Eu-155	Eu-155	1.000E+00	4.220E-02	3.669E-02	2.774E-02	1.459E-02	4.508E-03	1.190E-04	5.915E-05	2.032E-10	2.583E-20	0.000E+00
0Pu-239	Pu-239	1.000E+00	2.280E-02	2.280E-02	2.280E-02	2.279E-02	2.277E-02	2.273E-02	2.272E-02	2.258E-02	2.231E-02	2.121E-02
0U-235	Pu-239	1.000E+00	0.000E+00	2.241E-11	6.695E-11	1.680E-10	3.476E-10	8.652E-10	9.585E-10	2.343E-09	3.832E-09	5.108E-09
0Pa-231	Pu-239	1.000E+00	0.000E+00	2.372E-16	2.129E-15	1.357E-14	5.942E-14	3.946E-13	4.906E-13	3.684E-12	1.435E-11	7.910E-11
0Ac-227	Pu-239	1.000E+00	0.000E+00	2.498E-18	6.623E-17	1.033E-15	8.959E-15	1.310E-13	1.766E-13	2.419E-12	1.190E-11	7.519E-11
0Pu-240	Pu-240	1.000E+00	5.440E-03	5.439E-03	5.438E-03	5.434E-03	5.427E-03	5.406E-03	5.402E-03	5.330E-03	5.201E-03	4.685E-03
0U-236	Pu-240	1.000E+00	0.000E+00	1.607E-10	4.801E-10	1.204E-09	2.491E-09	6.195E-09	6.861E-09	1.670E-08	2.710E-08	3.453E-08
0Th-232	Pu-240	1.000E+00	0.000E+00	3.967E-21	3.560E-20	2.270E-19	9.941E-19	6.605E-18	8.214E-18	6.182E-17	2.419E-16	1.363E-15
0Ra-228	Pu-240	1.000E+00	0.000E+00	1.548E-22	3.934E-21	5.608E-20	4.217E-19	4.540E-18	5.867E-18	5.528E-17	2.309E-16	1.349E-15
0Th-228	Pu-240	1.000E+00	0.000E+00	1.314E-23	8.866E-22	2.502E-20	2.771E-19	3.905E-18	5.139E-18	5.315E-17	2.273E-16	1.344E-15
0Sr-90	Sr-90	1.000E+00	1.700E-01	1.659E-01	1.580E-01	1.412E-01	1.151E-01	6.107E-02	5.406E-02	6.026E-03	1.133E-04	4.400E-12

BRF(i) is the branch fraction of the parent nuclide.
0RESCALC.EXE execution time = 7.14 seconds

RESRAD INPUT PARAMETERS FOR THE DEEP ZONE LAYER 1

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.RAD

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

0 Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	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-154	2.860E-04	2.860E-04	DCF2(5)
B-1	Eu-155	4.140E-05	4.140E-05	DCF2(6)
B-1	H-3	6.400E-08	6.400E-08	DCF2(7)
B-1	Ni-63	6.290E-06	6.290E-06	DCF2(8)
B-1	Np-237+D	5.400E-01	5.400E-01	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-229+D	2.160E+00	2.160E+00	DCF2(16)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(17)
B-1	U-233	1.350E-01	1.350E-01	DCF2(18)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(19)
B-1	U-236	1.250E-01	1.250E-01	DCF2(20)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	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-154	9.550E-06	9.550E-06	DCF3(5)
D-1	Eu-155	1.530E-06	1.530E-06	DCF3(6)
D-1	H-3	6.400E-08	6.400E-08	DCF3(7)
D-1	Ni-63	5.770E-07	5.770E-07	DCF3(8)
D-1	Np-237+D	4.440E-03	4.440E-03	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-229+D	4.030E-03	4.030E-03	DCF3(16)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(17)
D-1	U-233	2.890E-04	2.890E-04	DCF3(18)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(19)
D-1	U-236	2.690E-04	2.690E-04	DCF3(20)
D-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				

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.RAD

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

Menu	Parameter	Current Value	Default	Parameter Name
D-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
D-34				
D-34	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)
D-34				
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-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	Eu-155 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	Eu-155 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(6,2)
D-34	Eu-155 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(6,3)
D-34				
D-34	H-3 , plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(7,1)
D-34	H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(7,2)
D-34	H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(7,3)
D-34				
D-34	Ni-63 , plant/soil concentration ratio, dimensionless	5.000E-02	5.000E-02	RTF(8,1)
D-34	Ni-63 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(8,2)
D-34	Ni-63 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-02	2.000E-02	RTF(8,3)
D-34				
D-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(9,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(9,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	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)

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

Menu	Parameter	Current Value	Default	Parameter Name
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(15,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(15,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(15,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(16,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(16,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(16,3)
D-34				
D-34	Th-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				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(18,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(18,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(18,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(19,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(19,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(19,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(20,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(20,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(20,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	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-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	Eu-155 , fish	5.000E+01	5.000E+01	BIOFAC(6,1)
D-5	Eu-155 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(6,2)
D-5				
D-5	H-3 , fish	1.000E+00	1.000E+00	BIOFAC(7,1)
D-5	H-3 , crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(7,2)
D-5				
D-5	Ni-63 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Ni-63 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(8,2)
D-5				
D-5	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(9,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(9,2)

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.RAD

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

Menu	Parameter	Current Value	Default	Parameter Name
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)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(16,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(16,2)
D-5				
D-5	Th-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-233 , fish	1.000E+01	1.000E+01	BIOFAC(18,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(18,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(19,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(19,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(20,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(20,2)

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.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)	2.198E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	7.500E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	4.000E+00	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)	7.600E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.600E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	4.200E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	4.700E+01	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.370E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	3.000E+02	0.000E+00	---	T(9)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	1.540E+02	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Co-60	5.580E+03	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Cs-137	4.900E+03	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Eu-154	8.700E+00	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Eu-155	6.450E+00	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Ni-63	1.030E+03	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Pu-239	2.080E+02	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): Pu-240	4.980E+01	0.000E+00	---	S1(12)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.460E+03	0.000E+00	---	S1(14)
R012	Concentration in groundwater (pCi/L): Am-241	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-154	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Eu-155	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Ni-63	not used	0.000E+00	---	W1(8)
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)	not used	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)	2.000E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.500E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.500E+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

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	2.000E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	3.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-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)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	1.470E+01	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	2.000E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	3.000E-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	2.500E-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 Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.984E-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	3.986E-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	3.986E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
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	9.984E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.RAD

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 Eu-155				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.984E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Ni-63				
R016	Contaminated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.632E-04	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
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	9.984E-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	9.984E-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)	1.500E+01	3.000E+01	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	1.500E+01	3.000E+01	---	DCNUCU(14,1)
R016	Saturated zone (cm**3/g)	1.500E+01	3.000E+01	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.321E-03	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+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	9.928E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.598E-01	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.RAD

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 Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.758E-05	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
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	3.986E-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)	1.000E+02	7.000E+01	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	7.000E+01	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	1.000E+02	7.000E+01	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.996E-04	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	9.984E-05	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(16)
R016	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	9.984E-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	9.984E-05	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for daughter U-233				
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	9.402E-03	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)

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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 U-235				
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	9.402E-03	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)
R016	Distribution coefficients for daughter U-236				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(20)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(20,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.402E-03	ALEACH(20)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(20)
R017	Inhalation rate (m**3/yr)	not used	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	not used	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	not used	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	not used	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	not used	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	not used	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	not used	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	not used	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	0.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	not used	1.500E-01	---	DM
R019	Depth of roots (m)	not used	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	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)
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	suppressed
2 -- inhalation (w/o radon)	suppressed
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	suppressed
9 -- radon	suppressed
Find peak pathway doses	active

1RESRAD, Version 6.1 T« Limit = 0.5 year 08/05/2002 10:23 Page 14
Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.RAD

Contaminated Zone Dimensions
ÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃ

Area:	21980.00 square meters
Thickness:	2.00 meters
Cover Depth:	4.60 meters

Initial Soil Concentrations, pCi/g
ÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃ

Am-241	1.540E+02
Co-60	5.580E+03
Cs-137	4.900E+03
Eu-154	8.700E+00
Eu-155	6.450E+00
Ni-63	1.030E+03
Pu-239	2.080E+02
Pu-240	4.980E+01
Sr-90	1.460E+03

0

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 4.000E+00 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
ÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃ

1RESRAD, Version 6.1 T½ Limit = 0.5 year 08/05/2002 10:23 Page 15
Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.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	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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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
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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.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	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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.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 = 7.600E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 7.600E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.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 = 1.600E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 1.600E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.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 = 4.200E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 4.200E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.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 = 4.700E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 4.700E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.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 = 1.370E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 1.370E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-	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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
				DSR(j,t) (mrem/yr)/(pCi/g)									
Am-241	Am-241	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	0.000E+00	0.000E+00
Am-241	Np-237	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	0.000E+00	0.000E+00
Am-241	U-233	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	0.000E+00	0.000E+00
Am-241	Th-229	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	0.000E+00	0.000E+00
Am-241	ãDSR(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	0.000E+00	0.000E+00
0Co-60	Co-60	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	0.000E+00	0.000E+00
0Cs-137	Cs-137	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	0.000E+00	0.000E+00
0Eu-154	Eu-154	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	0.000E+00	0.000E+00
0Eu-155	Eu-155	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	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	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	0.000E+00	0.000E+00
Pu-239	U-235	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	0.000E+00	0.000E+00
Pu-239	Pa-231	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	0.000E+00	0.000E+00
Pu-239	Ac-227	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	0.000E+00	0.000E+00
Pu-239	ãDSR(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	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	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	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pu-240	Th-232	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	0.000E+00	0.000E+00
Pu-240	Ra-228	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	0.000E+00	0.000E+00
Pu-240	Th-228	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	0.000E+00	0.000E+00
Pu-240	ãDSR(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	0.000E+00	0.000E+00
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	0.000E+00	0.000E+00

*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.

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.RAD

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 4.000E+00 mrem/yr

0Nuclide

(i)	t= 0.000E+00	1.000E+00	3.000E+00	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+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	*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	*8.701E+13	*8.701E+13
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	*2.639E+14	*2.639E+14
Eu-155	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+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	*5.916E+13	*5.916E+13
Pu-239	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10
Pu-240	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11
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	*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 = 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)
Am-241	1.540E+02	0.000E+00	0.000E+00	*3.430E+12	0.000E+00	*3.430E+12
Co-60	5.580E+03	0.000E+00	0.000E+00	*1.131E+15	0.000E+00	*1.131E+15
Cs-137	4.900E+03	0.000E+00	0.000E+00	*8.701E+13	0.000E+00	*8.701E+13
Eu-154	8.700E+00	0.000E+00	0.000E+00	*2.639E+14	0.000E+00	*2.639E+14
Eu-155	6.450E+00	0.000E+00	0.000E+00	*4.651E+14	0.000E+00	*4.651E+14
Ni-63	1.030E+03	0.000E+00	0.000E+00	*5.916E+13	0.000E+00	*5.916E+13
Pu-239	2.080E+02	0.000E+00	0.000E+00	*6.212E+10	0.000E+00	*6.212E+10
Pu-240	4.980E+01	0.000E+00	0.000E+00	*2.277E+11	0.000E+00	*2.277E+11
Sr-90	1.460E+03	0.000E+00	0.000E+00	*1.365E+14	0.000E+00	*1.365E+14

*At specific activity limit

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	Am-241	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	0.000E+00	0.000E+00
0Np-237	Am-241	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	0.000E+00	0.000E+00
0U-233	Am-241	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	0.000E+00	0.000E+00
0Th-229	Am-241	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	0.000E+00	0.000E+00
0Co-60	Co-60	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	0.000E+00	0.000E+00
0Cs-137	Cs-137	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	0.000E+00	0.000E+00
0Eu-154	Eu-154	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	0.000E+00	0.000E+00
0Eu-155	Eu-155	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	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	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	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	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Pa-231	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	0.000E+00	0.000E+00
0Ac-227	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	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	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	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Th-232	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	0.000E+00	0.000E+00
0Ra-228	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	0.000E+00	0.000E+00
0Th-228	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	0.000E+00	0.000E+00
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	0.000E+00	0.000E+00

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

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Summary : 116-N-3 DZ (Layer 1) Run #3 File: 116-N-3 DZ Layer 1.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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	1.540E+02	1.537E+02	1.532E+02	1.520E+02	1.499E+02	1.434E+02	1.422E+02	1.219E+02	9.238E+01	2.803E+01
0Np-237	Am-241	1.000E+00	0.000E+00	4.984E-05	1.492E-04	3.765E-04	7.868E-04	2.018E-03	2.249E-03	6.061E-03	1.157E-02	2.280E-02
0U-233	Am-241	1.000E+00	0.000E+00	1.087E-10	9.707E-10	6.124E-09	2.632E-08	1.651E-07	2.031E-07	1.274E-06	3.783E-06	1.013E-05
0Th-229	Am-241	1.000E+00	0.000E+00	3.424E-15	9.191E-14	1.475E-12	1.344E-11	2.263E-10	3.128E-10	6.135E-09	4.430E-08	5.127E-07
0Co-60	Co-60	1.000E+00	5.580E+03	4.890E+03	3.756E+03	2.048E+03	6.762E+02	2.191E+01	1.133E+01	7.921E-05	3.643E-14	0.000E+00
0Cs-137	Cs-137	1.000E+00	4.900E+03	4.786E+03	4.566E+03	4.098E+03	3.364E+03	1.826E+03	1.623E+03	1.958E+02	4.246E+00	3.039E-07
0Eu-154	Eu-154	1.000E+00	8.700E+00	8.040E+00	6.867E+00	4.778E+00	2.463E+00	3.169E-01	2.137E-01	1.766E-04	4.615E-10	4.878E-34
0Eu-155	Eu-155	1.000E+00	6.450E+00	5.608E+00	4.240E+00	2.228E+00	6.883E-01	1.814E-02	9.016E-03	3.082E-08	3.882E-18	0.000E+00
0Ni-63	Ni-63	1.000E+00	1.030E+03	1.022E+03	1.006E+03	9.701E+02	9.079E+02	7.397E+02	7.111E+02	3.498E+02	9.676E+01	3.882E-01
0Pu-239	Pu-239	1.000E+00	2.080E+02	2.080E+02	2.079E+02	2.078E+02	2.076E+02	2.069E+02	2.067E+02	2.044E+02	2.001E+02	1.829E+02
0U-235	Pu-239	1.000E+00	0.000E+00	2.039E-07	6.059E-07	1.502E-06	3.040E-06	7.088E-06	7.757E-06	1.561E-05	1.994E-05	1.942E-05
0Pa-231	Pu-239	1.000E+00	0.000E+00	2.160E-12	1.931E-11	1.221E-10	5.264E-10	3.339E-09	4.117E-09	2.690E-08	8.641E-08	3.224E-07
0Ac-227	Pu-239	1.000E+00	0.000E+00	2.275E-14	6.014E-13	9.317E-12	7.974E-11	1.120E-09	1.498E-09	1.797E-08	7.254E-08	3.043E-07
0Pu-240	Pu-240	1.000E+00	4.980E+01	4.979E+01	4.977E+01	4.972E+01	4.964E+01	4.937E+01	4.932E+01	4.842E+01	4.682E+01	4.053E+01
0U-236	Pu-240	1.000E+00	0.000E+00	1.467E-06	4.359E-06	1.080E-05	2.186E-05	5.092E-05	5.572E-05	1.116E-04	1.412E-04	1.305E-04
0Th-232	Pu-240	1.000E+00	0.000E+00	3.625E-17	3.241E-16	2.050E-15	8.845E-15	5.623E-14	6.935E-14	4.569E-13	1.492E-12	6.021E-12
0Ra-228	Pu-240	1.000E+00	0.000E+00	1.415E-18	3.586E-17	5.078E-16	3.771E-15	3.897E-14	4.997E-14	4.123E-13	1.433E-12	5.963E-12
0Th-228	Pu-240	1.000E+00	0.000E+00	1.201E-19	8.088E-18	2.269E-16	2.484E-15	3.365E-14	4.393E-14	3.978E-13	1.414E-12	5.945E-12
0Sr-90	Sr-90	1.000E+00	1.460E+03	1.424E+03	1.354E+03	1.206E+03	9.767E+02	5.083E+02	4.483E+02	4.672E+01	7.780E-01	1.791E-08

BRF(i) is the branch fraction of the parent nuclide.
0RESCALC.EXE execution time = 1.25 seconds

RESRAD INPUT PARAMETERS FOR THE DEEP ZONE LAYER 2

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

0 Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	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-154	2.860E-04	2.860E-04	DCF2(5)
B-1	Eu-155	4.140E-05	4.140E-05	DCF2(6)
B-1	H-3	6.400E-08	6.400E-08	DCF2(7)
B-1	Ni-63	6.290E-06	6.290E-06	DCF2(8)
B-1	Np-237+D	5.400E-01	5.400E-01	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-229+D	2.160E+00	2.160E+00	DCF2(16)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(17)
B-1	U-233	1.350E-01	1.350E-01	DCF2(18)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(19)
B-1	U-236	1.250E-01	1.250E-01	DCF2(20)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	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-154	9.550E-06	9.550E-06	DCF3(5)
D-1	Eu-155	1.530E-06	1.530E-06	DCF3(6)
D-1	H-3	6.400E-08	6.400E-08	DCF3(7)
D-1	Ni-63	5.770E-07	5.770E-07	DCF3(8)
D-1	Np-237+D	4.440E-03	4.440E-03	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-229+D	4.030E-03	4.030E-03	DCF3(16)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(17)
D-1	U-233	2.890E-04	2.890E-04	DCF3(18)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(19)
D-1	U-236	2.690E-04	2.690E-04	DCF3(20)
D-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				

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.RAD

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

0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
D-34				
D-34	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)
D-34				
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-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	Eu-155 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	Eu-155 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(6,2)
D-34	Eu-155 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(6,3)
D-34				
D-34	H-3 , plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(7,1)
D-34	H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(7,2)
D-34	H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(7,3)
D-34				
D-34	Ni-63 , plant/soil concentration ratio, dimensionless	5.000E-02	5.000E-02	RTF(8,1)
D-34	Ni-63 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(8,2)
D-34	Ni-63 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-02	2.000E-02	RTF(8,3)
D-34				
D-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(9,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(9,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	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)

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

0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(15,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(15,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(15,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(16,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(16,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(16,3)
D-34				
D-34	Th-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				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(18,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(18,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(18,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(19,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(19,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(19,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(20,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(20,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(20,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	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-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	Eu-155 , fish	5.000E+01	5.000E+01	BIOFAC(6,1)
D-5	Eu-155 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(6,2)
D-5				
D-5	H-3 , fish	1.000E+00	1.000E+00	BIOFAC(7,1)
D-5	H-3 , crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(7,2)
D-5				
D-5	Ni-63 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Ni-63 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(8,2)
D-5				
D-5	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(9,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(9,2)

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

Menu	Parameter	Current Value	Default	Parameter Name
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)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(16,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(16,2)
D-5				
D-5	Th-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-233 , fish	1.000E+01	1.000E+01	BIOFAC(18,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(18,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(19,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(19,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(20,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(20,2)

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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)	2.198E+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)	7.500E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	4.000E+00	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)	7.600E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.600E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	4.200E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	4.700E+01	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.370E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	3.000E+02	0.000E+00	---	T(9)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	4.380E+03	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Co-60	7.810E-01	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Cs-137	2.110E-01	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Eu-154	3.020E-01	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Eu-155	2.330E-01	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Ni-63	8.260E+01	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Pu-239	6.000E-03	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): Pu-240	1.440E-03	0.000E+00	---	S1(12)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.170E+02	0.000E+00	---	S1(14)
R012	Concentration in groundwater (pCi/L): Am-241	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-154	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Eu-155	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Ni-63	not used	0.000E+00	---	W1(8)
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)	6.600E+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)	1.000E-03	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	2.000E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.500E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.500E+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

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	2.000E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	3.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-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)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	7.400E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	2.000E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	3.000E-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	2.500E-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 Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.735E-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	1.092E-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	1.092E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
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	2.735E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.RAD

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 Eu-155				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.735E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Ni-63				
R016	Contaminated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.817E-04	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
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	2.735E-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	2.735E-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)	1.500E+01	3.000E+01	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	1.500E+01	3.000E+01	---	DCNUCU(14,1)
R016	Saturated zone (cm**3/g)	1.500E+01	3.000E+01	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.619E-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+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	2.720E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.379E-02	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)

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 Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-05	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
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	1.092E-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)	1.000E+02	7.000E+01	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	7.000E+01	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	1.000E+02	7.000E+01	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.467E-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	2.735E-05	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(16,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.123E-08	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	2.735E-05	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(18)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(18,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.092E-04	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)

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 U-235				
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	2.576E-03	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)
R016	Distribution coefficients for daughter U-236				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(20)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(20,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.576E-03	ALEACH(20)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(20)
R017	Inhalation rate (m**3/yr)	not used	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	not used	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	not used	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	not used	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	not used	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	not used	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	not used	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	not used	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	0.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	not used	1.500E-01	---	DM
R019	Depth of roots (m)	not used	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	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)
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	suppressed
2 -- inhalation (w/o radon)	suppressed
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	suppressed
9 -- radon	suppressed
Find peak pathway doses	active

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.RAD

Contaminated Zone Dimensions

Area:	21980.00 square meters
Thickness:	7.30 meters
Cover Depth:	6.60 meters

Initial Soil Concentrations, pCi/g

Am-241	4.380E-03
Co-60	7.810E-01
Cs-137	2.110E-01
Eu-154	3.020E-01
Eu-155	2.330E-01
Ni-63	8.260E+01
Pu-239	6.000E-03
Pu-240	1.440E-03
Sr-90	1.170E+02

0

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 4.000E+00 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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
TDOSE(t):	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
M(t):	0.000E+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	0.000E+00

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

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.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-	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Nuclide														
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Nuclide														
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.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	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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.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	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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.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 = 7.600E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 7.600E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.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 = 1.600E+01 years
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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 1.600E+01 years
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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.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 = 4.200E+01 years
0 Water Independent Pathways (Inhalation excludes radon)

0	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Nuclide														
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 4.200E+01 years
0 Water Dependent Pathways

0	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Nuclide														
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.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 = 4.700E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 4.700E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.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 = 1.370E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 1.370E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-	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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	Am-241	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	0.000E+00	0.000E+00
Am-241	Np-237	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	0.000E+00	0.000E+00
Am-241	U-233	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	0.000E+00	0.000E+00
Am-241	Th-229	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	0.000E+00	0.000E+00
Am-241	ãDSR(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	0.000E+00	0.000E+00
0Co-60	Co-60	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	0.000E+00	0.000E+00
0Cs-137	Cs-137	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	0.000E+00	0.000E+00
0Eu-154	Eu-154	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	0.000E+00	0.000E+00
0Eu-155	Eu-155	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	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	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	0.000E+00	0.000E+00
Pu-239	U-235	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	0.000E+00	0.000E+00
Pu-239	Pa-231	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	0.000E+00	0.000E+00
Pu-239	Ac-227	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	0.000E+00	0.000E+00
Pu-239	ãDSR(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	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	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	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pu-240	Th-232	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	0.000E+00	0.000E+00
Pu-240	Ra-228	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	0.000E+00	0.000E+00
Pu-240	Th-228	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	0.000E+00	0.000E+00
Pu-240	ãDSR(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	0.000E+00	0.000E+00
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	0.000E+00	0.000E+00

*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.

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.RAD

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 4.000E+00 mrem/yr

0

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+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	*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	*8.701E+13	*8.701E+13
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	*2.639E+14	*2.639E+14
Eu-155	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+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	*5.916E+13	*5.916E+13
Pu-239	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10	*6.212E+10
Pu-240	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11	*2.277E+11
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	*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 = 0.000E+00 years

0

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Am-241	4.380E+03	0.000E+00	0.000E+00	*3.430E+12	0.000E+00	*3.430E+12
Co-60	7.810E-01	0.000E+00	0.000E+00	*1.131E+15	0.000E+00	*1.131E+15
Cs-137	2.110E-01	0.000E+00	0.000E+00	*8.701E+13	0.000E+00	*8.701E+13
Eu-154	3.020E-01	0.000E+00	0.000E+00	*2.639E+14	0.000E+00	*2.639E+14
Eu-155	2.330E-01	0.000E+00	0.000E+00	*4.651E+14	0.000E+00	*4.651E+14
Ni-63	8.260E+01	0.000E+00	0.000E+00	*5.916E+13	0.000E+00	*5.916E+13
Pu-239	6.000E-03	0.000E+00	0.000E+00	*6.212E+10	0.000E+00	*6.212E+10
Pu-240	1.440E-03	0.000E+00	0.000E+00	*2.277E+11	0.000E+00	*2.277E+11
Sr-90	1.170E+02	0.000E+00	0.000E+00	*1.365E+14	0.000E+00	*1.365E+14

*At specific activity limit

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	Am-241	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	0.000E+00	0.000E+00
0Np-237	Am-241	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	0.000E+00	0.000E+00
0U-233	Am-241	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	0.000E+00	0.000E+00
0Th-229	Am-241	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	0.000E+00	0.000E+00
0Co-60	Co-60	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	0.000E+00	0.000E+00
0Cs-137	Cs-137	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	0.000E+00	0.000E+00
0Eu-154	Eu-154	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	0.000E+00	0.000E+00
0Eu-155	Eu-155	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	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	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	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	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Pa-231	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	0.000E+00	0.000E+00
0Ac-227	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	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	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	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0Th-232	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	0.000E+00	0.000E+00
0Ra-228	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	0.000E+00	0.000E+00
0Th-228	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	0.000E+00	0.000E+00
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	0.000E+00	0.000E+00

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

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Summary : 116-N-3 DZ (Layer 2) Run #4 File: 116-N-3 DZ Layer 2.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	7.500E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	4.380E+03	4.373E+03	4.359E+03	4.326E+03	4.267E+03	4.090E+03	4.057E+03	3.503E+03	2.685E+03	8.572E+02
0Np-237	Am-241	1.000E+00	0.000E+00	1.418E-03	4.246E-03	1.071E-02	2.240E-02	5.756E-02	6.415E-02	1.739E-01	3.354E-01	6.901E-01
0U-233	Am-241	1.000E+00	0.000E+00	3.100E-09	2.787E-08	1.784E-07	7.867E-07	5.339E-06	6.666E-06	5.378E-05	2.354E-04	1.834E-03
0Th-229	Am-241	1.000E+00	0.000E+00	9.760E-14	2.633E-12	4.271E-11	3.970E-10	7.095E-09	9.920E-09	2.358E-07	2.302E-06	6.393E-05
0Co-60	Co-60	1.000E+00	7.810E-01	6.847E-01	5.262E-01	2.872E-01	9.509E-02	3.105E-03	1.608E-03	1.153E-08	5.562E-18	0.000E+00
0Cs-137	Cs-137	1.000E+00	2.110E-01	2.062E-01	1.968E-01	1.769E-01	1.455E-01	7.959E-02	7.087E-02	8.772E-03	1.994E-04	1.748E-11
0Eu-154	Eu-154	1.000E+00	3.020E-01	2.791E-01	2.384E-01	1.659E-01	8.560E-02	1.104E-02	7.442E-03	6.193E-06	1.637E-11	1.820E-35
0Eu-155	Eu-155	1.000E+00	2.330E-01	2.026E-01	1.532E-01	8.054E-02	2.489E-02	6.574E-04	3.268E-04	1.125E-09	1.433E-19	0.000E+00
0Ni-63	Ni-63	1.000E+00	8.260E+01	8.199E+01	8.079E+01	7.808E+01	7.337E+01	6.053E+01	5.833E+01	2.996E+01	8.966E+00	5.039E-02
0Pu-239	Pu-239	1.000E+00	6.000E-03	6.000E-03	5.999E-03	5.997E-03	5.995E-03	5.986E-03	5.984E-03	5.954E-03	5.900E-03	5.672E-03
0U-235	Pu-239	1.000E+00	0.000E+00	5.901E-12	1.766E-11	4.446E-11	9.258E-11	2.349E-10	2.612E-10	6.794E-10	1.223E-09	2.039E-09
0Pa-231	Pu-239	1.000E+00	0.000E+00	6.246E-17	5.611E-16	3.586E-15	1.577E-14	1.061E-13	1.323E-13	1.038E-12	4.332E-12	2.894E-11
0Ac-227	Pu-239	1.000E+00	0.000E+00	6.576E-19	1.745E-17	2.728E-16	2.374E-15	3.512E-14	4.746E-14	6.772E-13	3.570E-12	2.749E-11
0Pu-240	Pu-240	1.000E+00	1.440E-03	1.440E-03	1.439E-03	1.439E-03	1.437E-03	1.432E-03	1.431E-03	1.414E-03	1.384E-03	1.260E-03
0U-236	Pu-240	1.000E+00	0.000E+00	4.257E-11	1.274E-10	3.207E-10	6.675E-10	1.692E-09	1.881E-09	4.873E-09	8.709E-09	1.394E-08
0Th-232	Pu-240	1.000E+00	0.000E+00	1.051E-21	9.438E-21	6.032E-20	2.653E-19	1.786E-18	2.226E-18	1.747E-17	7.307E-17	4.919E-16
0Ra-228	Pu-240	1.000E+00	0.000E+00	4.098E-23	1.042E-21	1.489E-20	1.124E-19	1.224E-18	1.586E-18	1.558E-17	6.956E-17	4.860E-16
0Th-228	Pu-240	1.000E+00	0.000E+00	3.479E-24	2.349E-22	6.641E-21	7.379E-20	1.052E-18	1.388E-18	1.496E-17	6.840E-17	4.841E-16
0Sr-90	Sr-90	1.000E+00	1.170E+02	1.142E+02	1.088E+02	9.737E+01	7.948E+01	4.240E+01	3.758E+01	4.270E+00	8.313E-02	3.745E-09

BRF(i) is the branch fraction of the parent nuclide.
0RESCALC.EXE execution time = 1.41 seconds

RESRAD INPUT PARAMETERS FOR THE DEEP ZONE LAYER 3

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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	Am-241	4.440E-01	4.440E-01	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-154	2.860E-04	2.860E-04	DCF2(5)
B-1	Eu-155	4.140E-05	4.140E-05	DCF2(6)
B-1	H-3	6.400E-08	6.400E-08	DCF2(7)
B-1	Ni-63	6.290E-06	6.290E-06	DCF2(8)
B-1	Np-237+D	5.400E-01	5.400E-01	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-229+D	2.160E+00	2.160E+00	DCF2(16)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(17)
B-1	U-233	1.350E-01	1.350E-01	DCF2(18)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(19)
B-1	U-236	1.250E-01	1.250E-01	DCF2(20)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	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-154	9.550E-06	9.550E-06	DCF3(5)
D-1	Eu-155	1.530E-06	1.530E-06	DCF3(6)
D-1	H-3	6.400E-08	6.400E-08	DCF3(7)
D-1	Ni-63	5.770E-07	5.770E-07	DCF3(8)
D-1	Np-237+D	4.440E-03	4.440E-03	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-229+D	4.030E-03	4.030E-03	DCF3(16)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(17)
D-1	U-233	2.890E-04	2.890E-04	DCF3(18)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(19)
D-1	U-236	2.690E-04	2.690E-04	DCF3(20)
D-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				

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

0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
D-34				
D-34	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)
D-34				
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-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	Eu-155 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	Eu-155 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(6,2)
D-34	Eu-155 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(6,3)
D-34				
D-34	H-3 , plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(7,1)
D-34	H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(7,2)
D-34	H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(7,3)
D-34				
D-34	Ni-63 , plant/soil concentration ratio, dimensionless	5.000E-02	5.000E-02	RTF(8,1)
D-34	Ni-63 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(8,2)
D-34	Ni-63 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-02	2.000E-02	RTF(8,3)
D-34				
D-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(9,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(9,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	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)

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

0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(15,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(15,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(15,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(16,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(16,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(16,3)
D-34				
D-34	Th-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				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(18,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(18,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(18,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(19,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(19,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(19,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(20,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(20,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(20,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	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-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	Eu-155 , fish	5.000E+01	5.000E+01	BIOFAC(6,1)
D-5	Eu-155 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(6,2)
D-5				
D-5	H-3 , fish	1.000E+00	1.000E+00	BIOFAC(7,1)
D-5	H-3 , crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(7,2)
D-5				
D-5	Ni-63 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Ni-63 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(8,2)
D-5				
D-5	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(9,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(9,2)

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

0 Menu	Parameter	Current Value	Default	Parameter Name
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)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(16,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(16,2)
D-5				
D-5	Th-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-233 , fish	1.000E+01	1.000E+01	BIOFAC(18,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(18,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(19,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(19,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(20,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(20,2)

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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)	2.198E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	7.400E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	7.500E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	4.000E+00	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)	7.600E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.600E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	4.200E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	4.700E+01	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.370E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	3.000E+02	0.000E+00	---	T(9)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	6.070E-03	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Co-60	7.170E-02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Cs-137	8.320E-02	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Eu-154	1.620E-01	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Eu-155	9.290E-02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Ni-63	8.120E+00	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Pu-239	8.310E-03	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): Pu-240	1.990E-03	0.000E+00	---	S1(12)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.150E+01	0.000E+00	---	S1(14)
R012	Concentration in groundwater (pCi/L): Am-241	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-154	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Eu-155	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Ni-63	not used	0.000E+00	---	W1(8)
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)	1.390E+01	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)	1.000E-03	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	2.000E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.500E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.500E+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

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	2.000E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	3.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-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)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	0	1	---	NS
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCC(2)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.698E-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	Saturated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.077E-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	Saturated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.077E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Eu-154				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(5)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.698E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for Eu-155				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(6)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.698E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Ni-63				
R016	Contaminated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCC(8)
R016	Saturated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.793E-04	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.RAD

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 Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(11)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.698E-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	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.698E-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)	1.500E+01	3.000E+01	---	DCNUCC(14)
R016	Saturated zone (cm**3/g)	1.500E+01	3.000E+01	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.570E-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+01	2.000E+01	---	DCNUCC(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	2.683E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(7)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.320E-02	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for daughter Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(9)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.097E-05	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(10)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.077E-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)	1.000E+02	7.000E+01	---	DCNUCC(13)
R016	Saturated zone (cm**3/g)	1.000E+02	7.000E+01	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.393E-05	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)

1RESRAD, Version 6.1 T½ Limit = 0.5 year 11/26/2002 14:18 Page 9
Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.RAD

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 Th-228				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(15)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.698E-05	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(16)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.000E-08	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	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.698E-05	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(18)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.077E-04	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)
R016	Distribution coefficients for daughter U-235				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(19)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.541E-03	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)
R016	Distribution coefficients for daughter U-236				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(20)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.541E-03	ALEACH(20)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(20)
R017	Inhalation rate (m**3/yr)	not used	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	not used	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	not used	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	not used	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	not used	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	not used	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	not used	1.000E+00	>0 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

0 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)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	not used	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	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Depth of soil mixing layer (m)	not used	1.500E-01	---	DM
R019	Depth of roots (m)	not used	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	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F
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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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	suppressed
2 -- inhalation (w/o radon)	suppressed
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	suppressed
9 -- radon	suppressed
Find peak pathway doses	active

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.RAD

Contaminated Zone Dimensions

Area:	21980.00 square meters
Thickness:	7.40 meters
Cover Depth:	13.90 meters

Initial Soil Concentrations, pCi/g

Am-241	6.070E-03
Co-60	7.170E-01
Cs-137	8.320E-02
Eu-154	1.620E-01
Eu-155	9.290E-02
Ni-63	8.120E+00
Pu-239	8.310E-03
Pu-240	1.990E-03
Sr-90	1.150E+01

0

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 4.000E+00 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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
TDOSE(t):	0.000E+00	3.894E-02	1.117E-01	2.536E-01	4.369E-01	6.159E-01	6.116E-01	2.076E-01	9.669E-03	1.074E-05
M(t):	0.000E+00	9.736E-03	2.792E-02	6.341E-02	1.092E-01	1.540E-01	1.529E-01	5.189E-02	2.417E-03	2.686E-06

0Maximum TDOSE(t): 6.159E-01 mrem/yr at t = 41.82 ñ 0.08 years
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 = 4.182E+01 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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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 = 4.182E+01 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.
Nuclide														
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	4.512E-04	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.512E-04	0.0007
Pu-239	2.843E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.843E-09	0.0000
Pu-240	2.058E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.058E-08	0.0000
Sr-90	6.155E-01	0.9993	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.155E-01	0.9993
Total	6.159E-01	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	6.159E-01	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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	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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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
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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	1.440E-05	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.440E-05	0.0004
Pu-239	1.671E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.671E-12	0.0000
Pu-240	1.212E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.212E-11	0.0000
Sr-90	3.893E-02	0.9996	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.893E-02	0.9996
Total	3.894E-02	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	3.894E-02	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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	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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	4.279E-05	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.279E-05	0.0004
Pu-239	1.507E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.507E-11	0.0000
Pu-240	1.093E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.093E-10	0.0000
Sr-90	1.116E-01	0.9996	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.116E-01	0.9996
Total	1.117E-01	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	1.117E-01	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.1 T« Limit = 0.5 year 11/26/2002 14:18 Page 18
Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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 = 7.600E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 7.600E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	1.050E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.050E-04	0.0004
Pu-239	9.648E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.648E-11	0.0000
Pu-240	6.994E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.994E-10	0.0000
Sr-90	2.535E-01	0.9996	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.535E-01	0.9996
Total	2.536E-01	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	2.536E-01	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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 = 1.600E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 1.600E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	2.081E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.081E-04	0.0005
Pu-239	4.249E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.249E-10	0.0000
Pu-240	3.079E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.079E-09	0.0000
Sr-90	4.367E-01	0.9995	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.367E-01	0.9995
Total	4.369E-01	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	4.369E-01	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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 = 4.200E+01 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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 4.200E+01 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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	4.525E-04	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.525E-04	0.0007
Pu-239	2.867E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.867E-09	0.0000
Pu-240	2.075E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.075E-08	0.0000
Sr-90	6.155E-01	0.9993	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.155E-01	0.9993
Total	6.159E-01	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	6.159E-01	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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 = 4.700E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 4.700E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	4.884E-04	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	4.884E-04	0.0008
Pu-239	3.513E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.513E-09	0.0000
Pu-240	2.541E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.541E-08	0.0000
Sr-90	6.111E-01	0.9992	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.111E-01	0.9992
Total	6.116E-01	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	6.116E-01	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.1 T½ Limit = 0.5 year 11/26/2002 14:18 Page 22
Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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 = 1.370E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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 = 1.370E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	7.411E-04	0.0036	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.411E-04	0.0036
Pu-239	1.395E-08	0.0000	0.000E+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-08	0.0000
Pu-240	1.000E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.000E-07	0.0000
Sr-90	2.068E-01	0.9964	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.068E-01	0.9964
Total	2.076E-01	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	2.076E-01	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.1 T< Limit = 0.5 year 11/26/2002 14:18 Page 23
Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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
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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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
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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	4.975E-04	0.0515	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.975E-04	0.0515
Pu-239	2.822E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.822E-08	0.0000
Pu-240	1.980E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.980E-07	0.0000
Sr-90	9.171E-03	0.9485	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.171E-03	0.9485
Total	9.669E-03	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	9.669E-03	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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-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
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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	1.034E-05	0.9626	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.034E-05	0.9626
Pu-239	5.532E-08	0.0051	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.532E-08	0.0051
Pu-240	3.460E-07	0.0322	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.460E-07	0.0322
Sr-90	6.053E-10	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	6.053E-10	0.0001
Total	1.074E-05	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	1.074E-05	1.0000

*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.RAD

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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
			DSR(j,t) (mrem/yr)/(pCi/g)									
Am-241	Am-241	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	0.000E+00	0.000E+00
Am-241	Np-237	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	0.000E+00	0.000E+00
Am-241	U-233	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	0.000E+00	0.000E+00
Am-241	Th-229	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	0.000E+00	0.000E+00
Am-241	ÄDSR(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	0.000E+00	0.000E+00
0Co-60	Co-60	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	0.000E+00	0.000E+00
0Cs-137	Cs-137	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	0.000E+00	0.000E+00
0Eu-154	Eu-154	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	0.000E+00	0.000E+00
0Eu-155	Eu-155	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	0.000E+00	0.000E+00
0Ni-63	Ni-63	1.000E+00	0.000E+00	1.774E-06	5.270E-06	1.293E-05	2.563E-05	5.573E-05	6.014E-05	9.127E-05	6.127E-05	1.274E-06
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	0.000E+00	0.000E+00
Pu-239	U-235	1.000E+00	0.000E+00	2.011E-10	1.814E-09	1.161E-08	5.112E-08	3.446E-07	4.222E-07	1.667E-06	3.324E-06	6.033E-06
Pu-239	Pa-231	1.000E+00	0.000E+00	1.014E-14	1.005E-13	1.139E-12	1.007E-11	1.760E-10	2.456E-10	3.690E-09	1.844E-08	1.435E-07
Pu-239	Ac-227	1.000E+00	0.000E+00	2.541E-14	1.151E-13	4.294E-13	4.708E-12	1.692E-10	2.563E-10	8.086E-09	5.319E-08	4.809E-07
Pu-239	ÄDSR(j)		0.000E+00	2.011E-10	1.814E-09	1.161E-08	5.113E-08	3.450E-07	4.227E-07	1.679E-06	3.396E-06	6.658E-06
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	0.000E+00	0.000E+00
Pu-240	U-236	1.000E+00	0.000E+00	6.089E-09	5.491E-08	3.515E-07	1.547E-06	1.042E-05	1.277E-05	5.025E-05	9.950E-05	1.739E-04
Pu-240	Th-232	1.000E+00	0.000E+00	0.000E+00	3.559E-18	2.434E-17	8.367E-17	8.364E-16	1.103E-15	1.560E-14	7.768E-14	5.951E-13
Pu-240	Ra-228	1.000E+00	0.000E+00	0.000E+00	3.487E-18	2.088E-17	5.505E-17	5.450E-16	7.270E-16	1.428E-14	7.759E-14	6.256E-13
Pu-240	Th-228	1.000E+00	0.000E+00	0.000E+00	9.766E-19	5.741E-18	1.358E-17	1.275E-16	1.707E-16	3.810E-15	2.141E-14	1.756E-13
Pu-240	ÄDSR(j)		0.000E+00	6.089E-09	5.491E-08	3.515E-07	1.547E-06	1.042E-05	1.277E-05	5.025E-05	9.950E-05	1.739E-04
0Sr-90	Sr-90	1.000E+00	0.000E+00	3.385E-03	9.707E-03	2.205E-02	3.797E-02	5.352E-02	5.314E-02	1.799E-02	7.975E-04	5.263E-11

*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 6 0.5 yr) daughters.

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.RAD

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 4.000E+00 mrem/yr

0Nuclide

(i)	t= 0.000E+00	1.000E+00	3.000E+00	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+12	*3.430E+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	*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	*8.701E+13	*8.701E+13
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	*2.639E+14	*2.639E+14
Eu-155	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14
Ni-63	*5.916E+13	2.255E+06	7.590E+05	3.093E+05	1.561E+05	7.178E+04	6.651E+04	4.383E+04	6.528E+04	3.140E+06
Pu-239	*6.212E+10	1.989E+10	2.205E+09	3.445E+08	7.823E+07	1.160E+07	9.463E+06	2.383E+06	1.178E+06	6.008E+05
Pu-240	*2.277E+11	6.569E+08	7.284E+07	1.138E+07	2.585E+06	3.837E+05	3.132E+05	7.960E+04	4.020E+04	2.301E+04
Sr-90	*1.365E+14	1.182E+03	4.121E+02	1.814E+02	1.053E+02	7.474E+01	7.527E+01	2.224E+02	5.016E+03	7.600E+10

*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 = 41.82 ñ 0.08 years

0Nuclide

(i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Am-241	6.070E-03	0.000E+00	0.000E+00	*3.430E+12	0.000E+00	*3.430E+12
Co-60	7.170E-02	0.000E+00	0.000E+00	*1.131E+15	0.000E+00	*1.131E+15
Cs-137	8.320E-02	0.000E+00	0.000E+00	*8.701E+13	0.000E+00	*8.701E+13
Eu-154	1.620E-01	0.000E+00	0.000E+00	*2.639E+14	0.000E+00	*2.639E+14
Eu-155	9.290E-02	0.000E+00	0.000E+00	*4.651E+14	0.000E+00	*4.651E+14
Ni-63	8.120E+00	137.9 ñ 0.3	9.127E-05	4.382E+04	5.556E-05	7.199E+04
Pu-239	8.310E-03	1.000E+03	6.658E-06	6.008E+05	3.421E-07	1.169E+07
Pu-240	1.990E-03	1.000E+03	1.739E-04	2.301E+04	1.034E-05	3.868E+05
Sr-90	1.150E+01	41.80 ñ 0.08	5.352E-02	7.474E+01	5.352E-02	7.474E+01

*At specific activity limit

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	Am-241	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	0.000E+00	0.000E+00
0Np-237	Am-241	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	0.000E+00	0.000E+00
0U-233	Am-241	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	0.000E+00	0.000E+00
0Th-229	Am-241	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	0.000E+00	0.000E+00
0Co-60	Co-60	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	0.000E+00	0.000E+00
0Cs-137	Cs-137	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	0.000E+00	0.000E+00
0Eu-154	Eu-154	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	0.000E+00	0.000E+00
0Eu-155	Eu-155	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	0.000E+00	0.000E+00
0Ni-63	Ni-63	1.000E+00	0.000E+00	1.440E-05	4.279E-05	1.050E-04	2.081E-04	4.525E-04	4.884E-04	7.411E-04	4.975E-04	1.034E-05
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	0.000E+00	0.000E+00
0U-235	Pu-239	1.000E+00	0.000E+00	1.671E-12	1.507E-11	9.647E-11	4.248E-10	2.864E-09	3.508E-09	1.385E-08	2.762E-08	5.014E-08
0Pa-231	Pu-239	1.000E+00	0.000E+00	8.427E-17	8.353E-16	9.461E-15	8.368E-14	1.463E-12	2.041E-12	3.067E-11	1.532E-10	1.192E-09
0Ac-227	Pu-239	1.000E+00	0.000E+00	2.111E-16	9.565E-16	3.568E-15	3.912E-14	1.406E-12	2.130E-12	6.719E-11	4.420E-10	3.996E-09
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	0.000E+00	0.000E+00
0U-236	Pu-240	1.000E+00	0.000E+00	1.212E-11	1.093E-10	6.994E-10	3.079E-09	2.075E-08	2.541E-08	1.000E-07	1.980E-07	3.460E-07
0Th-232	Pu-240	1.000E+00	0.000E+00	0.000E+00	7.083E-21	4.844E-20	1.665E-19	1.664E-18	2.194E-18	3.104E-17	1.546E-16	1.184E-15
0Ra-228	Pu-240	1.000E+00	0.000E+00	0.000E+00	6.938E-21	4.156E-20	1.096E-19	1.084E-18	1.447E-18	2.841E-17	1.544E-16	1.245E-15
0Th-228	Pu-240	1.000E+00	0.000E+00	0.000E+00	1.943E-21	1.142E-20	2.702E-20	2.537E-19	3.397E-19	7.582E-18	4.261E-17	3.495E-16
0Sr-90	Sr-90	1.000E+00	0.000E+00	3.893E-02	1.116E-01	2.535E-01	4.367E-01	6.155E-01	6.111E-01	2.068E-01	9.171E-03	6.053E-10

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

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Summary : 116-N-3 DZ (Layer 3) File: 116-N-3 DZ Layer 3.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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	6.070E-03	6.060E-03	6.040E-03	5.995E-03	5.914E-03	5.668E-03	5.622E-03	4.855E-03	3.722E-03	1.188E-03
0Np-237	Am-241	1.000E+00	0.000E+00	1.964E-09	5.884E-09	1.485E-08	3.105E-08	7.977E-08	8.891E-08	2.410E-07	4.648E-07	9.567E-07
0U-233	Am-241	1.000E+00	0.000E+00	4.296E-15	3.862E-14	2.472E-13	1.090E-12	7.399E-12	9.239E-12	7.454E-11	3.263E-10	2.543E-09
0Th-229	Am-241	1.000E+00	0.000E+00	1.353E-19	3.649E-18	5.919E-17	5.502E-16	9.833E-15	1.375E-14	3.268E-13	3.191E-12	8.864E-11
0Co-60	Co-60	1.000E+00	7.170E-02	6.286E-02	4.831E-02	2.637E-02	8.730E-03	2.850E-04	1.476E-04	1.059E-09	5.109E-19	0.000E+00
0Cs-137	Cs-137	1.000E+00	8.320E-02	8.129E-02	7.760E-02	6.974E-02	5.739E-02	3.138E-02	2.795E-02	3.459E-03	7.867E-05	6.902E-12
0Eu-154	Eu-154	1.000E+00	1.620E-01	1.497E-01	1.279E-01	8.901E-02	4.592E-02	5.920E-03	3.992E-03	3.322E-06	8.782E-12	9.769E-36
0Eu-155	Eu-155	1.000E+00	9.290E-02	8.078E-02	6.108E-02	3.211E-02	9.926E-03	2.621E-04	1.303E-04	4.484E-10	5.715E-20	0.000E+00
0Ni-63	Ni-63	1.000E+00	8.120E+00	8.060E+00	7.942E+00	7.676E+00	7.213E+00	5.951E+00	5.735E+00	2.946E+00	8.820E-01	4.966E-03
0Pu-239	Pu-239	1.000E+00	8.310E-03	8.310E-03	8.309E-03	8.306E-03	8.303E-03	8.291E-03	8.288E-03	8.247E-03	8.172E-03	7.859E-03
0U-235	Pu-239	1.000E+00	0.000E+00	8.174E-12	2.446E-11	6.159E-11	1.283E-10	3.256E-10	3.621E-10	9.431E-10	1.702E-09	2.855E-09
0Pa-231	Pu-239	1.000E+00	0.000E+00	8.650E-17	7.771E-16	4.967E-15	2.185E-14	1.471E-13	1.833E-13	1.439E-12	6.020E-12	4.043E-11
0Ac-227	Pu-239	1.000E+00	0.000E+00	9.108E-19	2.417E-17	3.779E-16	3.289E-15	4.866E-14	6.576E-14	9.393E-13	4.960E-12	3.839E-11
0Pu-240	Pu-240	1.000E+00	1.990E-03	1.990E-03	1.989E-03	1.988E-03	1.986E-03	1.979E-03	1.978E-03	1.954E-03	1.912E-03	1.742E-03
0U-236	Pu-240	1.000E+00	0.000E+00	5.883E-11	1.760E-10	4.432E-10	9.227E-10	2.340E-09	2.601E-09	6.750E-09	1.209E-08	1.949E-08
0Th-232	Pu-240	1.000E+00	0.000E+00	1.452E-21	1.304E-20	8.336E-20	3.667E-19	2.469E-18	3.078E-18	2.418E-17	1.013E-16	6.851E-16
0Ra-228	Pu-240	1.000E+00	0.000E+00	5.663E-23	1.441E-21	2.058E-20	1.553E-19	1.693E-18	2.193E-18	2.156E-17	9.642E-17	6.770E-16
0Th-228	Pu-240	1.000E+00	0.000E+00	4.807E-24	3.247E-22	9.177E-21	1.020E-19	1.455E-18	1.919E-18	2.070E-17	9.481E-17	6.744E-16
0Sr-90	Sr-90	1.000E+00	1.150E+01	1.123E+01	1.070E+01	9.571E+00	7.813E+00	4.169E+00	3.694E+00	4.200E-01	8.183E-03	3.699E-10

BRF(i) is the branch fraction of the parent nuclide.
0RESCALC.EXE execution time = 3.66 seconds

RESRAD INPUT PARAMETERS FOR OVERBURDEN

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Summary : 116-N-3 Overburden (Run #2) File: 116-N-3 Overburden.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	Am-241	4.440E-01	4.440E-01	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-154	2.860E-04	2.860E-04	DCF2(5)
B-1	Eu-155	4.140E-05	4.140E-05	DCF2(6)
B-1	Ni-63	6.290E-06	6.290E-06	DCF2(7)
B-1	Np-237+D	5.400E-01	5.400E-01	DCF2(8)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(9)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(10)
B-1	Pu-240	4.290E-01	4.290E-01	DCF2(11)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(12)
B-1	Sr-90+D	1.310E-03	1.310E-03	DCF2(13)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(14)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(15)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(16)
B-1	U-233	1.350E-01	1.350E-01	DCF2(17)
B-1	U-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	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	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-154	9.550E-06	9.550E-06	DCF3(5)
D-1	Eu-155	1.530E-06	1.530E-06	DCF3(6)
D-1	Ni-63	5.770E-07	5.770E-07	DCF3(7)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(8)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(9)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(10)
D-1	Pu-240	3.540E-03	3.540E-03	DCF3(11)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(12)
D-1	Sr-90+D	1.530E-04	1.530E-04	DCF3(13)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(14)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(15)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(16)
D-1	U-233	2.890E-04	2.890E-04	DCF3(17)
D-1	U-235+D	2.670E-04	2.670E-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	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)

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Summary : 116-N-3 Overburden (Run #2) File: 116-N-3 Overburden.RAD

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

0 Menu	Parameter	Current Value	Default	Parameter Name
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)
D-34				
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-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	Eu-155 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	Eu-155 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(6,2)
D-34	Eu-155 , 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	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(8,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(8,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(9,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(9,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(9,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(10,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(10,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(10,3)
D-34				
D-34	Pu-240 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(11,1)
D-34	Pu-240 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(11,2)
D-34	Pu-240 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(11,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(12,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(12,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(12,3)
D-34				
D-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(13,1)
D-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(13,2)
D-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(13,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(14,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(14,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(14,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(15,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(15,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(15,3)

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

Menu	Parameter	Current Value	Default	Parameter Name
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(16,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(16,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(16,3)
D-34				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(17,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(17,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(17,3)
D-34				
D-34	U-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	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	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-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	Eu-155 , fish	5.000E+01	5.000E+01	BIOFAC(6,1)
D-5	Eu-155 , 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	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(8,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(8,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(9,2)
D-5				
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(10,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(10,2)
D-5				
D-5	Pu-240 , fish	3.000E+01	3.000E+01	BIOFAC(11,1)
D-5	Pu-240 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(11,2)
D-5				

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

0 Menu	Parameter	Current Value	Default	Parameter Name
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(12,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(12,2)
D-5				
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(13,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(13,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(14,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(14,2)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(15,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(15,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(16,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(16,2)
D-5				
D-5	U-233 , fish	1.000E+01	1.000E+01	BIOFAC(17,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(17,2)
D-5				
D-5	U-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)

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Summary : 116-N-3 Overburden (Run #2) File: 116-N-3 Overburden.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)	2.198E+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)	7.500E+01	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)	7.600E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.600E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	4.200E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	4.700E+01	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.370E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	3.000E+02	0.000E+00	---	T(9)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	7.120E-02	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Co-60	9.460E-02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Eu-154	2.890E-02	0.000E+00	---	S1(5)
R012	Concentration in groundwater (pCi/L): Am-241	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): Eu-154	not used	0.000E+00	---	W1(5)
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)	2.000E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	3.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.500E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.500E+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)	2.000E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	3.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-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

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	1.640E+01	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	2.000E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	3.000E-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	2.500E-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 Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.341E-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	1.733E-04	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	4.341E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
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	4.316E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter 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	1.733E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Eu-155				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.341E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)

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 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	2.884E-04	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for daughter Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.373E-05	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.733E-04	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.341E-05	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for daughter Pu-240				
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	4.341E-05	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	1.000E+02	7.000E+01	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	7.000E+01	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	1.000E+02	7.000E+01	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.676E-05	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for daughter Sr-90				
R016	Contaminated zone (cm**3/g)	1.500E+01	3.000E+01	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	1.500E+01	3.000E+01	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	1.500E+01	3.000E+01	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.743E-04	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)

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 Th-228				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(14,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.341E-05	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for daughter Th-229				
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	4.341E-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	4.341E-05	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	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	4.088E-03	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	4.088E-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	4.088E-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)

0 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)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	0.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	0.000E+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

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	0.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	0.000E+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)	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

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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	257	---	---	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	suppressed
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

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 Summary : 116-N-3 Overburden (Run #2)                 File: 116-N-3 Overburden.RAD

      Contaminated Zone Dimensions            Initial Soil Concentrations, pCi/g
      ÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃ            ÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃ
        Area:  21980.00 square meters              Am-241      7.120E-02
   Thickness:      4.60 meters                     Co-60       9.460E-02
 Cover Depth:      0.00 meters                     Eu-154      2.890E-02
0
                                                 Total Dose TDOSE(t), mrem/yr
                                          Basic Radiation Dose Limit = 1.500E+01 mrem/yr
                        Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
                        ÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃÃ
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Summary : 116-N-3 Overburden (Run #2) File: 116-N-3 Overburden.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.
Am-241	2.065E-03	0.0019	1.383E-03	0.0012	0.000E+00	0.0000	1.460E-02	0.0131	2.649E-04	0.0002	2.876E-05	0.0000	7.561E-03	0.0068
Co-60	9.271E-01	0.8320	8.501E-07	0.0000	0.000E+00	0.0000	1.075E-02	0.0096	1.020E-02	0.0092	2.337E-03	0.0021	6.962E-05	0.0001
Eu-154	1.379E-01	0.1237	3.481E-07	0.0000	0.000E+00	0.0000	3.740E-05	0.0000	1.281E-05	0.0000	3.385E-07	0.0000	7.750E-06	0.0000
Total	1.067E+00	0.9576	1.384E-03	0.0012	0.000E+00	0.0000	2.539E-02	0.0228	1.048E-02	0.0094	2.366E-03	0.0021	7.639E-03	0.0069

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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.591E-02	0.0232
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	9.504E-01	0.8530
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	1.379E-01	0.1238
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	1.114E+00	1.0000

*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 Overburden (Run #2) File: 116-N-3 Overburden.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-	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.
Am-241	2.062E-03	0.0021	1.381E-03	0.0014	0.000E+00	0.0000	1.458E-02	0.0148	2.645E-04	0.0003	2.871E-05	0.0000	7.549E-03	0.0077
Co-60	8.127E-01	0.8238	7.452E-07	0.0000	0.000E+00	0.0000	9.423E-03	0.0096	8.940E-03	0.0091	2.048E-03	0.0021	6.103E-05	0.0001
Eu-154	1.274E-01	0.1292	3.217E-07	0.0000	0.000E+00	0.0000	3.457E-05	0.0000	1.184E-05	0.0000	3.128E-07	0.0000	7.162E-06	0.0000
Total	9.422E-01	0.9551	1.382E-03	0.0014	0.000E+00	0.0000	2.404E-02	0.0244	9.216E-03	0.0093	2.078E-03	0.0021	7.617E-03	0.0077

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-	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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.586E-02	0.0262
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	8.332E-01	0.8446
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	1.275E-01	0.1292
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	9.865E-01	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 116-N-3 Overburden (Run #2) File: 116-N-3 Overburden.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.
Am-241	2.055E-03	0.0027	1.376E-03	0.0018	0.000E+00	0.0000	1.453E-02	0.0188	2.636E-04	0.0003	2.861E-05	0.0000	7.524E-03	0.0097
Co-60	6.245E-01	0.8059	5.726E-07	0.0000	0.000E+00	0.0000	7.241E-03	0.0093	6.870E-03	0.0089	1.574E-03	0.0020	4.690E-05	0.0001
Eu-154	1.089E-01	0.1405	2.748E-07	0.0000	0.000E+00	0.0000	2.953E-05	0.0000	1.011E-05	0.0000	2.672E-07	0.0000	6.118E-06	0.0000
Total	7.355E-01	0.9490	1.377E-03	0.0018	0.000E+00	0.0000	2.180E-02	0.0281	7.144E-03	0.0092	1.603E-03	0.0021	7.577E-03	0.0098

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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.578E-02	0.0333
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	6.403E-01	0.8262
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	1.089E-01	0.1405
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	7.750E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 7.600E+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.
Am-241	2.039E-03	0.0045	1.366E-03	0.0030	0.000E+00	0.0000	1.442E-02	0.0320	2.616E-04	0.0006	2.840E-05	0.0001	7.467E-03	0.0166
Co-60	3.408E-01	0.7561	3.125E-07	0.0000	0.000E+00	0.0000	3.951E-03	0.0088	3.749E-03	0.0083	8.590E-04	0.0019	2.559E-05	0.0001
Eu-154	7.575E-02	0.1681	1.912E-07	0.0000	0.000E+00	0.0000	2.055E-05	0.0000	7.037E-06	0.0000	1.860E-07	0.0000	4.258E-06	0.0000
Total	4.186E-01	0.9286	1.367E-03	0.0030	0.000E+00	0.0000	1.840E-02	0.0408	4.018E-03	0.0089	8.876E-04	0.0020	7.497E-03	0.0166

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 7.600E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.559E-02	0.0568
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	3.494E-01	0.7751
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	7.579E-02	0.1681
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	4.508E-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 = 1.600E+01 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.
Am-241	2.012E-03	0.0112	1.347E-03	0.0075	0.000E+00	0.0000	1.423E-02	0.0791	2.581E-04	0.0014	2.801E-05	0.0002	7.365E-03	0.0409
Co-60	1.128E-01	0.6267	1.034E-07	0.0000	0.000E+00	0.0000	1.307E-03	0.0073	1.240E-03	0.0069	2.842E-04	0.0016	8.468E-06	0.0000
Eu-154	3.907E-02	0.2172	9.863E-08	0.0000	0.000E+00	0.0000	1.060E-05	0.0001	3.630E-06	0.0000	9.592E-08	0.0000	2.196E-06	0.0000
Total	1.538E-01	0.8550	1.347E-03	0.0075	0.000E+00	0.0000	1.554E-02	0.0864	1.502E-03	0.0083	3.123E-04	0.0017	7.376E-03	0.0410

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.600E+01 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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.524E-02	0.1403
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	1.156E-01	0.6425
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	3.909E-02	0.2173
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	1.799E-01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.200E+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.
Am-241	1.928E-03	0.0584	1.291E-03	0.0391	0.000E+00	0.0000	1.363E-02	0.4133	2.475E-04	0.0075	2.684E-05	0.0008	7.056E-03	0.2139
Co-60	3.675E-03	0.1114	3.370E-09	0.0000	0.000E+00	0.0000	4.261E-05	0.0013	4.043E-05	0.0012	9.264E-06	0.0003	2.760E-07	0.0000
Eu-154	5.035E-03	0.1526	1.271E-08	0.0000	0.000E+00	0.0000	1.366E-06	0.0000	4.677E-07	0.0000	1.236E-08	0.0000	2.830E-07	0.0000
Total	1.064E-02	0.3225	1.291E-03	0.0391	0.000E+00	0.0000	1.368E-02	0.4146	2.884E-04	0.0087	3.611E-05	0.0011	7.057E-03	0.2139

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.200E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.418E-02	0.7331
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	3.768E-03	0.1142
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	5.037E-03	0.1527
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	3.299E-02	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 = 4.700E+01 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.
Am-241	1.912E-03	0.0652	1.280E-03	0.0436	0.000E+00	0.0000	1.352E-02	0.4610	2.455E-04	0.0084	2.662E-05	0.0009	6.998E-03	0.2386
Co-60	1.903E-03	0.0649	1.745E-09	0.0000	0.000E+00	0.0000	2.206E-05	0.0008	2.093E-05	0.0007	4.796E-06	0.0002	1.429E-07	0.0000
Eu-154	3.395E-03	0.1158	8.570E-09	0.0000	0.000E+00	0.0000	9.209E-07	0.0000	3.154E-07	0.0000	8.335E-09	0.0000	1.908E-07	0.0000
Total	7.210E-03	0.2458	1.280E-03	0.0436	0.000E+00	0.0000	1.354E-02	0.4618	2.667E-04	0.0091	3.142E-05	0.0011	6.999E-03	0.2386

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.700E+01 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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.398E-02	0.8177
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	1.951E-03	0.0665
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	3.397E-03	0.1158
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	2.933E-02	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 = 1.370E+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.
Am-241	1.650E-03	0.0797	1.104E-03	0.0533	0.000E+00	0.0000	1.167E-02	0.5638	2.122E-04	0.0103	2.296E-05	0.0011	6.034E-03	0.2916
Co-60	1.357E-08	0.0000	1.244E-14	0.0000	0.000E+00	0.0000	1.574E-10	0.0000	1.493E-10	0.0000	3.421E-11	0.0000	1.019E-12	0.0000
Eu-154	2.821E-06	0.0001	7.122E-12	0.0000	0.000E+00	0.0000	7.653E-10	0.0000	2.621E-10	0.0000	6.926E-12	0.0000	1.586E-10	0.0000
Total	1.653E-03	0.0799	1.104E-03	0.0533	0.000E+00	0.0000	1.167E-02	0.5638	2.122E-04	0.0103	2.296E-05	0.0011	6.034E-03	0.2916

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.370E+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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.069E-02	0.9999
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	1.391E-08	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	2.823E-06	0.0001
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	2.069E-02	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+02 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.
Am-241	1.264E-03	0.0798	8.440E-04	0.0533	0.000E+00	0.0000	8.937E-03	0.5642	1.632E-04	0.0103	1.756E-05	0.0011	4.614E-03	0.2913
Co-60	6.477E-18	0.0000	5.939E-24	0.0000	0.000E+00	0.0000	7.509E-20	0.0000	7.124E-20	0.0000	1.633E-20	0.0000	4.864E-22	0.0000
Eu-154	7.438E-12	0.0000	1.878E-17	0.0000	0.000E+00	0.0000	2.018E-15	0.0000	6.909E-16	0.0000	1.826E-17	0.0000	4.181E-16	0.0000
Total	1.264E-03	0.0798	8.440E-04	0.0533	0.000E+00	0.0000	8.937E-03	0.5642	1.632E-04	0.0103	1.756E-05	0.0011	4.614E-03	0.2913

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
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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.584E-02	1.0000
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	6.640E-18	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	7.442E-12	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	1.584E-02	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+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.
Am-241	4.056E-04	0.0802	2.667E-04	0.0527	0.000E+00	0.0000	2.868E-03	0.5670	5.430E-05	0.0107	5.577E-06	0.0011	1.458E-03	0.2882
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
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
Total	4.056E-04	0.0802	2.667E-04	0.0527	0.000E+00	0.0000	2.868E-03	0.5670	5.430E-05	0.0107	5.577E-06	0.0011	1.458E-03	0.2882

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.
Am-241	0.000E+00	0.0000	5.590E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.058E-03	1.0000
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
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
Total	0.000E+00	0.0000	5.590E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.058E-03	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 Product Branch DSR(j,t) (mrem/yr)/(pCi/g)

(i)	(j)	Fraction*	t= 0.000E+00	1.000E+00	3.000E+00	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	3.639E-01	3.633E-01	3.621E-01	3.593E-01	3.544E-01	3.395E-01	3.368E-01	2.904E-01	2.220E-01	7.008E-02
Am-241	Np-237	1.000E+00	9.385E-07	2.924E-06	6.907E-06	1.602E-05	3.247E-05	8.195E-05	9.122E-05	2.454E-04	4.713E-04	9.595E-04
Am-241	U-233	1.000E+00	2.505E-14	1.431E-13	6.710E-13	3.340E-12	1.330E-11	8.272E-11	1.022E-10	7.206E-10	2.573E-09	1.766E-08
Am-241	Th-229	1.000E+00	8.814E-18	1.271E-16	1.458E-15	1.756E-14	1.459E-13	2.395E-12	3.319E-12	7.075E-11	5.911E-10	9.651E-09
Am-241	ΣDSR(j)		3.639E-01	3.633E-01	3.621E-01	3.594E-01	3.544E-01	3.396E-01	3.369E-01	2.906E-01	2.225E-01	7.104E-02
0Co-60	Co-60	1.000E+00	1.005E+01	8.807E+00	6.768E+00	3.693E+00	1.222E+00	3.983E-02	2.062E-02	1.471E-07	7.019E-17	0.000E+00
0Eu-154	Eu-154	1.000E+00	4.773E+00	4.412E+00	3.768E+00	2.622E+00	1.353E+00	1.743E-01	1.175E-01	9.767E-05	2.575E-10	2.831E-34

*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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	4.122E+01	4.129E+01	4.143E+01	4.174E+01	4.232E+01	4.417E+01	4.453E+01	5.162E+01	6.743E+01	2.112E+02
Co-60	1.493E+00	1.703E+00	2.216E+00	4.061E+00	1.228E+01	3.766E+02	7.274E+02	1.020E+08	*1.131E+15	*1.131E+15
Eu-154	3.143E+00	3.400E+00	3.981E+00	5.720E+00	1.109E+01	8.606E+01	1.276E+02	1.536E+05	5.825E+10	*2.639E+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)
Am-241	7.120E-02	0.000E+00	3.639E-01	4.122E+01	3.639E-01	4.122E+01
Co-60	9.460E-02	0.000E+00	1.005E+01	1.493E+00	1.005E+01	1.493E+00
Eu-154	2.890E-02	0.000E+00	4.773E+00	3.143E+00	4.773E+00	3.143E+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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	2.591E-02	2.586E-02	2.578E-02	2.559E-02	2.523E-02	2.418E-02	2.398E-02	2.067E-02	1.581E-02	4.990E-03
0Np-237	Am-241	1.000E+00	6.682E-08	2.082E-07	4.918E-07	1.140E-06	2.312E-06	5.835E-06	6.495E-06	1.747E-05	3.356E-05	6.832E-05
0U-233	Am-241	1.000E+00	1.784E-15	1.019E-14	4.777E-14	2.378E-13	9.469E-13	5.890E-12	7.280E-12	5.131E-11	1.832E-10	1.258E-09
0Th-229	Am-241	1.000E+00	6.275E-19	9.048E-18	1.038E-16	1.250E-15	1.038E-14	1.705E-13	2.363E-13	5.038E-12	4.209E-11	6.872E-10
0Co-60	Co-60	1.000E+00	9.504E-01	8.332E-01	6.403E-01	3.494E-01	1.156E-01	3.768E-03	1.951E-03	1.391E-08	6.640E-18	0.000E+00
0Eu-154	Eu-154	1.000E+00	1.379E-01	1.275E-01	1.089E-01	7.579E-02	3.909E-02	5.037E-03	3.397E-03	2.823E-06	7.442E-12	0.000E+00

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	7.600E+00	1.600E+01	4.200E+01	4.700E+01	1.370E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	7.120E-02	7.108E-02	7.085E-02	7.031E-02	6.935E-02	6.644E-02	6.590E-02	5.682E-02	4.344E-02	1.371E-02
0Np-237	Am-241	1.000E+00	0.000E+00	2.304E-08	6.901E-08	1.742E-07	3.641E-07	9.352E-07	1.042E-06	2.822E-06	5.429E-06	1.106E-05
0U-233	Am-241	1.000E+00	0.000E+00	5.033E-14	4.512E-13	2.870E-12	1.252E-11	8.210E-11	1.018E-10	7.318E-10	2.627E-09	1.014E-08
0Th-229	Am-241	1.000E+00	0.000E+00	1.585E-18	4.267E-17	6.890E-16	6.350E-15	1.106E-13	1.538E-13	3.350E-12	2.816E-11	4.573E-10
0Co-60	Co-60	1.000E+00	9.460E-02	8.293E-02	6.373E-02	3.478E-02	1.151E-02	3.750E-04	1.942E-04	1.385E-09	6.609E-19	0.000E+00
0Eu-154	Eu-154	1.000E+00	2.890E-02	2.671E-02	2.281E-02	1.588E-02	8.190E-03	1.055E-03	7.116E-04	5.913E-07	1.559E-12	1.714E-36

BRF(i) is the branch fraction of the parent nuclide.
0RESCALC.EXE execution time = 2.34 seconds

CALCULATION BRIEF EXCERPTS

DISCLAIMER FOR CALCULATIONS

The calculations that are provided in the following appendix are included for reference only. Use of these calculations by persons who do not have access to all of their pertinent factors could lead to incorrect conclusions or assumptions.

Before applying these calculations to work activities or projects outside the context of this report, these calculations must be thoroughly reviewed with appropriate and authorized Hanford Site ERC personnel. Without this review, the ER Project cannot assume any responsibility for the use of these calculations.

CALCULATION BRIEFS

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

116-N-3 Trench Shallow Zone Variance Calculation, Calculation No. 0100N-CA-V0041, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

116-N-3 Crib Shallow Zone Pilot Study Sample Variance Calculation, Calculation No. 0100N-CA-V0053, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

116-N-3 Trench Pilot Study (Variance) Sampling to Support Statement #3 Sample Design, Calculation No. 0100N-CA-V0030, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.[a]

Cleanup Verification Sampling of Overburden from the 116-N-3 to 116-N-1 Pipeline and Bypass Corridor, Calculation No. 0100N-CA-V0048, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

Shallow and Deep Zone Sample Design for the 116-N-3 Trench, Calculation No. 0100N-CA-V0040, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

116-N-3 Crib Variance and Closeout Sample Design, Calculation No. 0100N-CA-V0049, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

116-N-3 to 116-N-1 Pipeline and Bypass Corridor Sample Design, Calculation No. 0100N-CA-V0044, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification 95% UCL Calculations, Calculation No. 0100N-CA-V0058, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

116-N-3 Combined Trench, Crib, and Pipeline RESRAD Calculation, Calculation No. 0100N-CA-V0059, Rev. 2, Bechtel Hanford, Inc., Richland, Washington.

116-N-3 Combined Trench, Crib, and Pipeline Comparison to Drinking Water Standards, Calculation No. 0100N-CA-V0060, Rev. 0, Bechtel Hanford, Inc., Richland, Washington

[a] This sample design calculation brief was originally designated for the purpose of collecting variance samples from the bottom of the 116-N-3 Trench. These samples were ultimately used for verification samples in order to obtain deep zone gamma analyses for the 95% UCL calculation.

NOTE: The calculation briefs referenced in this appendix are kept in the active Environmental Restoration Contractor 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:	100-N Remedial Action	**Job No.**	22192
Area	100-N Remedial Action		
Discipline	Environmental	***Calc. No.**	0100N-CA-V0041
Subject	116-N-3 Trench Shallow Zone Variance Calculation		
Computer Program	Excel	**Program No.**	Excel 97

Committed Calculation ☒ **Preliminary** **Superseded**

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover - 1 Calculations - 3 Total - 4	SW Callison 7/23/01 S. W. Callison	P G Doctor 7/24/01 P. G. Doctor	K E Cook 7/24/01 K. E. Cook	DFO D. F. Obenauer D. F. Obenauer	7/25/01

SUMMARY OF REVISIONS

Scanned	Rev.	Date	Bar Code No.

* Obtain Calc. No. from DIS.

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator	S. W. Callison SWC	Date	7/23/01	Calc. No.	0100N-CA-V0041	Rev. No.	0
Project	100-N Remedial Action	Job No.	22192	Checked	P. G. Doctor PGD	Date	7/29/01
Subject	116-N-3 Trench Shallow Zone Variance Calculation					Sheet No.	1 of 3

Problem:
Calculate the number of closeout samples required for 116-N-3 Trench verification sampling as required in "Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout" (DOE/RL-2000-07, Rev 0).

Given:
1) Sample locations for the 116-N-3 Trench are identified on the Shallow Zone Sample Design for the 116-N-3 Trench, Calculation number 0100N-CA-V0039, Rev. 0.
2) Lookup values from Remedial Design Report/Remedial Action Work Plan (RDR/RAWP) for the 100-NR-1 Treatment, Storage, and Disposal Units (DOE/RL-2000-16, Rev 1).
3) Gamma Energy Analysis (GEA) results from analysis conducted by Eberline Services Laboratory.

Solution:
Calculation methodology is described in Appendix B of DOE/RL-2000-07, Rev. 0 (SAP) and is based on consultation with the project statistician (P. G. Doctor) as the SAP specifies. The Rev. 0 SAP, Appendix B, equation B-2 (for calculation of the required number of closeout verification samples) contains an error. Equation B-2 should read:

$$n_d = sigma^2 (2.487/(C_s-\mu_1))^2 + (1/2)(1.645)^2$$

Where
n_d = required number of closeout verification samples.
sigma = standard deviation.
C_s = cleanup standard or lookup value from the RDR/RAWP.
μ_1 = mean concentration from the variance sample analyses.

The correct formula will be reflected in Rev. 1 of the SAP. The Excel ROUNDUP function is used in the calculation to round up to the nearest integer.

Data from attached worksheets are used to calculate the required number of closeout samples. Variance is calculated with data from cesium-137, cobalt-60, europium-152, europium-154, and europium-155. These analytes were selected for the variance calculations because they are primary contaminants of concern. Europium-152 is not a contaminant of concern for the 116-N-3 site, but was analyzed for by the laboratory along with the other europium radionuclides and is included in this calc. brief for completeness. The europium 152 lookup value is from the "100 Area Remedial Action Sampling and Analysis Plan" (DOE/RL-96-22). The basic premise of the sample design is that these radionuclides are the predominant components of the contamination and are adequately representative of the overall contaminant distribution for this variance assessment.

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

Conclusion:
The required number of samples (3 samples - rounded up to nearest integer) for each decision unit is less than the default number (10 samples) specified in the DOE/RL-2000-07, Rev 0. Therefore, the default number of 10 samples will be collected from the trench shallow zone decision unit.

CALCULATION SHEET

Bechtel Hanford, Inc.

Originator	S. W. Callison SWC	Date 7/23/01	Calc. No. 0100N-CA-V0041		Rev. No. 0
Project	100-N Remedial Action	Job No. 22192	Checked P. G. Doctor PGD		Date 7/24/01
Subject	116-N-3 Trench Shallow Zone 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 pa
Each value is reflective of the specific analyte evaluated.
The highest value of the evaluations is used to determine the required number samples as compared against the default of ten.
Sample locations are from Calculation 0100N-CA-V0039.
Number of Samples formula is from DOE/RL-2000-07, Appendix B.

Decision Unit: **Shallow Zone**

Samples values from cesium-137, cobalt-60, europium-152, europium-154, and europium-155 analysis in pCi/g.

			Constituent															
Sample #	Sample Date	Location	Co-60 (pCi/g)			Cs-137 (pCi/g)			Eu-152 (pCi/g)			Eu-154 (pCi/g)			Eu-155 (pCi/g)		
			Result	Q	MDA	Result	Q	MDA	Result	Q	MDA	Result	Q	MDA	Result	Q	MDA
Look-up Value==>			1.4			6.1			3.3			3.1			127		
B124H5	06/21/2001	B-17	0.053	U	0.053	0.043	U	0.043	0.088	U	0.088	0.16	U	0.16	0.069	U	0.069
B124H6	06/21/2001	B-02	0.077		0.03	0.049	J	0.024	0.056	U	0.056	0.088	U	0.088	0.054	U	0.054
B124H7	06/21/2001	B-08	0.049	U	0.049	0.046	U	0.046	0.1	U	0.1	0.16	U	0.16	0.11	U	0.11
B124H8	06/21/2001	B-20	0.028	U	0.028	0.023	U	0.023	0.058	U	0.058	0.099	U	0.099	0.079	U	0.079
B124H9	06/21/2001	B-10	0.05	U	0.05	0.038	U	0.038	0.097	U	0.097	0.17	U	0.17	0.071	U	0.071
B124J0	06/21/2001	B-23	0.03	U	0.03	0.028	U	0.028	0.072	U	0.072	0.12	U	0.12	0.076	U	0.076
B124J1	06/21/2001	B-05	0.215		0.029	0.158		0.026	0.053	U	0.053	0.08	U	0.08	0.046	U	0.046
B124J2	06/21/2001	B-21	0.089		0.023	0.07	J	0.025	0.052	U	0.052	0.071	U	0.071	0.068	U	0.068
B124J3	06/21/2001	B-29	0.138		0.03	0.076	J	0.026	0.057	U	0.057	0.095	U	0.095	0.081	U	0.081
B124J4	06/21/2001	B-06	0.059	U	0.059	0.05	U	0.05	0.11	U	0.11	0.17	U	0.17	0.11	U	0.11
B124J5	06/21/2001	B-07	0.022	U	0.022	0.02	U	0.02	0.05	U	0.05	0.074	U	0.074	0.061	U	0.061
B124J6	06/21/2001	B-15	0.043	U	0.043	0.044	U	0.044	0.094	U	0.094	0.15	U	0.15	0.1	U	0.1
B124J7	06/30/2001	B-04	2.55		0.07	2.72		0.1	0.17	U	0.17	0.21	U	0.21	0.1	U	0.1
B124J8	06/30/2001	B-24	0.163		0.065	0.079	U	0.079	0.12	U	0.12	0.19	U	0.19	0.13	U	0.13
B124J9	06/30/2001	B-16	0.166		0.066	0.394		0.062	0.11	U	0.11	0.15	U	0.15	0.11	U	0.11
B124K0	06/30/2001	B-14	0.031	U	0.031	0.024	U	0.024	0.062	U	0.062	0.084	U	0.084	0.074	U	0.074
B124K1	06/30/2001	B-26	0.052	U	0.052	0.049	U	0.049	0.11	U	0.11	0.19	U	0.19	0.15	U	0.15
B124K2	06/30/2001	B-11	0.033	U	0.033	0.025	U	0.025	0.06	U	0.06	0.088	U	0.088	0.059	U	0.059
B124K3	06/30/2001	B-12	0.041	U	0.041	0.031	U	0.031	0.084	U	0.084	0.13	U	0.13	0.094	U	0.094
B124K4	06/30/2001	B-13	0.22		0.043	0.184		0.046	0.081	U	0.081	0.15	U	0.15	0.061	U	0.061
B124K5	06/30/2001	B-01	0.057	U	0.057	0.041	U	0.041	0.079	U	0.079	0.14	U	0.14	0.078	U	0.078
B124K6	06/30/2001	B-03	0.074	U	0.074	0.26	U	0.26	0.14	U	0.14	0.22	U	0.22	0.16	U	0.16
B124K7	06/12/2001	B-28	0.08		0.038	0.06	J	0.039	0.097	U	0.097	0.13	U	0.13	0.089	U	0.089
B124K8	06/12/2001	B-27	0.025	U	0.025	0.021	U	0.021	0.046	U	0.046	0.079	U	0.079	0.062	U	0.062
B124K9	06/12/2001	B-30	0.523		0.036	0.401		0.044	0.083	U	0.083	0.11	U	0.11	0.12	U	0.12
B124L0	06/12/2001	B-18	0.04	U	0.04	0.036	U	0.036	0.087	U	0.087	0.12	U	0.12	0.13	U	0.13
B124L1	06/12/2001	B-09	0.043	U	0.043	0.034	U	0.034	0.076	U	0.076	0.12	U	0.12	0.064	U	0.064
B124L2	06/12/2001	B-25	0.12	U	0.12	0.052	U	0.052	0.11	U	0.11	0.18	U	0.18	0.085	U	0.085
B124L3	06/12/2001	B-19	0.077		0.025	0.042	J	0.022	0.046	U	0.046	0.076	U	0.076	0.061	U	0.061
B124L4	06/12/2001	B-22	0.068		0.035	0.033	U	0.033	0.082	U	0.082	0.11	U	0.11	0.12	U	0.12
Mean==========>			0.174			0.171			0.084			0.130			0.089		
Standard Deviation=>			0.459			0.492			0.029			0.043			0.029		
Number of Samples>			3			2			2			2			2		

CALCULATION SHEET

Bechtel Hanford, Inc.

Originator	S. W. Callison SWC	Date 7/23/01	Calc. No. 0100N-CA-V0041	Rev. No. 0
Project	100-N Remedial Action	Job No. 22192	Checked P. G. Doctor	Date 7/24/01
Subject	116-N-3 Variance Calculation			Sheet No. 3 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 evaluations is used to determine the required number samples as compared against the default of ten.
Sample locations are from Calculation 0100N-CA-V0039.
Number of Samples formula is from DOE/RL-2000-07, Appendix B.

Decision Unit: **Shallow Zone**

Samples values from cesium-137, cobalt-60, europium-152, europium-154, and europium-155 analysis in pCi/g.

Sample #	Sample Date	Location	Co-60 (pCi/g) Result	Q	MDA
Look-up Value===>			**1.4**		
B124H5	06/21/2001	B-17	0.053	U	0.053
B124H6	06/21/2001	B-02	0.077		0.03
B124H7	06/21/2001	B-08	0.049	U	0.049
B124H8	06/21/2001	B-20	0.028	U	0.028
B124H9	06/21/2001	B-10	0.05	U	0.05
B124J0	06/21/2001	B-23	0.03	U	0.03
B124J1	06/21/2001	B-05	0.215		0.029
B124J2	06/21/2001	B-21	0.089		0.023
B124J3	06/21/2001	B-29	0.138		0.03
B124J4	06/21/2001	B-06	0.059	U	0.059
B124J5	06/21/2001	B-07	0.022	U	0.022
B124J6	06/21/2001	B-15	0.043	U	0.043
B124J7	06/30/2001	B-04	2.55		0.07
B124J8	06/30/2001	B-24	0.163		0.065
B124J9	06/30/2001	B-16	0.166		0.066
B124K0	06/30/2001	B-14	0.031	U	0.031
B124K1	06/30/2001	B-26	0.052	U	0.052
B124K2	06/30/2001	B-11	0.033	U	0.033
B124K3	06/30/2001	B-12	0.041	U	0.041
B124K4	06/30/2001	B-13	0.22		0.043
B124K5	06/30/2001	B-01	0.057	U	0.057
B124K6	06/30/2001	B-03	0.074	U	0.074
B124K7	06/12/2001	B-28	0.08		0.038
B124K8	06/12/2001	B-27	0.025	U	0.025
B124K9	06/12/2001	B-30	0.523		0.036
B124L0	06/12/2001	B-18	0.04	U	0.04
B124L1	06/12/2001	B-09	0.043	U	0.043
B124L2	06/12/2001	B-25	0.12	U	0.12
B124L3	06/12/2001	B-19	0.077		0.025
B124L4	06/12/2001	B-22	0.068		0.035

Mean=========>	=AVERAGE(E21:E50)
Standard Deviation=>	=STDEV(E21:E50)
Number of Samples>	=ROUNDUP(((E53^2)*((2.487/(E20-E52))^2)+1.353),0)

CALCULATION COVER SHEET

Project Title:	100-NR-1 TSD Sites	**Job No.**	22192
Area	100-N Remedial Action		
Discipline	Environmental	***Calc. No.**	0100N-CA-V0053
Subject	116-N-3 Crib Shallow Zone Pilot Study Sample Variance		
Computer Program	Excel	**Program No.**	Excel 97

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover - 1 Calculations - 3 Total - 4	J.S. Thomson 4/15/02 J. E. Thomson	4/15/02 P. G. Doctor	KEC 4/15/02 K. E. Cook	D.F. Obenauer D. F. Obenauer	4/15/02
1	Cover - 1 Calculations-3 Total - 4	5/13/02 J.E. Thomson	P.G. Doctor	S.E. Parnell for KEC K.E. Cook	D.F. Obenauer D.F. Obenauer	4/5/02

SUMMARY OF REVISIONS

This calculation was revised to improve readability of calculation sheet (3), and to correct page-numbering error on page (3). For convenience, page (3) has been replaced in its entirety.

Scanned	Rev.	Date	Bar Code No.

* Obtain Calc. No. from DIS.

CALCULATION SHEET

Bechtel Hanford Inc.

Originator	J. E. Thomson	Date 4/15/02	Calc. No. 0100N-CA-V0053	Rev. No. 0	
Project	100-NR-1 TSD Sit	Job No. 22192	Checked	Date 4/15/02	
Subject	116-N-3 Crib Shallow Zone Pilot Study Sample Variance			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 evaluations is used to determine the required number of samples as compared to the default number of ten.
Sample locations are from Calculation 0100N-CA-V0049.
Number of Samples formulas are from the SAP, Appendix B (DOE-RL, 2000).

Decision Unit: Shallow Zone
Sample values from GEA analysis

Sample #	Sample Date and Time	Location	Am241 pCi/g	Q	Co60 pCi/g	Q	Cs137 pCi/g	Q	Eu152 pCi/g	Q	Eu154 pCi/g	Q	Eu155 pCi/g	Q
Look-up Value ==========>			416		14		6.1		3.3		3.1		127.0	
B14601	3/13/2002 14:57	Shallow Zone sample point: VSZ-01	0.25	U	0.068	U	0.073	U	0.15	U	0.23	U	0.17	U
B14602	3/13/2002 9:55	Shallow Zone sample point: VSZ-02	0.3	U	1.00		0.243		0.18	U	0.23	U	0.19	U
B14603	3/13/2002 13:29	Shallow Zone sample point: VSZ-03	0.21	U	1.26		0.55		0.23	U	0.27	U	0.22	U
B14604	3/14/2002 8:52	Shallow Zone sample point: VSZ-03	0.059	U	0.032	U	0.021	J	0.03	U	0.043	U	0.04	U
B14605	3/13/2002 13:21	Shallow Zone sample point: VSZ-05	0.033	U	0.024	U	0.026	U	0.06	U	0.09	U	0.06	U
B14606	3/18/2002 10:33	Shallow Zone sample point: VSZ-06	0.22	U	0.041	U	0.06	J	0.08	U	0.12	U	0.11	U
B14607	3/13/2002 13:35	Shallow Zone sample point: VSZ-07	0.07	U	0.913		0.453		0.18	U	0.22	U	0.15	U
B14608	3/13/2002 9:48	Shallow Zone sample point: VSZ-08	0.23	U	0.864		1.8		0.26	U	0.30	U	0.24	U
B14609	3/13/2002 10:00	Shallow Zone sample point: VSZ-09	0.16	U	0.071	U	0.053	U	0.12	U	0.19	U	0.12	U
B14610	3/14/2002 8:57	Shallow Zone sample point: VSZ-10	0.32	U	0.100	U	0.139		0.19	U	0.25	U	0.2	U
B14611	3/18/2002 10:25	Shallow Zone sample point: VSZ-11	0.04	U	0.142		0.23		0.07	U	0.091	U	0.064	U
B14612	3/14/2002 8:25	Shallow Zone sample point: VSZ-12	0.062	U	0.083	U	0.076	U	0.170	U	0.24	U	0.14	U
B14613	3/18/2002 10:37	Shallow Zone sample point: VSZ-13	0.14	U	0.057	U	0.201		0.099	U	0.16	U	0.11	U
B14614	3/14/2002 8:44	Shallow Zone sample point: VSZ-14	0.230	U	0.15	U	0.13	U	0.24	U	0.38	U	0.23	U
B14615	3/14/2002 8:10	Shallow Zone sample point: VSZ-15	0.11	U	0.841		0.757		0.08	U	0.083	U	0.07	U
B14616	3/14/2002 8:32	Shallow Zone sample point: VSZ-16	0.072	U	0.079	U	0.079	U	0.18	U	0.26	U	0.16	U
B14617	3/13/2002 13:17	Shallow Zone sample point: VSZ-17	0.46	U	3.44		8.240		0.33	U	0.27	U	0.28	U
B14618	3/13/2002 15:00	Shallow Zone sample point: VSZ-18	0.031	U	0.042	U	0.033	U	0.079	U	0.14	U	0.049	U
B14619	3/18/2002 10:30	Shallow Zone sample point: VSZ-19	0.016	U	0.022	J	0.044	J	0.029	U	0.05	U	0.029	U
B14620	3/13/2002 13:06	Shallow Zone sample point: VSZ-20	0.12	U	0.231		0.187		0.073	U	0.099	U	0.075	U
B14621	3/13/2002 10:05	Shallow Zone sample point: VSZ-21	0.014	U	0.015	U	0.010	U	0.024	U	0.034	U	0.041	U
B14622	3/13/2002 13:00	Shallow Zone sample point: VSZ-22	0.11	U	0.708		0.372		0.25	U	0.36	U	0.16	U
B14623	3/13/2002 13:12	Shallow Zone sample point: VSZ-23	0.32	U	0.170	U	0.084	U	0.19	U	0.26	U	0.2	U
B14624	3/13/2002 9:44	Shallow Zone sample point: VSZ-24	0.15	U	0.109		0.214		0.11	U	0.16	U	0.12	U
B14625	3/13/2002 13:39	Shallow Zone sample point: VSZ-25	0.08	U	0.774		0.395		0.2	U	0.33	U	0.12	U
B14626	3/13/2002 13:23	Shallow Zone sample point: VSZ-26	0.26	U	0.434		0.066	J	0.15	U	0.24	U	0.16	U
B14627	3/18/2002 10:20	Shallow Zone sample point: VSZ-27	0.052	U	0.276		0.618		0.04	U	0.053	U	0.041	U
B14628	3/14/2002 8:36	Shallow Zone sample point: VSZ-28	0.058	U	0.075	U	0.063	U	0.15	U	0.2	U	0.13	U
B14629	3/14/2002 14:53	Shallow Zone sample point: VSZ-29	0.12	U	0.091	U	0.052	U	0.13	U	0.18	U	0.11	U
B14630	3/18/2002 10:48	Shallow Zone sample point: VSZ-30	0.1	U	1.7		0.519		0.036	U	0.048	U	0.079	U
Mean ==========>			0.15		0.46		0.53		0.14		0.19		0.13	
Standard Deviation (S) ==========>			0.11		0.71		1.50		0.08		0.10		0.07	
α (5%) ==========>			1.645		1.645		1.645		1.645		1.645		1.645	
β (20%) ==========>			0.842		0.842		0.842		0.842		0.842		0.842	
Number of Samples ==========>			2		5		2		2		2		2	

CALCULATION SHEET

Bechtel Hanford Inc.

Originator J. E. Thomson — Date 5/13/02 — Calc. No. 0100N-CA-V0053 — Rev. No. 1

Project 100-NR-1 TSD Sites — Job No. 22192 — Checked [illegible] — Date 5/15/02

Subject 116-N-3 Crib Shallow Zone Pilot Study Sample Variance — Sheet No. 3 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 evaluations is used to determine the required number of samples as compared to the default number of ten.
Sample locations are from Calculation 0100N-CA-V0049.
Number of Samples formulas are from the SAP, Appendix B (DOE-RL, 2000).

				Constituent	
Decision Unit: Shallow Zone					
Sample values from GEA analysis					
Sample #	**Sample Date and Time**		**Location**	**Am241**	**Q**
				pCi/g	
Look-up Value ==========>				41.6	
B14601	3/13/2002 2:57:00 PM		Shallow Zone sample point: VSZ-01	0.25	U
B14602	3/13/2002 9:55:00 AM		Shallow Zone sample point: VSZ-02	0.3	U
B14603	3/13/2002 1:29:00 PM		Shallow Zone sample point: VSZ-03	0.21	U
B14604	3/14/2002 8:52:00 AM		Shallow Zone sample point: VSZ-03	0.059	U
B14605	3/13/2002 1:21:00 PM		Shallow Zone sample point: VSZ-05	0.033	U
B14606	3/18/2002 10:33:00 AM		Shallow Zone sample point: VSZ-06	0.22	U
B14607	3/13/2002 1:35:00 PM		Shallow Zone sample point: VSZ-07	0.07	U
B14608	3/13/2002 9:48:00 AM		Shallow Zone sample point: VSZ-08	0.23	U
B14609	3/13/2002 10:00:00 AM		Shallow Zone sample point: VSZ-09	0.16	U
B14610	3/14/2002 8:57:00 AM		Shallow Zone sample point: VSZ-10	0.32	U
B14611	3/18/2002 10:25:00 AM		Shallow Zone sample point: VSZ-11	0.035	U
B14612	3/14/2002 8:25:00 AM		Shallow Zone sample point: VSZ-12	0.062	U
B14613	3/18/2002 10:37:00 AM		Shallow Zone sample point: VSZ-13	0.14	U
B14614	3/14/2002 8:44:00 AM		Shallow Zone sample point: VSZ-14	0.23	U
B14615	3/14/2002 8:10:00 AM		Shallow Zone sample point: VSZ-15	0.11	U
B14616	3/14/2002 8:32:00 AM		Shallow Zone sample point: VSZ-16	0.072	U
B14617	3/13/2002 1:17:00 PM		Shallow Zone sample point: VSZ-17	0.46	U
B14618	3/13/2002 3:00:00 PM		Shallow Zone sample point: VSZ-18	0.031	U
B14619	3/18/2002 10:30:00 AM		Shallow Zone sample point: VSZ-19	0.016	U
B14620	3/13/2002 1:06:00 PM		Shallow Zone sample point: VSZ-20	0.12	U
B14621	3/13/2002 10:05:00 AM		Shallow Zone sample point: VSZ-21	0.014	U
B14622	3/13/2002 1:00:00 PM		Shallow Zone sample point: VSZ-22	0.11	U
B14623	3/13/2002 1:12:00 PM		Shallow Zone sample point: VSZ-23	0.32	U
B14624	3/13/2002 9:44:00 AM		Shallow Zone sample point: VSZ-24	0.15	U
B14625	3/13/2002 1:39:00 PM		Shallow Zone sample point: VSZ-25	0.08	U
B14626	3/13/2002 1:23:00 PM		Shallow Zone sample point: VSZ-26	0.26	U
B14627	3/18/2002 10:20:00 AM		Shallow Zone sample point: VSZ-27	0.052	U
B14628	3/14/2002 8:36:00 AM		Shallow Zone sample point: VSZ-28	0.058	U
B14629	3/14/2002 2:53:00 PM		Shallow Zone sample point: VSZ-29	0.12	U
B14630	3/18/2002 10:48:00 AM		Shallow Zone sample point: VSZ-30	0.1	U
Mean ==========>				=AVERAGE(E23:E52)	
Standard Deviation (S) ==========>				=STDEV(E23:E52)	
α (5%) ==========>				1.645	
β (20%) ==========>				0.842	
Number of Samples ==========>				=ROUNDUP(((E54^2)*(((E55+E56)/(E22-E53))^2)+0.5*E55^2),0)	

CALCULATION COVER SHEET

Project Title 100-NR-1 TSD Sites Remediation **Job No.** 22192
Area 100-N
Discipline Environmental ***Calc. No.** 0100N-CA-V0030
Subject 116-N-3 Trench Pilot Study (Variance) Sampling to Support Decision Statement #3 Sample Design
Computer Program Microsoft Excel **Program No.** 97 XR-2

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Calc. = 6 Total = 7	J. D. Ludowise JDL 8-30-00	CA Kahler-Roper 8/30/00 CAKR	KE Cook KEC 9/6/00	J.K. Roth J.K. Roth	9/12/00 9/12/00

SUMMARY OF REVISION

*Obtain Calc. No. from DIS

November 1998

DE01-437.03

Calc No.: 0100N-CA-V0030		Rev. No.:	0
Originator: J. D. Ludowise		Date:	08/30/2000
Checked: CCL Kohler-Royer		Date:	8/30/00
Project: 100-NR-1 TSD Remediation		Job No.:	22192
Subject: 116-N-3 Trench Pilot Study		Sheet No. :	1 of 6
(Variance) Sampling to Support Decision Statement #3 Sample Design			

1. Purpose

Calculate the coordinates of locations for conducting a pilot study for variance analysis in the 116-N-3 Trench per the requirements of the *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout* (DOE-RL 2000).

2. Requirements

Section 3.2.1.7 of the Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout (DOE-RL 2000) requires the following:

- 30 samples to be collected for a variance analysis from the bottom of the 116-N-3 Trench excavation
- A simple random sampling method

3. Given/Assumed Information

The coordinates of the corners of the bottom of the excavation:

Washington State Plane Coordinates (meters)	
Easting	Northing
571,961.49	149,627.86
571,971.01	149,620.19
572,116.38	149,800.53
572,106.87	149,808.20

Field measurements will be accurate to within 1 meter.

4. References

Stewart, J., 1991, *Calculus*, 2 ed., Brooks/Cole Publishing Co., Pacific Grove, California.

DOE-RL, 2000, *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout, DOE/RL-2000-07, Rev. 0,* U.S. Department of Energy, Richland Operations Office, Richland, Washington.

5. Calculations

Coordinates of sampling locations can be calculated by using the procedure outlined in Section A.1 of Appendix A of DOE-RL (2000):

1. Generate a set of coordinates (X,Y) using the following equations:

$$X = X_{min} + (X_{max}-X_{min})*RND \quad \text{(Eq. 1)}$$

$$Y = Y_{min} + (Y_{max}-Y_{min})*RND \quad \text{(Eq. 2)}$$

where RND is the next unused random number between 0 and 1 in a sequence of random numbers.

2. If (X,Y) is located outside the sample area, return to step 1 to generate another random coordinate; Otherwise go to step 3.

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Originator: J. D. Ludowise		Date:	08/30/2000
Checked: CA Kahler - Refer CAK		Date:	8/30/00
Project: 100-NR-1 TSD Remediation		Job No.:	22192
Subject: 116-N-3 Trench Pilot Study		Sheet No.:	2 of 6
(Variance) Sampling to Support Decision Statement #3 Sample Design			

5. Calculations (Continued)

3. Define (X_i, Y_i) using the following steps:
   a. Round X to the nearest unit that can be located easily in the field; set this to X_i.
   b. Round Y to the nearest unit that can be located easily in the field; set this to Y_i.

4. Continue to generate the next random coordinate (X_i, Y_i).

The sampling coordinates are calculated with respect to a trench coordinate system described as follows:

- The origin of the trench coordinates is established as the southeastern corner of the trench at Washington Plane Coordinates E571971.01, N149620.19.
- The X-axis parallels the long axis of the trench
- The Y-axis parallels the short axis of the trench

The trench coordinate system is shown on Figure 1.

The trench space coordinates of the 4 corners of the trench are calculated from the Washington Plane coordinates using the Pythagorean Theorem. Results are shown in Table 1.

Table 1. Coordinates of Excavation Corners

Washington State Plane Coordinates (meters)		Trench Space Coordinates (meters)	
Easting	Northing	X	Y
571,961.49	149,627.86	0.00	12.23
571,971.01	149,620.19	0.00	0.00
572,116.38	149,800.53	231.64	0.00
572,106.87	149,808.20	231.64	12.22

The minimum and maximum X values are:

X_{min} 0.00
X_{max} 231.64

The minimum and maximum X values are:

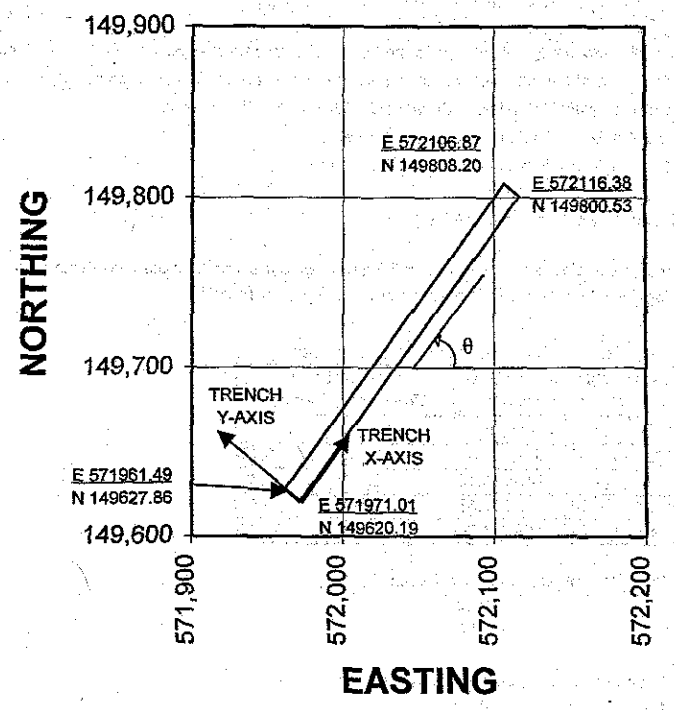
Y_{min} 0.00
Y_{max} 12.23

Calc No.: 0100N-CA-V0030		Rev. No.:	0
Originator: J. D. Ludowise		Date:	08/30/2000
Checked: CA Kahler-Rafer Carr		Date:	8/30/00
Project: 100-NR-1 TSD Remediation		Job No.:	22192
Subject: 116-N-3 Trench Pilot Study		Sheet No. :	3 of 6
(Variance) Sampling to Support Decision Statement #3 Sample Design			

5. Calculations (Continued).

FIGURE 1. 116-N-3 TRENCH

(NOT TO SCALE)



Calc No.: 0100N-CA-V0030		Rev. No.:	0
Originator:	J. D. Ludowise	Date:	08/30/2000
Checked: CA Kahler-Royer	CAKR	Date:	8/30/00
Project: 100-NR-1 TSD Remediation		Job No.:	22192
Subject: 116-N-3 Trench Pilot Study		Sheet No. :	4 of 6
(Variance) Sampling to Support Decision Statement #3 Sample Design			

5. Calculations (Continued)

The values for X_i and Y_i are calculated using Equations 1 and 2. The Microsoft Excel (R) RAND() function was used to calculate values for RND. The results are shown in Table 2.

Table 2. Sampling Locations in Trench Space Coordinates.

	Random Number = RAND()		Trench Space Coordinates, Rounded to the Nearest Meter	
Sample No.	For Calculating X Coordinate	For Calculating Y Coordinate	X	Y
1	0.3037640661678130	0.0126354176831451	70	0
2	0.3376791310067840	0.5580726176227760	78	7
3	0.0425046732868184	0.6497233498434590	10	8
4	0.1443458126122280	0.8315526646879980	33	10
5	0.8900469008331550	0.3619400824116270	206	4
6	0.8248763645844700	0.3221035840809700	191	4
7	0.5906262592026210	0.7518186289388350	137	9
8	0.8220818083017920	0.8767663318949220	190	11
9	0.9334725400303980	0.8451426385412790	216	10
10	0.3571801139056480	0.0772256673697724	83	1
11	0.6446062385350620	0.8891956528432860	149	11
12	0.0018335739079864	0.2188563503348370	0	3
13	0.5995436384387770	0.3294001072278720	139	4
14	0.2497800849270620	0.3015410686796800	58	4
15	0.6461625031329400	0.1732702686025660	150	2
16	0.8986349458050690	0.7051297515791250	208	9
17	0.2906172585827790	0.3634235414756450	67	4
18	0.3939278323099380	0.9765681158967120	91	12
19	0.0867932216074303	0.6075564065730180	20	7
20	0.0227959536088367	0.0903873923850657	5	1
21	0.9059076137303610	0.1300014458785960	210	2
22	0.9555269736942630	0.4417356513578370	221	5
23	0.4971589853214320	0.8097218417857530	115	10
24	0.4895351778781890	0.9363089416909910	113	11
25	0.7014433472258070	0.0864401046465249	162	1
26	0.1395947335205640	0.1712049054612950	32	2
27	0.6147035353822130	0.2147479887117570	142	3
28	0.2513241381648290	0.4656879167813850	58	6
29	0.7323577099863660	0.6963967760967900	170	9
30	0.5240650465741980	0.0541494051947544	121	1

Calc No.: 0100N-CA-V0030		Rev. No.:	0
Originator: J. D. Ludowise		Date:	08/30/2000
Checked: CA Kahler-Reyer CAKR		Date:	8/30/00
Project: 100-NR-1 TSD Remediation		Job No.:	22192
Subject: 116-N-3 Trench Pilot Study		Sheet No. :	5 of 6
(Variance) Sampling to Support Decision Statement #3 Sample Design			

5. Calculations (Continued).

The coordinates in Table 2 need to be converted to Washington Plane Coordinates. This conversion is accomplished by rotating the X-Y axes into the Washington Plane Coordinates.

If x and y are the Easting and Northing valued, respectively, and X and Y are the trench space coordinates, then the formulas for conversion are provided in Appendix E or Stewart (1991):

$$x = X\cos(\theta) - Y\sin(\theta) \quad \text{(Eq. 3)}$$

$$y = X\sin(\theta) + Y\cos(\theta) \quad \text{(Eq. 4)}$$

where θ is the angle of rotation as shown in Figure 1.

θ is calculated from the formula:

$$\theta = \arctan[(y_2-y_1)/(x_2-x_1)]$$

Using the coordinates of the southeast and northeast corners of the trench excavation,

$$\theta = \arctan[(y_2-y_1)/(x_2-x_1)]$$

$$= \arctan[(149{,}800.53 - 149{,}620.19) / (572{,}116.38 - 571{,}971.01)]$$

$$= 0.89 \text{ radians or } 51.13 \text{ degrees}$$

Because the origin of the trench coordinate system and the Washington Plane Coordinate system are not the same point, equations 3 and 4 need to be adjusted by this difference:

$$x = X_0 + X\cos(\theta) - Y\sin(\theta) \quad \text{(Eq. 5)}$$

$$y = Y_0 + X\sin(\theta) + Y\cos(\theta) \quad \text{(Eq. 6)}$$

where X_0 and Y_0 are the Washington Plane coordinates of the origin of the trench space coordinate system, 571,971.01 and 149,620.19 meters, respectively. The results, using equations 5 and 6 are shown in Table 3.

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Project: 100-NR-1 TSD Remediation		Job No.:	22192
Subject: 116-N-3 Trench Pilot Study		Sheet No. :	6 of 6
(Variance) Sampling to Support Decision Statement #3 Sample Design			

5. Calculations (Continued).

Table 3. Sampling Locations in Washington Plan Coordinates.

Sample No.	Trench Space Coordinates, Rounded to the Nearest Meter		Washington State Plane Coordinates, Rounded to the Nearest Meter	
	X	Y	Easting	Northing
1	70	0	572,015	149,675
2	78	7	572,015	149,685
3	10	8	571,971	149,633
4	33	10	571,984	149,652
5	206	4	572,097	149,783
6	191	4	572,088	149,771
7	137	9	572,050	149,732
8	190	11	572,082	149,775
9	216	10	572,099	149,795
10	83	1	572,022	149,685
11	149	11	572,056	149,743
12	0	3	571,969	149,622
13	139	4	572,055	149,731
14	58	4	572,004	149,668
15	150	2	572,064	149,738
16	208	9	572,095	149,788
17	67	4	572,010	149,675
18	91	12	572,019	149,699
19	20	7	571,978	149,640
20	5	1	571,973	149,625
21	210	2	572,101	149,785
22	221	5	572,106	149,795
23	115	10	572,035	149,716
24	113	11	572,033	149,715
25	162	1	572,072	149,747
26	32	2	571,990	149,646
27	142	3	572,058	149,733
28	58	6	572,003	149,669
29	170	9	572,071	149,758
30	121	1	572,046	149,715

CALCULATION COVER SHEET

Project Title 100-NR-1 Remedial Action **Job No.** 22192

Area 100-N

Discipline Environmental Engineering ***Calc. No.** 0100N-CA-V0048

Subject Cleanup Verification Sampling of Overburden from the 116-N-3 to 116-N-1 Pipeline and Bypass Corridor

Computer Program Microsoft Excel **Program No.** Office 97 Version

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 sheet Calculations = 5 sheets Attach A = 2 sheets Attach B = 1 sheet Attach C = 1 sheet Total = 10 sheets	NDC 2/26/02 N.D.Clapper	JDL 2-26-02 J.D. Ludowise	KEC 2/26/02 K.E. Cook	DF Obenauer 2/27/02 D.F. Obenauer	2/27/02

SUMMARY OF REVISIONS

* Obtain Calc. No. from DIS

BHI-DE-01, EDPI-4.37-01, DE01437.03

Bechtel Hanford, Inc. **CALCULATION**

Originator N.D.Clapper NDC Date 2/26/02 Calc. No. 0100N-CA-V0048 Rev. No. 0

Project 100-NR-1 Remedial Action Job No. 22192 Checked J.D. Ludowise JDL Date 2-26-02

Subject Cleanup Verification Sampling of Overburden from the 116-N-3 to 116-N-1 Pipeline and Bypass Corridor

Sheet No. 1 of 5

1. Purpose

Calculate the coordinates of cleanup verification samples for the overburden stockpiles associated with the 116-N-3 to 116-N-1 pipeline and bypass corridor per the requirements of the *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout* (DOE-RL 2000).

2. Results Summary

Based on this Calculation, ten sample locations are identified for the overburden stockpiles (See Attachments).

Contents

Sheet No.	Title	Topic/Contents
	Cover	Cover
1 of 5	Calculation Sheet 1	Purpose, Results Summary, Contents, and Attachments
2 of 5	Calculation Sheet 2	Requirements, Given/Assumed Information, References, and Calculations
3 of 5	Calculation Sheet 3	Calculations (Continued)
4 of 5	Calculation Sheet 4	Calculations (Continued), Figure 1.
5 of 5	Calculation Sheet 5	Calculations (Continued)

Attachments

Number of Sheets	Attachments	Topic/Contents
2	Attachment A	*Sample Locations in Stockpile Space Coordinates*
1	Attachment B	Sample Locations in Washington State Plane Coordinates
1	Attachment C	*Map of Waste Site With Sample Locations*

Bechtel Hanford, Inc. CALCULATION SHEET

Originator N.D.Clapper NDC Date 7/26/02 Calc. No. 0100N-CA-V0048 Rev. No. 0

Project 100-NR-1 Remedial Action Job No. 22192 Checked J.D. Ludowise JDL Date 2-28-02

Subject Cleanup Verification Sampling of Overburden from the 116-N-3 to 116-N-1 Pipeline and Bypass Corridor

Sheet No. 2 of 5

3. Requirements

Section 3.2.3.1 of the *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout* (DOE-RL 2000) requires the following:

- Use the number of sampling locations determined from the 116-N-3 Trench or 116-N-3 Crib variance calculation (worst case results).
- Use randomly determined sample locations

4. Given/Assumed Information

Assume the 116-N-3 Trench or 116-N-3 Crib variance calculation will determine that collection of 10 samples is required (Note: this calculation will be revised if the worst case variance calculation requires more than 10 samples.)

The coordinates of the corners of a rectangle that encloses the overburden stockpiles (design rectangle):

Washington State Plane Coordinates (meters)	
Easting	Northing
571,830.46	149,597.85
571,846.33	149,664.31
571,533.10	149,739.07
571,517.24	149,672.61

Field measurements should be accurate to within 1 meter.

5. References

Stewart, J., 1991, *Calculus*, 2 ed., Brooks/Cole Publishing Co., Pacific Grove, California.

DOE-RL, 2000, *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout, DOE/RL-2000-07, Rev. 0*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

6. Calculations

Coordinates of sampling locations are calculated using the procedure outlined in Section A.1 of Appendix A of DOE-RL (2000):

1. Generate a set of coordinates (X,Y) using the following equations:

$$X = X_{min} + (X_{max}-X_{min})*RND \quad \text{(Eq. 1)}$$

$$Y = Y_{min} + (Y_{max}-Y_{min})*RND \quad \text{(Eq. 2)}$$

where RND is the next unused random number between 0 and 1 in a sequence of random numbers (Attachment C).

2. If (X,Y) is located outside the sample area, return to step 1 to generate another random coordinate; Otherwise go to step 3.

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator N.D.Clapper NDC **Date** 2/26/02 **Calc. No.** 0100N-CA-V0048 **Rev. No.** 0
Project 100-NR-1 Remedial Action **Job No.** 22192 **Checked** J.D. Ludowise JDL **Date** 2-26-02
Subject Cleanup Verification Sampling of Overburden from the 116-N-3 to 116-N-1 Pipeline and Bypass Corridor
Sheet No. 3 of 5

6. *Calculations (Continued)*

3. Define (X_i, Y_i) using the following steps:
   a. Round X to the nearest unit that can be located easily in the field; set this to X_i.
   b. Round Y to the nearest unit that can be located easily in the field; set this to Y_i.

4. Continue to generate the next random coordinate (X_i, Y_i).

The sampling coordinates are calculated with respect to a stockpile coordinate system described as follows:

- The origin of the stockpile coordinates is established as the eastern most corner of the design rectangle at Washington State Plane Coordinates E571846.33, N149664.31.
- The X-axis parallels the long axis of the design rectangle
- The Y-axis parallels the short axis of the design rectangle

The design rectangle for the overburden stockpiles associated with 116-N-3 and 116-N-1 is shown on Figure 1.

The stockpile space coordinates of the 4 corners of the design rectangle are calculated from the Washington State Plane Coordinates using the Pythagorean Theorem. Results are shown in Table 1.

Table 1. Coordinates of design rectangle

Washington State Plane Coordinates (meters)		stockpile Space Coordinates (meters)	
Easting	Northing	X	Y
571,830.46	149,597.85	0.00	68.33
571,846.33	149,664.31	0.00	0.00
571,533.10	149,739.07	322.03	0.00
571,517.24	149,672.61	322.02	68.33

The minimum and maximum X values are:

X_{min} 0.00
X_{max} 322.03

The minimum and maximum Y values are:

Y_{min} 0.00
Y_{max} 68.33

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator N.D.Clapper NDC **Date** 2/26/02 **Calc. No.** 0100N-CA-V0048 **Rev. No.** 0

Project 100-NR-1 Remedial Action **Job No.** 22192 **Checked** J.D. Ludowise **Date** 2-26-02

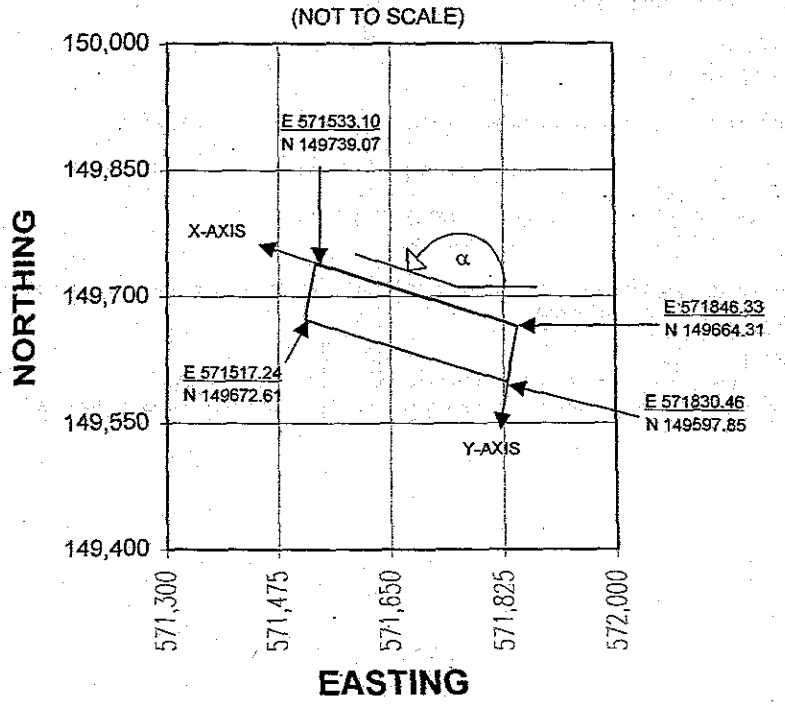
Subject Cleanup Verification Sampling of Overburden from the 116-N-3 to 116-N-1 Pipeline and Bypass Corridor

Sheet No. 4 of 5

6. Calculations (Continued).

FIGURE 1. Design Rectangle for Overburden Stockpiles Associated with 116-N-3 and 116-N-1

(NOT TO SCALE)



Note: Figure 1. illustrates the coordinate rotation (α) of the design rectangle that is used in Equations 3 and 4.

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator N.D.Clapper NDC **Date** 2/26/02 **Calc. No.** 0100N-CA-V0048 **Rev. No.** 0
Project 100-NR-1 Remedial Action **Job No.** 22192 **Checked** J.D. Ludowise JL **Date** 2-26-02
Subject Cleanup Verification Sampling of Overburden from the 116-N-3 to 116-N-1 Pipeline and Bypass Corridor
Sheet No. 5 of 5

6. Calculations (Continued).

The stockpile space coordinates in Attachment A need to be converted to Washington State Plane Coordinates. This conversion is accomplished by rotating the X-Y axes into the Washington State Plane Coordinates.

If x and y are the Easting and Northing values, respectively, and X and Y are the stockpile space coordinates, then the formulas for conversion are provided in Appendix E of Stewart (1991):

$x = X \cos(\alpha) - Y \sin(\alpha)$ (Eq. 3)

$y = X \sin(\alpha) + Y \cos(\alpha)$ (Eq. 4)

where α is the angle of rotation as shown in Figure 1.

α is calculated from the formula:

$\alpha = \arctan[(y_2-y_1)/(x_2-x_1)] + Pi()$

Because the design rectangle is sloping in a negative direction, Pi was added in the formula to make α a positive value.

Using the coordinates of the southeast and northeast corners of the design rectangle excavation,

$\alpha = \arctan[(y_2-y_1)/(x_2-x_1)] + Pi()$

$= \arctan[(149{,}739.07 - 149{,}664.31) / (571{,}533.10 - 571{,}846.33)] + Pi()$

$=$ 2.91 radians or 166.58 degrees

Because the origin of the stockpile coordinate system and the Washington State Plane Coordinate system are not the same point, equations 3 and 4 need to be adjusted by this difference:

$x = X_0 + X \cos(\alpha) - Y \sin(\alpha)$ (Eq. 5)

$y = Y_0 + X \sin(\alpha) + Y \cos(\alpha)$ (Eq. 6)

where X0 and Y0 are the Washington State Plane Coordinates of the origin of the stockpile space coordinate system, 571,846.33 and 149,664.31 meters, respectively. The results, using equations 5 and 6 are shown in Attachment B.

Sampling Locations in Stockpile Space Coordinates

Attachment A			
Originator: N.D. Clapper	NDC	Date:	2/22/02
Checked: J.D. Ludowise	JDL	Date:	2-26-02
Calc. No.: 0100N-CA-V0048			
Rev.: 0		Sheet No.: 1 of 2	

The values for X_i and Y_i are calculated using Equations 1 and 2. The Microsoft Excel (R) RAND() function was used to calculate values for RND.

Sample No.	Random Number = RAND()		Stockpile Space Coordinates, Rounded to the Nearest Meter	
	For Calculating X Coordinate	For Calculating Y Coordinate	X	Y
1	0.1592	0.4015	51	27
2	0.5211	0.9971	168	68
3	0.3830	0.6309	123	43
4	0.9490	0.9118	306	62
5	0.0842	0.9092	27	62
6	0.4349	0.4974	140	34
7	0.5253	0.5101	169	35
8	0.1263	0.0001	41	0
9	0.8392	0.0690	270	5
10	0.4578	0.4947	147	34
11	0.6544	0.4124	211	28
12	0.9068	0.6598	292	45
13	0.9459	0.4620	305	32
14	0.8574	0.6258	276	43
15	0.6241	0.2549	201	17
16	0.0331	0.7961	11	54
17	0.8187	0.5251	264	36
18	0.7656	0.0827	247	6
19	0.0352	0.2134	11	15
20	0.2239	0.1054	72	7
21	0.5939	0.2495	191	17
22	0.5799	0.4719	187	32
23	0.6661	0.0452	215	3
24	0.0640	0.1286	21	9
25	0.8893	0.9120	286	62
26	0.4755	0.1554	153	11
27	0.1478	0.4840	48	33
28	0.6269	0.2966	202	20
29	0.6694	0.5239	216	36
30	0.8456	0.8676	272	59
31	0.2013	0.4924	65	34
32	0.1549	0.7629	50	52
33	0.1741	0.4390	56	30
34	0.7428	0.3029	239	21
35	0.4225	0.5005	136	34
36	0.4122	0.1584	133	11
37	0.9130	0.1253	294	9
38	0.7285	0.9506	235	65
39	0.7853	0.9647	253	66
40	0.9810	0.2684	316	18
41	0.8435	0.4566	272	31
42	0.1888	0.2388	61	16
43	0.9222	0.6628	297	45
44	0.2987	0.7584	96	52
45	0.4645	0.8763	150	60
46	0.5883	0.1690	189	12
47	0.3308	0.9454	107	65
48	0.4676	0.9222	151	63
49	0.3401	0.9208	110	63
50	0.3298	0.0210	106	1

Sampling Locations in Stockpile Space Coordinates

Attachment A			
Originator: N.D. Clapper	NDC	Date:	2/22/02
Checked: J.D. Ludowise	JDL	Date:	2-26-02
Calc. No.: 0100N-CA-V0048			
Rev.: 0		Sheet No.: 2 of 2	

The values for X_i and Y_i are calculated using Equations 1 and 2. The Microsoft Excel (R) RAND() function was used to calculate values for RND.

	Random Number = RAND()		Stockpile Space Coordinates, Rounded to the Nearest Meter	
Sample No.	For Calculating X Coordinate	For Calculating Y Coordinate	X	Y
51	0.4489	0.0124	145	1
52	0.0474	0.9111	15	62
53	0.3877	0.2109	125	14
54	0.8029	0.9779	259	67
55	0.7356	0.1294	237	9
56	0.5200	0.2860	167	20
57	0.9694	0.3300	312	23
58	0.8879	0.9143	286	62
59	0.0931	0.5774	30	39
60	0.2940	0.7381	95	50
61	0.9764	0.3439	314	23
62	0.5013	0.2634	161	18
63	0.5725	0.0421	184	3
64	0.8945	0.4779	288	33
65	0.9387	0.9068	302	62
66	0.7294	0.3086	235	21
67	0.3907	0.4798	126	33
68	0.9301	0.4765	300	33
69	0.9731	0.3245	313	22
70	0.0326	0.5540	11	38
71	0.8410	0.9854	271	67
72	0.8240	0.0425	265	3
73	0.3062	0.6357	99	43
74	0.2006	0.7702	65	53
75	0.7977	0.4437	257	30
76	0.1669	0.0967	54	7
77	0.3450	0.9002	111	62
78	0.0146	0.9385	5	64
79	0.2363	0.8832	76	60
80	0.1305	0.2050	42	14
81	0.0409	0.1677	13	11
82	0.6214	0.0852	200	6
83	0.1244	0.9343	40	64
84	0.3982	0.6622	128	45
85	0.7980	0.4853	257	33
86	0.6617	0.7874	213	54
87	0.3930	0.2833	127	19
88	0.1738	0.7641	56	52
89	0.3286	0.7775	106	53
90	0.2065	0.7358	67	50
91	0.3161	0.9308	102	64
92	0.1083	0.2226	35	15
93	0.6526	0.2864	210	20
94	0.7456	0.7153	240	49
95	0.4776	0.5085	154	35
96	0.5609	0.4327	181	30
97	0.8796	0.2800	283	19
98	0.8853	0.6202	285	42
99	0.6319	0.4139	203	28
100	0.0714	0.0117	23	1

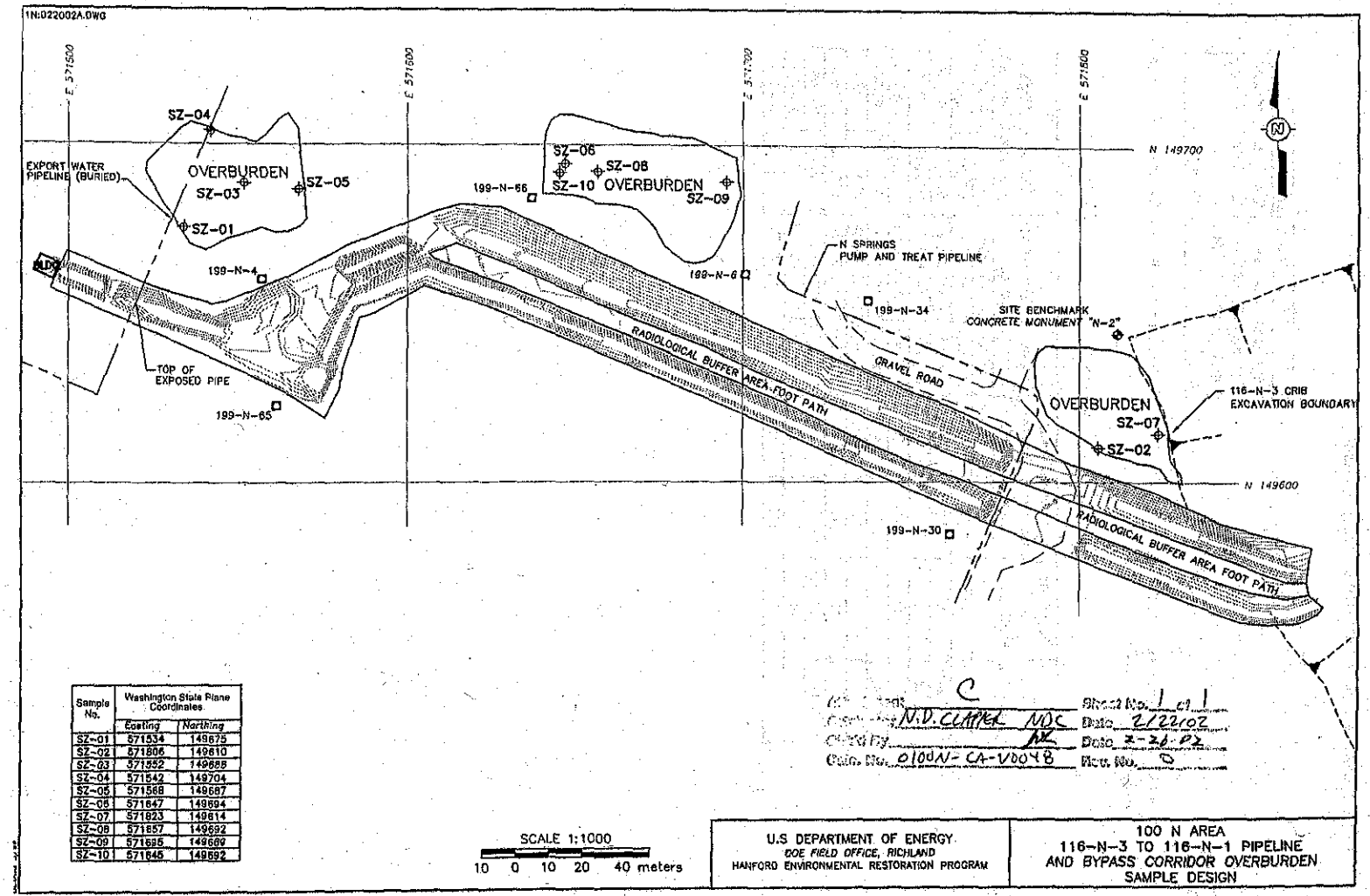
Sample Locations in Washington State Plane Coordinates

Attachment B	
Originator: N.D. Clapper NDC	Date: 2/22/02
Checked: J.D. Ludowise JDL	Date: 2-26-02
Calc. No.: 0100N-CA-V0048	
Rev.: 0	Sheet No.: 1 of 1

The following table represents the 10 sample locations for the Shallow Zone Decision Unit that fell within the sample area as shown on Attachment C.

Shallow Zone

Sample No.	Sample No. from Attachment A	Stockpile Space Coordinates, Rounded to the Nearest Meter		Washington State Plane Coordinates		Rounded Washington State Plane Coordinates	
		X	Y	Easting	Northing	Easting	Northing
SZ-01	4	306	62	571,534.30	149,675.04	571,534	149,675
SZ-02	5	27	62	571,805.67	149,610.27	571,806	149,610
SZ-03	12	292	45	571,551.86	149,688.33	571,552	149,688
SZ-04	13	305	32	571,542.23	149,703.99	571,542	149,704
SZ-05	14	276	43	571,567.89	149,686.56	571,568	149,687
SZ-06	15	201	17	571,646.87	149,694.44	571,647	149,694
SZ-07	16	11	54	571,823.09	149,614.34	571,823	149,614
SZ-08	21	191	17	571,656.60	149,692.12	571,657	149,692
SZ-09	26	153	11	571,694.96	149,689.13	571,695	149,689
SZ-10	28	202	20	571,645.21	149,691.75	571,645	149,692



Sample No.	Washington State Plane Coordinates	
	Easting	Northing
SZ-01	571534	149675
SZ-02	571806	149610
SZ-03	571552	149688
SZ-04	571542	149704
SZ-05	571568	149687
SZ-06	571647	149694
SZ-07	571823	149614
SZ-08	571857	149692
SZ-09	571695	149689
SZ-10	571645	149692

C

Drawn By N.D. CLAPPER NDC Date 2/22/02

Checked By NK Date 2-26-02

Dwg. No. 0100N-CA-V0048 Rev. No. 0

Sheet No. 1 of 1

U.S DEPARTMENT OF ENERGY
DOE FIELD OFFICE, RICHLAND
HANFORD ENVIRONMENTAL RESTORATION PROGRAM

100 N AREA
116-N-3 TO 116-N-1 PIPELINE
AND BYPASS CORRIDOR OVERBURDEN
SAMPLE DESIGN

CALCULATION COVER SHEET

Project Title 100 Area Remediation **Job No.** 22192

Area 100-N

Discipline Environmental Engineering ***Calc. No.** 0100N-CA-V0040

Subject Shallow and Deep Zone Sample Design for the 116-N-3 Trench

Computer Program Microsoft Excel **Program No.** Office 97 Version

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 sheet Calculations = 5 sheets Attach A = 1 sheet Attach B = 1 sheet Attach C = 3 sheets Attach D = 1 sheet Total = 12 sheets	7-24-01 D.N. Strom	J.D. Ludowise 7-24-01 J.D. Ludowise	K.E. Cook 7/24/01 K.E. Cook	D.F. Obenauer D.F. Obenauer J.D. Fancher	7/25/01 7/25/01
1	Cover = 1 sheet Calculation = 5 sheets Attach A = 1 sheet Attach B = 1 sheet Attach C = 3 sheets Attach D = 1 sheet TOTAL = 12 sheets	8-20-01 D.N. STROM	J.D. Ludowise 8-20-01 J.D. Ludowise	KEC 8/20/01 K.E. COOK	D.F. Obenauer D.F. Obenauer J.D. Fancher	8/21/01 8/21/01

SUMMARY OF REVISIONS

1	Rev. 1 incorporates the following change within Attachment A, the Shallow Zone sample identification number SZ-08's Northing coordinate was changed from 149732 to 149733.

* Obtain Calc. No. from DIS

BHI-DE-01, EDPI-4.37-01, DE01437.03

Bechtel Hanford, Inc. **CALCULATION**

Originator D.N. Strom DNS **Date** 7/24/01 **Calc. No.** 0100N-CA-V0040 **Rev. No.** 0
Project 100 Area Remediation **Job No.** 22192 **Checked** J.D. Ludowise JDL **Date** 7-24-01
Subject Shallow and Deep Zone Sample Design for the 116-N-3 Trench
Sheet No. 1 of 5

1. Purpose

Calculate the coordinates of locations of cleanup verification samples for the Shallow and Deep Zone of 116-N-3 Trench per the requirements of the *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout (DOE-RL 2000).*

2. Results Summary

Based on this Calculation, ten sample locations are identified for each of the Shallow and Deep Zone (See Attachment A & B).

Contents

Sheet No.	Title	Topic/Contents
	Cover	Cover
1 of 5	Calculation Sheet 1	Purpose, Results Summary, and Contents
2 of 5	Calculation Sheet 2	Requirements, References, Calculations, and Given/Assumed Information
3 of 5	Calculation Sheet 3	Calculations (Continued)
4 of 5	Calculation Sheet 4	Calculations Continued, Figure 1.
5 of 5	Calculation Sheet 5	Calculations Continued

Attachments

Number of Sheets	Attachments	Topic/Contents
1	Attachment A	Sample Locations (Shallow Zone)
1	Attachment B	Sample Locations (Deep Zone)
3	Attachment C	Sample Locations in Trench Space Coordinates
1	Attachment D	Sample Locations in Washington State Plane Coordinates

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator D.N. Strom DNS **Date** 7/24/01 **Calc. No.** 0100N-CA-V0040 **Rev. No.** 0

Project 100 Area Remediation **Job No.** 22192 **Checked** J.D. Ludowise JDL **Date** 7-24-01

Subject Shallow and Deep Zone Sample Design for the 116-N-3 Trench
Sheet No. 2 of 5

3. Requirements

Section 3.2.1.9 of the *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout* (DOE-RL 2000) and the *116-N-3 Variance Calculation*, 0100N-CA-V0041, Rev. 0 requires the following:

- 10 samples to be collected from each of the Shallow and Deep Zones of the 116-N-3 Trench
- A simple random sampling method

4. Given/Assumed Information

The coordinates of the corners of a rectangle that encloses the excavation (design rectangle):

Washington State Plane Coordinates (meters)	
Easting	Northing
571,943.19	149,614.01
571,981.95	149,583.17
572,139.77	149,781.58
572,101.21	149,812.68

Field measurements will be accurate to within 1 meter.

5. References

Stewart, J., 1991, *Calculus*, 2 ed., Brooks/Cole Publishing Co., Pacific Grove, California.

DOE-RL, 2000, *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout, DOE/RL-2000-07, Rev. 0*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

6. Calculations

Coordinates of sampling locations can be calculated by using the procedure outlined in Section A.1 of Appendix A of DOE-RL (2000):

1. Generate a set of coordinates (X,Y) using the following equations:

$$X = X_{min} + (X_{max}-X_{min})*RND \quad \text{(Eq. 1)}$$

$$Y = Y_{min} + (Y_{max}-Y_{min})*RND \quad \text{(Eq. 2)}$$

where RND is the next unused random number between 0 and 1 in a sequence of random numbers (Attachment C).

2. If (X,Y) is located outside the sample area, return to step 1 to generate another random coordinate; Otherwise go to step 3.

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator D.N. Strom MS **Date** 7/24/01 **Calc. No.** 0100N-CA-V0040 **Rev. No.** 0

Project 100 Area Remediation **Job No.** 22192 **Checked** J.D. Ludowise **Date** 7-24-01

Subject Shallow and Deep Zone Sample Design for the 116-N-3 Trench
Sheet No. 3 of 5

6. Calculations (Continued)

3. Define (X_i, Y_i) using the following steps:
   a. Round X to the nearest unit that can be located easily in the field; set this to X_i.
   b. Round Y to the nearest unit that can be located easily in the field; set this to Y_i.

4. Continue to generate the next random coordinate (X_i, Y_i).

The sampling coordinates are calculated with respect to a trench coordinate system described as follows:

- The origin of the trench coordinates is established as the southern most corner of the design rectangle at Washington State Plane Coordinates E571891.95, N149583.17.
- The X-axis parallels the long axis of the trench
- The Y-axis parallels the short axis of the trench

The trench coordinate system is shown on Figure 1.

The trench space coordinates of the 4 corners of the trench are calculated from the Washington State Plane Coordinates using the Pythagorean Theorem. Results are shown in Table 1.

Table 1. Coordinates of design rectangle

Washington State Plane Coordinates (meters)		Trench Space Coordinates (meters)	
Easting	Northing	X	Y
571,943.19	149,614.01	0.00	49.53
571,981.95	149,583.17	0.00	0.00
572,139.77	149,781.58	253.52	0.00
572,101.21	149,812.68	253.85	49.54

The minimum and maximum X values are:

X_{min} 0.00
X_{max} 253.85

The minimum and maximum Y values are:

Y_{min} 0.00
Y_{max} 49.54

Bechtel Hanford, Inc. CALCULATION SHEET

Originator D.N. Strom DNS Date 7/16/01 Calc. No. 0100N-CA-V0040 Rev. No. 0

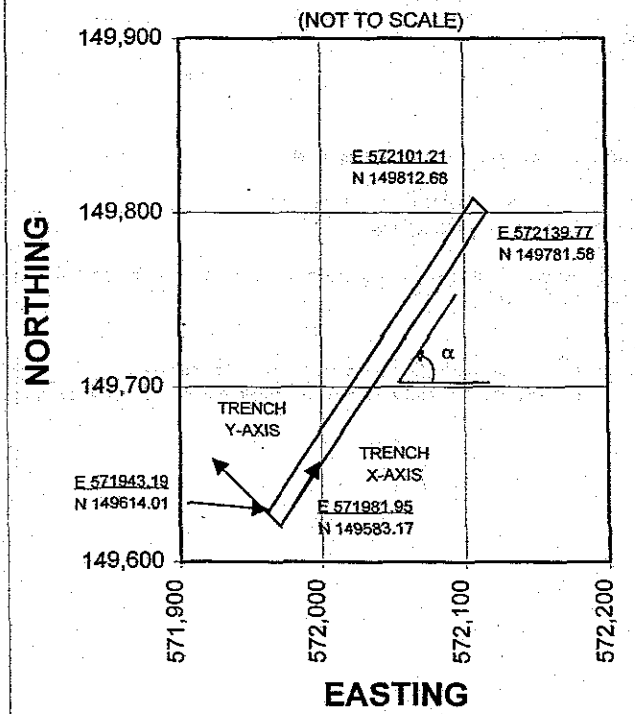
Project 100 Area Remediation Job No. 22192 Checked J.D. Ludowise JL Date 7-17-01

Subject Shallow and Deep Zone Sample Design for the 116-N-3 Trench
Sheet No. 4 of 5

5. Calculations (Continued).

FIGURE 1. 116-N-3 TRENCH

(NOT TO SCALE)



Note: Figure 1. illustrates the coordinate rotation (α) of the design rectangle that is used in Equations 3 and 4.

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator D.N. Strom DNS **Date** 7/24/01 **Calc. No.** 0100N-CA-V0040 **Rev. No.** 0

Project 100 Area Remediation **Job No.** 22192 **Checked** J.D. Ludowise JL **Date** 7-24-01

Subject Shallow and Deep Zone Sample Design for the 116-N-3 Trench
Sheet No. 5 of 5

6. Calculations (Continued).

The coordinates in Attachment C need to be converted to Washington State Plane Coordinates. This conversion is accomplished by rotating the X-Y axes into the Washington State Plane Coordinates (Attachment D).

If x and y are the Easting and Northing valued, respectively, and X and Y are the trench space coordinates, then the formulas for conversion are provided in Appendix E of Stewart (1991):

$$x = X \cos(\alpha) - Y \sin(\alpha) \qquad \text{(Eq. 3)}$$

$$y = X \sin(\alpha) + Y \cos(\alpha) \qquad \text{(Eq. 4)}$$

where α is the angle of rotation as shown in Figure 1.

α is calculated from the formula:

$$\alpha = \arctan [(y_2-y_1)/(x_2-x_1)]$$

Using the coordinates of the southeast and northeast corners of the trench excavation,

$$\alpha = \arctan [(y_2-y_1)/(x_2-x_1)]$$
$$= \arctan [(149{,}781.58 - 149{,}583.17) / (572{,}139.77 - 571{,}981.95)]$$
$$= 0.90 \text{ radians or } 51.50 \text{ degrees}$$

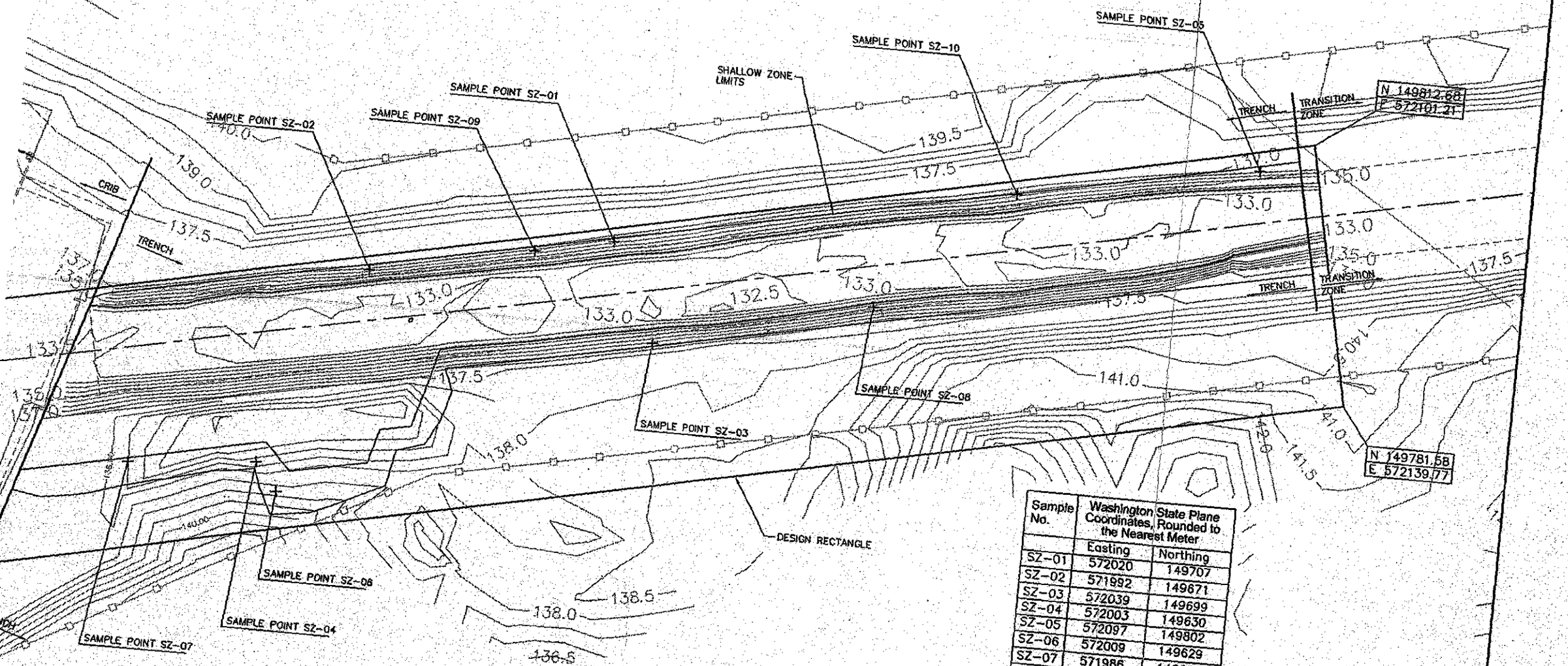
Because the origin of the trench coordinate system and the Washington State Plane Coordinate system are not the same point, equations 3 and 4 need to be adjusted by this difference:

$$x = X_0 + X \cos(\alpha) - Y \sin(\alpha) \qquad \text{(Eq. 5)}$$

$$y = Y_0 + X \sin(\alpha) + Y \cos(\alpha) \qquad \text{(Eq. 6)}$$

where X_0 and Y_0 are the Washington State Plane Coordinates of the origin of the trench space coordinate system, 571,981.95 and 149,583.17 meters, respectively. The results, using equations 5 and 6 are shown in Attachment D.

Attachment A Sheet No. 1 of 1
Originator D.N. STROM DNS Date 7-24-01
Chk'd by J.D. WARNICK JDW Date 7-24-01
Calc. No. 0100N-CA-V0040 Rev. No. 0



Sample No.	Washington State Plane Coordinates, Rounded to the Nearest Meter	
	Easting	Northing
SZ-01	572020	149707
SZ-02	571992	149671
SZ-03	572039	149699
SZ-04	572003	149630
SZ-05	572097	149802
SZ-06	572009	149629
SZ-07	571986	149613
SZ-08	572064	~~149732~~ 149733
SZ-09	572011	149695
SZ-10	572068	149767

DNS 8-20-01

SCALE 1:800

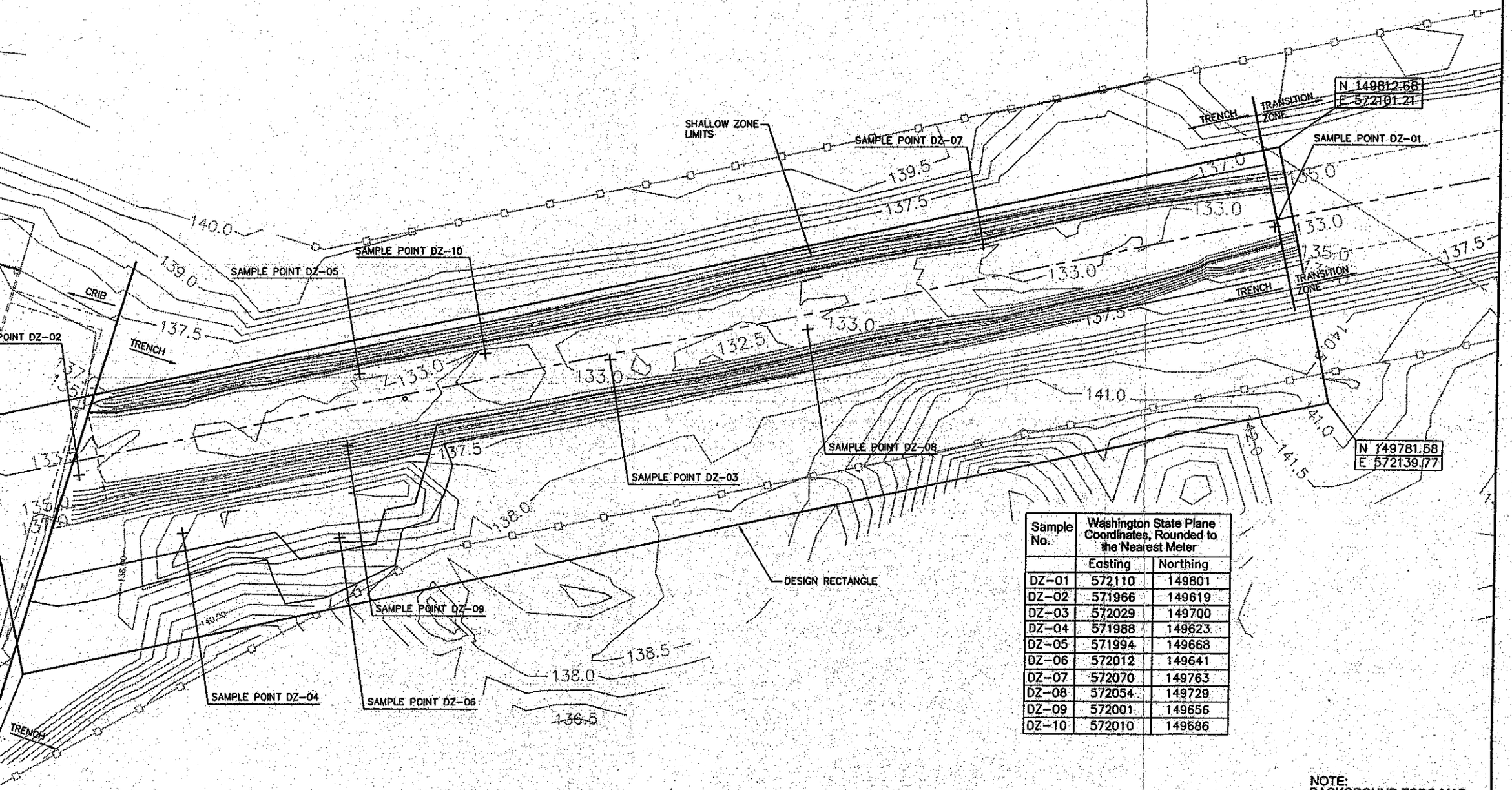
8 0 8 16 32 meters

NOTE:
BACKGROUND TOPO MAP DOES NOT REFLECT THE CURRENT TOPO

U.S DEPARTMENT OF ENERGY
DOE FIELD OFFICE, RICHLAND
HANFORD ENVIRONMENTAL RESTORATION PROGRAM

100 N AREA
100-NR-1 REMEDIAL ACTION DESIGN
116-N-3 TRENCH SHALLOW ZONE
SAMPLE DESIGN

Attachment B Sheet No. 1 of 1
Originator D.N. STROM DNS Date 7-24-01
Chk'd by T.D. LUDOWISE Date 7-24-01
Calc. No. 0100N-CA-V0040 Rev. No. 0



Sample No.	Washington State Plane Coordinates, Rounded to the Nearest Meter	
	Easting	Northing
DZ-01	572110	149801
DZ-02	571966	149619
DZ-03	572029	149700
DZ-04	571988	149623
DZ-05	571994	149668
DZ-06	572012	149641
DZ-07	572070	149763
DZ-08	572054	149729
DZ-09	572001	149656
DZ-10	572010	149686

NOTE:
BACKGROUND TOPO MAP DOES NOT REFLECT THE CURRENT TOPO

SCALE 1:800
8 0 8 16 32 meters

U.S DEPARTMENT OF ENERGY
DOE FIELD OFFICE, RICHLAND
HANFORD ENVIRONMENTAL RESTORATION PROGRAM

100 N AREA
100-NR-1 REMEDIAL ACTION DESIGN
116-N-3 TRENCH DEEP ZONE
SAMPLE DESIGN

Sampling Locations in Trench Space Coordinates

Attachment C			
Originator: D.N. Strom	DNS	Date:	07/16/01
Checked: J.D. Ludowise	JDL	Date:	7-17-01
Calc. No.: 0100N-CA-V0040			
Rev.: 0		Sheet No.: 1 of 3	

The values for X_i and Y_i are calculated using Equations 1 and 2. The Microsoft Excel (R) RAND() function was used to calculate values for RND.

	Random Number = RAND()		Trench Space Coordinates, Rounded to the Nearest Meter	
Sample No.	For Calculating X Coordinate	For Calculating Y Coordinate	X	Y
1	0.1822	0.4518	46	22
2	0.3939	0.5286	100	26
3	0.3508	0.5144	89	25
4	0.4484	0.4590	114	23
5	0.3105	0.9245	79	46
6	0.0616	0.3575	16	18
7	0.8728	0.8297	222	41
8	0.4983	0.4648	127	23
9	0.9104	0.6694	231	33
10	0.3601	0.7141	91	35
11	0.3934	0.7173	100	36
12	0.4773	0.9421	121	47
13	0.0863	0.3401	22	17
14	0.4976	0.9316	126	46
15	0.7085	0.3606	180	18
16	0.6049	0.1749	154	9
17	0.1830	0.7801	46	39
18	0.3201	0.9229	81	46
19	0.7683	0.3494	195	17
20	0.4422	0.3195	112	16
21	0.6897	0.8898	175	44
22	0.9142	0.1183	232	6
23	0.2601	0.4388	66	22
24	0.2972	0.9519	75	47
25	0.4729	0.2431	120	12
26	0.3523	0.3420	89	17
27	0.9842	0.7028	250	35
28	0.4397	0.0573	112	3
29	0.7965	0.7474	202	37
30	0.1587	0.8023	40	40
31	0.6672	0.8232	169	41
32	0.6418	0.0437	163	2
33	0.3207	0.5815	81	29
34	0.0379	0.6573	10	33
35	0.4236	0.2760	108	14
36	0.5781	0.6481	147	32
37	0.0712	0.6997	18	35
38	0.4977	0.5533	126	27
39	0.9723	0.9978	247	49
40	0.9760	0.9044	248	45
41	0.0942	0.3593	24	18
42	0.3463	0.5190	88	26
43	0.1965	0.2658	50	13
44	0.2834	0.9454	72	47
45	0.3327	0.1778	84	9
46	0.8430	0.1169	214	6
47	0.8677	0.1990	220	10

Sampling Locations in Trench Space Coordinates

Attachment C	
Originator: D.N. Strom DNS	Date: 07/16/01
Checked: J.D. Ludowise JDL	Date: 7-17-01
Calc. No.: 0100N-CA-V0040	
Rev.: 0	Sheet No.: 2 of 3

The values for X_i and Y_i are calculated using Equations 1 and 2. The Microsoft Excel (R) RAND() function was used to calculate values for RND.

	Random Number = RAND()		Trench Space Coordinates, Rounded to the Nearest Meter	
Sample No.	For Calculating X Coordinate	For Calculating Y Coordinate	X	Y
48	0.4761	0.7347	121	36
49	0.9591	0.9227	243	46
50	0.7585	0.3015	193	15
51	0.4241	0.1469	108	7
52	0.0228	0.6643	6	33
53	0.6128	0.5113	156	25
54	0.1368	0.4008	35	20
55	0.2073	0.1465	53	7
56	0.9981	0.0810	253	4
57	0.9148	0.7492	232	37
58	0.2903	0.8586	74	43
59	0.9973	0.0838	253	4
60	0.5628	0.9880	143	49
61	0.9248	0.7499	235	37
62	0.1928	0.8928	49	44
63	0.2911	0.1165	74	6
64	0.2034	0.6235	52	31
65	0.2536	0.2669	64	13
66	0.7337	0.4500	186	22
67	0.7688	0.8661	195	43
68	0.5722	0.6626	145	33
69	0.6273	0.6953	159	34
70	0.1081	0.2342	27	12
71	0.7557	0.9848	192	49
72	0.4591	0.3017	117	15
73	0.9643	0.0638	245	3
74	0.6784	0.5776	172	29
75	0.2293	0.7626	58	38
76	0.9087	0.0128	231	1
77	0.2980	0.4058	76	20
78	0.9741	0.1079	247	5
79	0.1115	0.3099	28	15
80	0.1031	0.3259	26	16
81	0.6625	0.5843	168	29
82	0.7067	0.8040	179	40
83	0.2700	0.5983	69	30
84	0.1003	0.6272	25	31
85	0.0276	0.0915	7	5
86	0.4156	0.9526	106	47
87	0.7565	0.5261	192	26
88	0.9405	0.9579	239	47
89	0.3862	0.8437	98	42
90	0.5932	0.1160	151	5
91	0.8811	0.7045	224	35
92	0.9465	0.3267	240	16
93	0.9989	0.2649	254	13
94	0.0848	0.3529	22	17

Sampling Locations in Trench Space Coordinates

Attachment C			
Originator: D.N. Strom	DNS	Date:	07/16/01
Checked: J.D. Ludowise	JDL	Date:	7-17-01
Calc. No.: 0100N-CA-V0040			
Rev.: 0		Sheet No.: 3 of 3	

The values for X_i and Y_i are calculated using Equations 1 and 2. The Microsoft Excel (R) RAND() function was used to calculate values for RND.

Sample No.	Random Number = RAND()		Trench Space Coordinates, Rounded to the Nearest Meter	
	For Calculating X Coordinate	For Calculating Y Coordinate	X	Y
95	0.4305	0.9556	109	47
96	0.7762	0.9482	197	47
97	0.7149	0.9810	181	49
98	0.8099	0.8952	206	44
99	0.9206	0.5086	234	25
100	0.7815	0.3505	198	17

Attachment C

Sample Locations in Washington State Plane Coordinates

Attachment D	
Originator: D.N. Strom DNS	Date: 07/24/01
Checked: J.D. Ludowise JDL	Date: 7-24-01
Calc. No.: 0100N-CA-V0040	
Rev.: 0	Sheet No.: 1 of 1

The following table represents the 10 sample locations for the Shallow Zone Decision Unit that fell within the sample area as shown on Attachment A.

Shallow Zone

Sample No.	Sample No. from Attachment C	Trench Space Coordinates, Rounded to the Nearest Meter		Washington State Plane Coordinates, Rounded to the Nearest Meter	
		X	Y	Easting	Northing
SZ-01	12	121	47	572,020	149,707
SZ-02	24	75	47	571,992	149,671
SZ-03	38	126	27	572,039	149,699
SZ-04	43	50	13	572,003	149,630
SZ-05	49	243	46	572,097	149,802
SZ-06	55	53	7	572,009	149,629
SZ-07	80	26	16	571,986	149,613
SZ-08	81	168	29	572,064	149,733
SZ-09	86	106	47	572,011	149,695
SZ-10	96	197	47	572,068	149,767

The following table represents the 10 sample locations for the Deep Zone Decision Unit that fell within the sample area as shown on Attachment B.

Deep Zone

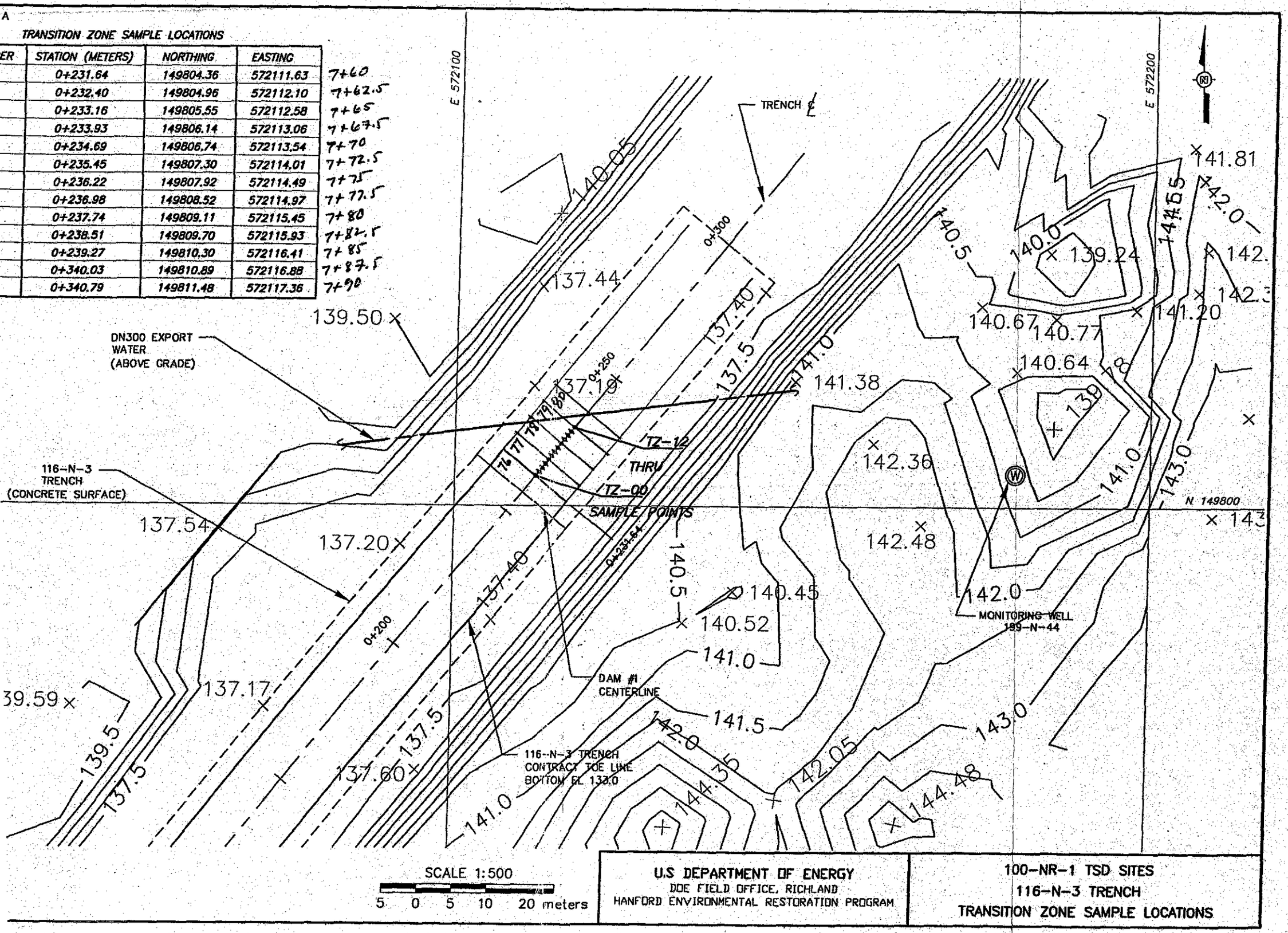
Sample No.	Sample No. from Attachment C	Trench Space Coordinates, Rounded to the Nearest Meter		Washington State Plane Coordinates, Rounded to the Nearest Meter	
		X	Y	Easting	Northing
DZ-01	27	250	35	572,110	149,801
DZ-02	37	18	35	571,966	149,619
DZ-03	48	121	36	572,029	149,700
DZ-04	54	35	20	571,988	149,623
DZ-05	58	74	43	571,994	149,668
DZ-06	65	64	13	572,012	149,641
DZ-07	67	195	43	572,070	149,763
DZ-08	69	159	34	572,054	149,729
DZ-09	83	69	30	572,001	149,656
DZ-10	89	98	42	572,010	149,686

Attachment D

A

TRANSITION ZONE SAMPLE LOCATIONS

ER	STATION (METERS)	NORTHING	EASTING	
	0+231.64	149804.36	572111.63	7+60
	0+232.40	149804.96	572112.10	7+62.5
	0+233.16	149805.55	572112.58	7+65
	0+233.93	149806.14	572113.06	7+67.5
	0+234.69	149806.74	572113.54	7+70
	0+235.45	149807.30	572114.01	7+72.5
	0+236.22	149807.92	572114.49	7+75
	0+236.98	149808.52	572114.97	7+77.5
	0+237.74	149809.11	572115.45	7+80
	0+238.51	149809.70	572115.93	7+82.5
	0+239.27	149810.30	572116.41	7+85
	0+340.03	149810.89	572116.88	7+87.5
	0+340.79	149811.48	572117.36	7+90



SCALE 1:500

5 0 5 10 20 meters

U.S DEPARTMENT OF ENERGY
DOE FIELD OFFICE, RICHLAND
HANFORD ENVIRONMENTAL RESTORATION PROGRAM

100-NR-1 TSD SITES
116-N-3 TRENCH
TRANSITION ZONE SAMPLE LOCATIONS

CALCULATION COVER SHEET

Project Title 100-NR-1 TSD Sites **Job No.** 22192

Area 100-N

Discipline Environmental Engineering ***Calc. No.** 0100N-CA-V0049

Subject 116-N-3 Crib Variance and Closeout Sample Design

Computer Program Microsoft Excel **Program No.** Office 97 Version

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 sheet Calculations = 5 sheets Attach A = 4 sheet Attach B = 1 sheet Attach C = 1 sheets Attach D = 1 sheet Attach E = 1 sheet Attach F = 1 sheet Total = 15 sheets	NDC 3/18/02 N.D. Clapper	JR 3-18-02 J.D. Ludowise	KEC 3/20/02 K.E. Cook	VDA D.F. Obenauer D.F. Obenauer	3/21/02

SUMMARY OF REVISIONS

* Obtain Calc. No. from DIS

BHI-DE-01, EDPI-4.37-01, DE01437.03

Bechtel Hanford, Inc. **CALCULATION**

Originator N.D. Clapper NDC **Date** 3/18/02 **Calc. No.** 0100N-CA-V0049 **Rev. No.** 0
Project 100-NR-1 TSD Sites **Job No.** 22192 **Checked** J.D. Ludowise JDL **Date** 3-18-02
Subject 116-N-3 Crib Variance and Closeout Sample Design **Sheet** 1 of 5

1. Purpose

Calculate the coordinates of the variance (Shallow Zone) and cleanup verification (Shallow and Deep Zone) samples for the 116-N-3 Crib per the requirements of the *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout (DOE-RL 2000).*

2. Results/Summary

Based on this calculation, thirty variance sample locations are identified for the Shallow Zone (See Attachments B and D)

Based on this calculation, ten cleanup verification sample locations are identified for both the Shallow and Deep Zones (See Attachments C, E, and F).

Contents

Sheet No.	Title	Topic/Contents
	Cover	Cover
1 of 5	Calculation Sheet 1	Purpose, Results/Summary, Contents, and Attachments
2 of 5	Calculation Sheet 2	Requirements, Given/Assumed Information, and References
3 of 5	Calculation Sheet 3	Calculations
4 of 5	Calculation Sheet 4	Calculations (Continued), Figure 1.
5 of 5	Calculation Sheet 5	Calculations (Continued)

Attachments

Number of Sheets	Attachments	Topic/Contents
4	Attachment A	Sample Locations in Crib Space Coordinates
1	Attachment B	Variance Sample Locations in Washington State Plane Coordinates
1	Attachment C	Cleanup Verification Sample Locations in Washington State Plane Coordinates
1	Attachment D	Map of Waste Site With Shallow Zone Variance Sample Locations
1	Attachment E	Map of Waste Site With Shallow Zone Cleanup Verification Sample Locations
1	Attachment F	Map of Waste Site With Deep Zone Cleanup Verification Sample Locations

Bechtel Hanford, Inc. CALCULATION SHEET

Originator N.D. Clapper NDC Date 3/18/02 Calc. No. 0100N-CA-V0049 Rev. No. 0
Project 100-NR-1 TSD Sites Job No. 22192 Checked J.D. Ludowise JDL Date 3-18-02
Subject 116-N-3 Crib Variance and Closeout Sample Design Sheet 2 of 5

3. Requirements

The following sections of the *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout* (DOE-RL 2000) require:

Section 3.2.1.8 (Variance Sample Design)

- 30 sampling locations on the shallow zone side wall of the crib excavation
- Use randomly determined sample locations

Section 3.2.1.11 (Cleanup Verification for Shallow Zone)

- Use the number of sampling locations determined from the 116-N-3 Crib variance calculation
- Use randomly determined sample locations

Section 3.2.1.12 (Cleanup Verification for Deep Zone)

- Use the number of sampling locations determined from the 116-N-3 Crib variance calculation
- Use randomly determined sample locations

4. Given/Assumed Information

For cleanup verification, assume the 116-N-3 Crib variance calculation will determine that collection of 10 samples is required (Note: this calculation will be revised if the variance calculation requires more than 10 samples.)

The first 30 shallow zone sample locations in Attachment A are used for the variance sample design (See Attachment B), the following 10 shallow zone samples are for cleanup verification (See Attachment C). The first 10 deep zone sample locations in Attachment A are for cleanup verification (See Attachment C).

The coordinates of the corners of a rectangle that encloses the excavation of the 116-N-3 crib (design rectangle):

Washington State Plane Coordinates (meters)	
Easting	Northing
571,840.40	149,627.69
571,886.12	149,520.15
571,994.96	149,565.42
571,950.33	149,672.96

Field measurements should be accurate to within 1 meter.

5. References

Stewart, J., 1991, *Calculus*, 2 ed., Brooks/Cole Publishing Co., Pacific Grove, California.

DOE-RL, 2000, *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout, DOE/RL-2000-07, Rev. 1*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator N.D. Clapper NDC **Date** 3/18/02 **Calc. No.** 0100N-CA-V0049 **Rev. No.** 0
Project 100-NR-1 TSD Sites **Job No.** 22192 **Checked** J.D. Ludowise JDL **Date** 3-18-02
Subject 116-N-3 Crib Variance and Closeout Sample Design **Sheet** 3 of 5

6. Calculations

Coordinates of sampling locations can be calculated by using the procedure outlined in Section A.1 of Appendix A of DOE-RL (2000):

1. Generate a set of coordinates (X,Y) using the following equations:

$$X = Xmin + (Xmax-Xmin)*RND \quad \text{(Eq. 1)}$$
$$Y = Ymin + (Ymax-Ymin)*RND \quad \text{(Eq. 2)}$$

where RND is the next unused random number between 0 and 1 in a sequence of random numbers (Attachment A). Only one table of random numbers is generated. The first 30 shallow zone sample locations are used for the variance sample design, the following 10 shallow zone samples are for cleanup verification. The first 10 deep zone sample locations are for cleanup verification.

2. If (X,Y) is located outside the sample area, return to step 1 to generate another random coordinate; Otherwise go to step 3.

3. Define (X_i,Y_i) using the following steps:
   a. Round X to the nearest unit that can be located easily in the field; set this to X_i.
   b. Round Y to the nearest unit that can be located easily in the field; set this to Y_i.

4. Continue to generate the next random coordinate (X_i, Y_i).

The sampling coordinates are calculated with respect to a crib coordinate system described as follows:

- The origin of the crib coordinates is established as the southern most corner of the design rectangle at Washington State Plane Coordinates E571886.12, N149520.15.
- *The X-axis parallels the long axis of the design rectangle*
- The Y-axis parallels the short axis of the design rectangle

The design rectangle for the 116-N-3 crib is shown on Figure 1.

The crib space coordinates of the 4 corners of the design rectangle are calculated from the Washington State Plane Coordinates using the Pythagorean Theorem. Results are shown in Table 1.

Table 1. Coordinates of design rectangle

Washington State Plane Coordinates (meters)		Crib Space Coordinates (meters)	
Easting	Northing	X	Y
571,840.40	149,627.69	0.00	116.86
571,886.12	149,520.15	0.00	0.00
571,994.96	149,565.42	117.88	0.00
571,950.33	149,672.96	118.89	116.43

The minimum and maximum X values are:

X_{min} 0.00
X_{max} *118.89*

The minimum and maximum Y values are:

Y_{min} 0.00
Y_{max} 116.86

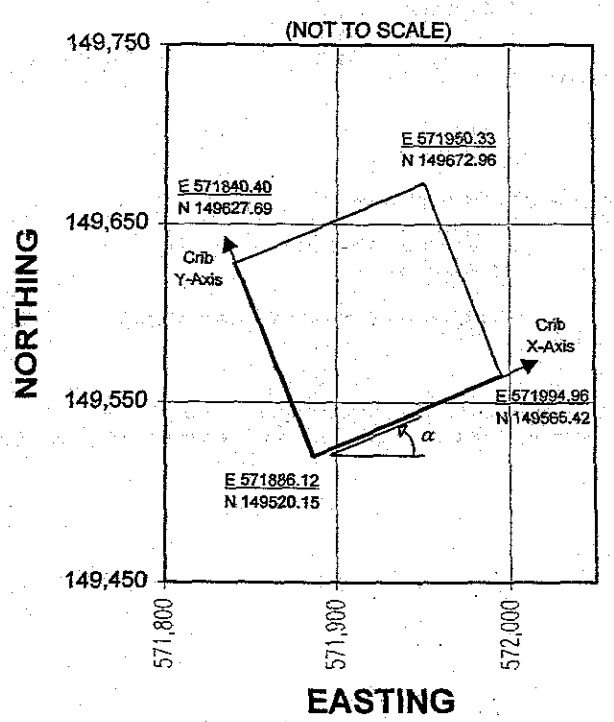
Bechtel Hanford, Inc. CALCULATION SHEET

Originator N.D. Clapper NDC Date 3/19/02 Calc. No. 0100N-CA-V0049 Rev. No. 0
Project 100-NR-1 TSD Sites Job No. 22192 Checked J.D. Ludowise JDL Date 3-18-02
Subject 116-N-3 Crib Variance and Closeout Sample Design Sheet 4 of 5

5. Calculations (Continued).

FIGURE 1. 116-N-3 Crib

(NOT TO SCALE)



Note: Figure 1. illustrates the coordinate rotation (α) of the design rectangle that is used in Equations 3 and 4.

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator N.D. Clapper NDC **Date** 3/8/02 **Calc. No.** 0100N-CA-V0049 **Rev. No.** 0
Project 100-NR-1 TSD Sites **Job No.** 22192 **Checked** J.D. Ludowise JL **Date** 3-18-02
Subject 116-N-3 Crib Variance and Closeout Sample Design **Sheet** 5 of 5

6. Calculations (Continued).

The coordinates in Attachment A need to be converted to Washington State Plane Coordinates. This conversion is accomplished by rotating the X-Y axes into the Washington State Plane Coordinates.

If x and y are the Easting and Northing values, respectively, and X and Y are the crib space coordinates, then the formulas for conversion are provided in Appendix E of Stewart (1991):

$$x = X \cos(\alpha) - Y \sin(\alpha) \quad \text{(Eq. 3)}$$

$$y = X \sin(\alpha) + Y \cos(\alpha) \quad \text{(Eq. 4)}$$

where α is the angle of rotation as shown in Figure 1.

α is calculated from the formula:

$$\alpha = \arctan [(y_2-y_1)/(x_2-x_1)]$$

Using the coordinates of the southeast and northeast corners of the crib excavation,

$$\alpha = \arctan [(y_2-y_1)/(x_2-x_1)]$$
$$= \arctan [(149{,}565.42 - 149{,}520.15) / (571{,}994.96 - 571{,}886.12)]$$
$$= 0.39 \text{ radians or } 22.58 \text{ degrees}$$

Because the origin of the crib coordinate system and the Washington State Plane Coordinate system are not the same point, equations 3 and 4 need to be adjusted by this difference:

$$x = X_0 + X \cos(\alpha) - Y \sin(\alpha) \quad \text{(Eq. 5)}$$

$$y = Y_0 + X \sin(\alpha) + Y \cos(\alpha) \quad \text{(Eq. 6)}$$

where X_0 and Y_0 are the Washington State Plane Coordinates of the origin of the crib space coordinate system, 571,886.12 and 149,520.15 meters, respectively. The results, using equations 5 and 6 are shown in Attachments B and C.

Sampling Locations in Trench Space Coordinates

Attachment A		
Originator: N.D. Clapper	NDC	Date: 3/18/02
Checked: J.D. Ludowise	JDL	Date: 3-18-02
Calc. No.: 0100N-CA-V0049		
Rev.: 0		Sheet No.: 1 of 4

The values for X_i and Y_i are calculated using Equations 1 and 2. The Microsoft Excel (R) RAND() function was used to calculate values for RND.

Sample No.	Random Number = RAND()		Crib Space Coordinates	
	For Calculating X Coordinate	For Calculating Y Coordinate	X	Y
1	0.4434	0.0893	53	10
2	0.1170	0.4784	14	56
3	0.4698	0.4498	56	53
4	0.3614	0.8363	43	98
5	0.7426	0.4689	88	55
6	0.1513	0.4247	18	50
7	0.8022	0.5110	95	60
8	0.3444	0.3910	41	46
9	0.1757	0.2200	21	26
10	0.0863	0.6511	10	76
11	0.1308	0.8316	16	97
12	0.0172	0.1292	2	15
13	0.2802	0.4421	33	52
14	0.9588	0.5538	114	65
15	0.7819	0.1782	93	21
16	0.3395	0.6989	40	82
17	0.9897	0.9481	118	111
18	0.0178	0.8766	2	102
19	0.9676	0.0507	115	6
20	0.1797	0.9859	21	115
21	0.9740	0.6673	116	78
22	0.9945	0.0866	118	10
23	0.0326	0.4426	4	52
24	0.1161	0.7314	14	85
25	0.5211	0.7829	62	91
26	0.4569	0.0412	54	5
27	0.7540	0.9149	90	107
28	0.8638	0.5269	103	62
29	0.7938	0.2349	94	27
30	0.0009	0.6282	0	73
31	0.9712	0.8076	115	94
32	0.3130	0.2606	37	30
33	0.3256	0.3272	39	38
34	0.8380	0.1605	100	19
35	0.0848	0.4123	10	48
36	0.0283	0.0070	3	1
37	0.6649	0.7495	79	88
38	0.0917	0.6696	11	78
39	0.1367	0.6239	16	73
40	0.4994	0.3892	59	45
41	0.1530	0.2896	18	34
42	0.5176	0.5919	62	69
43	0.3059	0.6801	36	79
44	0.0787	0.1361	9	16
45	0.0495	0.4869	6	57
46	0.4489	0.3171	53	37
47	0.9213	0.9710	110	113
48	0.9750	0.0666	116	8
49	0.8377	0.3628	100	42
50	0.0024	0.3930	0	46
51	0.9951	0.0660	118	8

Sampling Locations in Trench Space Coordinates

Attachment A	
Originator: N.D. Clapper	NDC Date: 3/18/02
Checked: J.D. Ludowise	JDL Date: 3-18-02
Calc. No.: 0100N-CA-V0049	
Rev.: 0	Sheet No.: 2 of 4

The values for X_i and Y_i are calculated using Equations 1 and 2. The Microsoft Excel (R) RAND() function was used to calculate values for RND.

	Random Number = RAND()		Crib Space Coordinates	
Sample No.	For Calculating X Coordinate	For Calculating Y Coordinate	X	Y
52	0.3256	0.3967	39	46
53	0.6638	0.6860	79	80
54	0.6146	0.2817	73	33
55	0.1648	0.4257	20	50
56	0.5863	0.1656	70	19
57	0.5958	0.5054	71	59
58	0.3000	0.1153	36	13
59	0.1142	0.7560	14	88
60	0.0528	0.0298	6	3
61	0.4437	0.5367	53	63
62	0.0397	0.5063	5	59
63	0.4766	0.0126	57	1
64	0.0022	0.3331	0	39
65	0.6794	0.1442	81	17
66	0.6548	0.2067	78	24
67	0.8653	0.5090	103	59
68	0.7511	0.9980	89	117
69	0.3553	0.6991	42	82
70	0.5561	0.6355	66	74
71	0.7997	0.6532	95	76
72	0.7756	0.6405	92	75
73	0.6585	0.7367	78	86
74	0.4268	0.0195	51	2
75	0.2863	0.1896	34	22
76	0.1679	0.5541	20	65
77	0.3135	0.9314	37	109
78	0.0279	0.1153	3	13
79	0.8788	0.3820	104	45
80	0.8209	0.1160	98	14
81	0.2366	0.3820	28	45
82	0.6722	0.4065	80	48
83	0.7347	0.4631	87	54
84	0.2843	0.5790	34	68
85	0.3250	0.1631	39	19
86	0.8407	0.7915	100	92
87	0.8378	0.3659	100	43
88	0.0331	0.4332	4	51
89	0.5937	0.9842	71	115
90	0.8197	0.3647	97	43
91	0.6362	0.5327	76	62
92	0.4396	0.5501	52	64
93	0.4886	0.2215	58	26
94	0.3778	0.5119	45	60
95	0.6924	0.9529	82	111
96	0.9300	0.6896	111	81
97	0.5796	0.9814	69	115
98	0.9532	0.7770	113	91
99	0.7977	0.9090	95	106
100	0.1908	0.5408	23	63
101	0.0085	0.6316	1	74
102	0.4816	0.1147	57	13

Sampling Locations in Trench Space Coordinates

Attachment A			
Originator: N.D. Clapper	NDC	Date: 3/18/02	
Checked: J.D. Ludowise	JDL	Date: 3-18-02	
Calc. No.: 0100N-CA-V0049			
Rev.: 0		Sheet No.: ~~2~~ 3 of 4	

The values for X_i and Y_i are calculated using Equations 1 and 2. The Microsoft Excel (R) RAND() function was used to calculate values for RND.

Sample No.	Random Number = RAND()		Crib Space Coordinates	
	For Calculating X Coordinate	For Calculating Y Coordinate	X	Y
103	0.0939	0.9563	11	112
104	0.2795	0.3448	33	40
105	0.0405	0.5573	5	65
106	0.4413	0.0349	52	4
107	0.3655	0.0726	43	8
108	0.6989	0.3738	83	44
109	0.9267	0.9650	110	113
110	0.3472	0.0837	41	10
111	0.3823	0.4521	45	53
112	0.5992	0.2143	71	25
113	0.4935	0.2745	59	32
114	0.7299	0.8657	87	101
115	0.7879	0.5463	94	64
116	0.2713	0.5410	32	63
117	0.6332	0.7926	75	93
118	0.0494	0.2319	6	27
119	0.4136	0.1353	49	16
120	0.1873	0.3001	22	35
121	0.4095	0.9053	49	106
122	0.0393	0.1573	5	18
123	0.5680	0.2137	68	25
124	0.6725	0.2106	80	25
125	0.9550	0.1944	114	23
126	0.7485	0.4488	89	52
127	0.3913	0.7608	47	89
128	0.3384	0.7563	40	88
129	0.7726	0.8732	92	102
130	0.6235	0.8685	74	101
131	0.9323	0.4369	111	51
132	0.1113	0.4546	13	53
133	0.1826	0.7337	22	86
134	0.4584	0.3175	54	37
135	0.2745	0.3373	33	39
136	0.5313	0.8465	63	99
137	0.6676	0.1510	79	18
138	0.7322	0.0761	87	9
139	0.4199	0.3011	50	35
140	0.4130	0.4265	49	50
141	0.6109	0.8549	73	100
142	0.5237	0.2557	62	30
143	0.5958	0.6026	71	70
144	0.7905	0.0877	94	10
145	0.7497	0.5479	89	64
146	0.7969	0.7343	95	86
147	0.5999	0.9414	71	110
148	0.2279	0.3894	27	46
149	0.7909	0.3753	94	44
150	0.1413	0.6020	17	70
151	0.6279	0.8370	75	98
152	0.6618	0.5684	79	66
153	0.4342	0.6723	52	79

Sampling Locations in Trench Space Coordinates

Attachment A			
Originator: N.D. Clapper	NDC	Date: 3/18/02	
Checked: J.D. Ludowise	JDL	Date: 3-18-02	
Calc. No.: 0100N-CA-V0049			
Rev.: 0		Sheet No.: 4 of 4	

The values for X_i and Y_i are calculated using Equations 1 and 2. The Microsoft Excel (R) RAND() function was used to calculate values for RND.

Sample No.	Random Number = RAND()		Crib Space Coordinates	
	For Calculating X Coordinate	For Calculating Y Coordinate	X	Y
154	0.8244	0.9322	98	109
155	0.5373	0.5798	64	68
156	0.5270	0.9790	63	114
157	0.0618	0.7790	7	91
158	0.9280	0.2416	110	28
159	0.9350	0.3839	111	45
160	0.3973	0.7463	47	87
161	0.6383	0.7029	76	82
162	0.7296	0.9640	87	113
163	0.2762	0.6281	33	73
164	0.2559	0.5180	30	61
165	0.8622	0.0017	103	0
166	0.6919	0.9751	82	114
167	0.5212	0.8472	62	99
168	0.7582	0.7435	90	87
169	0.4206	0.7093	50	83
170	0.2901	0.0673	34	8
171	0.6048	0.1102	72	13
172	0.0451	0.7903	5	92
173	0.0196	0.2436	2	28
174	0.1513	0.5167	18	60
175	0.9430	0.0489	112	6
176	0.6242	0.3583	74	42
177	0.8173	0.6402	97	75
178	0.3512	0.2068	42	24
179	0.3966	0.1884	47	22
180	0.1605	0.2035	19	24
181	0.5008	0.8188	60	96
182	0.2705	0.5783	32	68
183	0.1528	0.8178	18	96
184	0.9759	0.1693	116	20
185	0.9860	0.8251	117	96
186	0.8938	0.1505	106	18
187	0.4581	0.9391	54	110
188	0.1390	0.9345	17	109
189	0.5144	0.0082	61	1
190	0.4585	0.6128	55	72
191	0.0521	0.8688	6	102
192	0.0601	0.2725	7	32
193	0.3575	0.8117	42	95
194	0.6053	0.4914	72	57
195	0.6173	0.7665	73	90
196	0.9811	0.6870	117	80
197	0.0256	0.9473	3	111
198	0.1094	0.7724	13	90
199	0.2098	0.5312	25	62
200	0.7688	0.8660	91	101

Sample Locations in Washington State Plane Coordinates

Attachment B	
Originator: N.D. Clapper	NDC Date: 3/18/02
Checked: J.D. Ludowise	JDL Date: 3-18-02
Calc. No.: 0100N-CA-V0049	
Rev.: 0	Sheet No.: 1 of 1

The following table represents the first 30 variance sample locations for the Shallow Zone Decision Unit that fell within the sample area as shown on Attachment D.

Variance Sample Locations (Shallow Zone)

Sample No.	Sample No. from Attachment A	Crib Space Coordinates		Washington State Plane Coordinates		Washington State Plane Coordinates, rounded to the nearest meter	
		X	Y	Easting	Northing	Easting	Northing
VSZ-01	12	2	15	571,882.21	149,534.77	571,882	149,535
VSZ-02	17	118	111	571,952.44	149,667.95	571,952	149,668
VSZ-03	18	2	102	571,848.79	149,615.10	571,849	149,615
VSZ-04	19	115	6	571,990.00	149,569.85	571,990	149,570
VSZ-05	20	21	115	571,861.35	149,634.40	571,861	149,634
VSZ-06	23	4	52	571,869.84	149,569.70	571,870	149,570
VSZ-07	30	0	73	571,858.09	149,587.55	571,858	149,588
VSZ-08	31	115	94	571,956.20	149,651.11	571,956	149,651
VSZ-09	47	110	113	571,944.29	149,666.73	571,944	149,667
VSZ-10	48	116	8	571,990.15	149,572.08	571,990	149,572
VSZ-11	50	0	46	571,868.45	149,562.62	571,868	149,563
VSZ-12	60	6	3	571,890.51	149,525.22	571,891	149,525
VSZ-13	62	5	59	571,868.08	149,576.55	571,868	149,577
VSZ-14	63	57	1	571,938.37	149,542.96	571,938	149,543
VSZ-15	64	0	39	571,871.14	149,556.16	571,871	149,556
VSZ-16	74	51	2	571,932.44	149,541.58	571,932	149,542
VSZ-17	77	37	109	571,878.42	149,635.00	571,878	149,635
VSZ-18	78	3	13	571,883.90	149,533.31	571,884	149,533
VSZ-19	88	4	51	571,870.23	149,568.78	571,870	149,569
VSZ-20	89	71	115	571,907.51	149,653.60	571,908	149,654
VSZ-21	95	82	111	571,919.20	149,654.13	571,919	149,654
VSZ-22	96	111	81	571,957.50	149,637.57	571,958	149,638
VSZ-23	97	69	115	571,905.66	149,652.83	571,906	149,653
VSZ-24	98	113	91	571,955.51	149,647.57	571,956	149,648
VSZ-25	101	1	74	571,858.62	149,588.86	571,859	149,589
VSZ-26	103	11	112	571,853.26	149,627.79	571,853	149,628
VSZ-27	105	5	65	571,865.77	149,582.09	571,866	149,582
VSZ-28	106	52	4	571,932.60	149,543.81	571,933	149,544
VSZ-29	122	5	18	571,883.82	149,538.69	571,884	149,539
VSZ-30	125	114	23	571,982.55	149,585.17	571,983	149,585

Sample Locations in Washington State Plane Coordinates

Attachment C	
Originator: N.D. Clapper	NDC Date: 3/18/02
Checked: J.D. Ludowise	JDL Date: 3-18-02
Calc. No.: 0100N-CA-V0049	
Rev.: 0	Sheet No.: 1 of 1

The following table represents the next 10 cleanup verification sample locations for the Shallow Zone Decision Unit that fell within the *sample area as shown on* Attachment E.

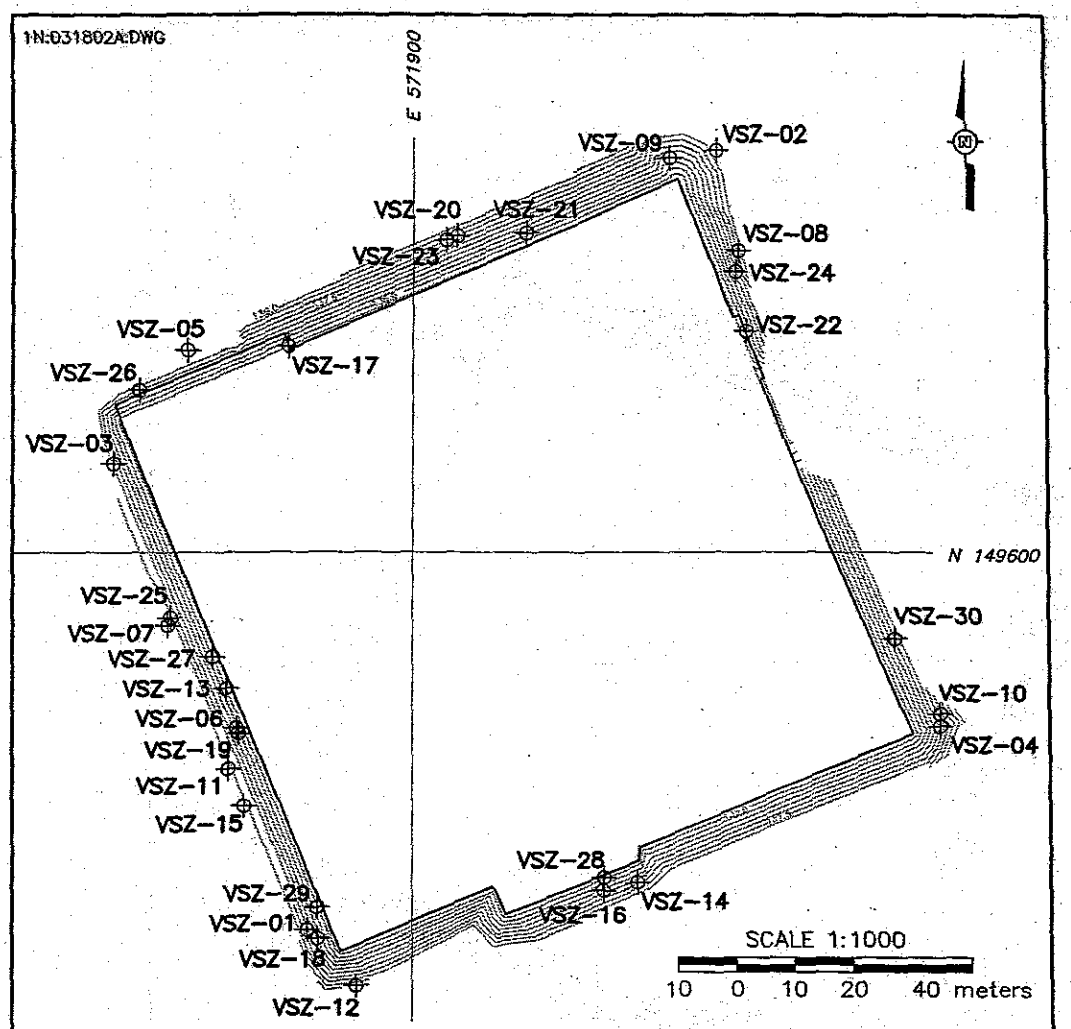
Cleanup Verification (Shallow Zone)

Sample No.	Sample No. from Attachment A	Crib Space Coordinates		Washington State Plane Coordinates		Washington State Plane Coordinates, rounded to the nearest meter	
		X	Y	Easting	Northing	Easting	Northing
SZ-01	147	71	110	571,909.43	149,648.98	571,909	149,649
SZ-02	*156*	*63*	*114*	*571,900.51*	*149,649.60*	*571,901*	*149,650*
SZ-03	162	87	113	571,923.05	149,657.90	571,923	149,658
SZ-04	165	103	0	571,981.22	149,559.71	571,981	149,560
SZ-05	166	82	114	571,918.05	149,656.90	571,918	149,657
SZ-06	170	34	8	571,914.44	149,540.59	571,914	149,541
SZ-07	172	5	92	571,855.41	149,607.02	571,855	149,607
SZ-08	173	2	28	571,877.21	149,546.77	571,877	149,547
SZ-09	175	112	6	571,987.23	149,568.70	571,987	149,569
SZ-10	*185*	*117*	*96*	*571,957.28*	*149,653.72*	*571,957*	*149,654*

The following table represents the first 10 cleanup verification sample locations for the Deep Zone Decision Unit that fell within the sample area as shown on Attachment F.

Cleanup Verification (Deep Zone)

Sample No.	Sample No. from Attachment A	Crib Space Coordinates		Washington State Plane Coordinates		Washington State Plane Coordinates, rounded to the nearest meter	
		X	Y	Easting	Northing	Easting	Northing
DZ-01	1	53	10	571,931.22	149,549.74	571,931	149,550
DZ-02	2	14	56	571,877.54	149,577.23	571,878	149,577
DZ-03	3	56	53	571,917.47	149,590.59	571,917	149,591
DZ-04	4	43	98	571,888.19	149,627.15	571,888	149,627
DZ-05	5	88	55	571,946.25	149,604.73	571,946	149,605
DZ-06	6	18	50	571,883.54	149,573.23	571,884	149,573
DZ-07	7	95	60	571,950.79	149,612.03	571,951	149,612
DZ-08	8	41	46	571,906.31	149,578.37	571,906	149,578
DZ-09	9	21	26	571,895.52	149,552.22	571,896	149,552
DZ-10	10	10	76	571,866.17	149,594.16	571,866	149,594

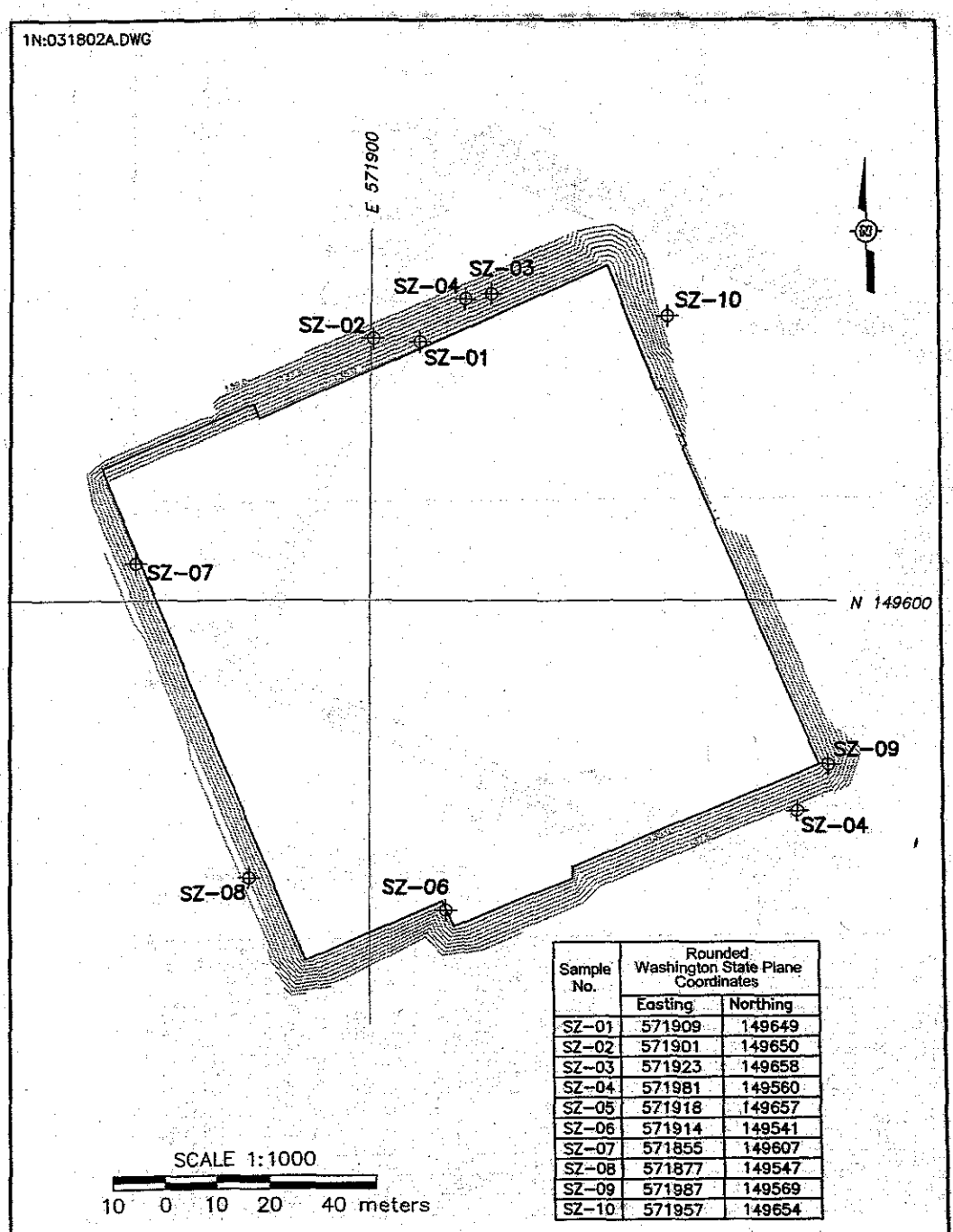


Sample No.	Rounded Washington State Plane Coordinates		Sample No.	Rounded Washington State Plane Coordinates		Sample No.	Rounded Washington State Plane Coordinates	
	Easting	Northing		Easting	Northing		Easting	Northing
VSZ-01	571882	149535	VSZ-11	571868	149563	VSZ-21	571919	149654
VSZ-02	571952	149668	VSZ-12	571891	149525	VSZ-22	571958	149638
VSZ-03	571849	149615	VSZ-13	571868	149577	VSZ-23	571906	149653
VSZ-04	571990	149570	VSZ-14	571938	149543	VSZ-24	571956	149648
VSZ-05	571861	149634	VSZ-15	571871	149556	VSZ-25	571859	149589
VSZ-06	571870	149570	VSZ-16	571932	149542	VSZ-26	571853	149628
VSZ-07	571858	149588	VSZ-17	571878	149635	VSZ-27	571866	149582
VSZ-08	571956	149651	VSZ-18	571884	149533	VSZ-28	571933	149544
VSZ-09	571944	149667	VSZ-19	571870	149569	VSZ-29	571884	149539
VSZ-10	571990	149572	VSZ-20	571908	149654	VSZ-30	571983	149585

U.S DEPARTMENT OF ENERGY
DOE FIELD OFFICE, RICHLAND
HANFORD ENVIRONMENTAL RESTORATION PROGRAM

100 N AREA
116-N-3 CRIB VARIANCE
SHALLOW ZONE SAMPLE DESIGN

Attachment D Sheet No. 1 of 1
Drawn by N.D. CLAPPER MK Date 3/18/02
Checked By [illegible] Date 3-18-02
Dwg. No. 0100N-CA-V0049 Rev. No. 0

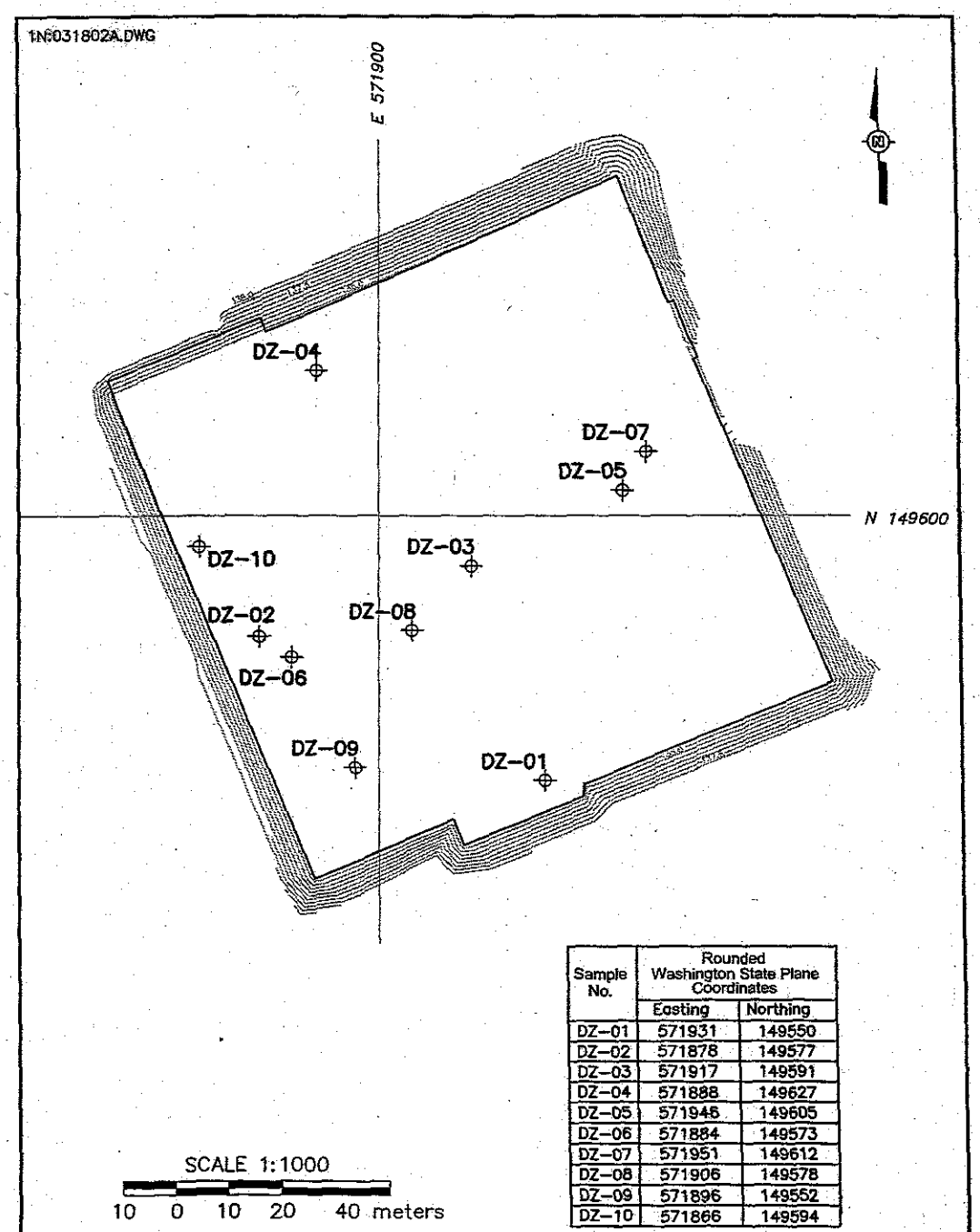


Sample No.	Rounded Washington State Plane Coordinates	
	Easting	Northing
SZ-01	571909	149649
SZ-02	571901	149650
SZ-03	571923	149658
SZ-04	571981	149560
SZ-05	571918	149657
SZ-06	571914	149541
SZ-07	571855	149607
SZ-08	571877	149547
SZ-09	571987	149569
SZ-10	571957	149654

U.S DEPARTMENT OF ENERGY
DOE FIELD OFFICE, RICHLAND
HANFORD ENVIRONMENTAL RESTORATION PROGRAM

100 N AREA
116-N-3 CRIB
SHALLOW ZONE SAMPLE DESIGN

Attachment E Sheet No. 1 of 1
Originator N.D. CLAPER NDC Date 3/18/02
Chk'd By [illegible] Date 3-18-02
Code No. 0100N-CA-V0049 Rev. No. 0



Sample No.	Rounded Washington State Plane Coordinates	
	Easting	Northing
DZ-01	571931	149550
DZ-02	571878	149577
DZ-03	571917	149591
DZ-04	571888	149627
DZ-05	571946	149605
DZ-06	571884	149573
DZ-07	571951	149612
DZ-08	571906	149578
DZ-09	571896	149552
DZ-10	571866	149594

U.S DEPARTMENT OF ENERGY
DOE FIELD OFFICE, RICHLAND
HANFORD ENVIRONMENTAL RESTORATION PROGRAM

100 N AREA
116-N-3 CRIB
DEEP ZONE SAMPLE DESIGN

Attachment F Sheet No. 1 of 1
Originator N.D. CLAPPER Date 3/13/02
Chk'd By Date 3-18-02
Calc. No. 0100N-CA-V0049 Rev. No. 0

CALCULATION COVER SHEET

Project Title 100 Area Remediation **Job No.** 22192

Area 100-N

Discipline Environmental Engineering ***Calc. No.** 0100N-CA-V0044

Subject 116-N-3 to 116-N-1 Pipeline and Bypass Corridor Sample Design

Computer Program Microsoft Excel **Program No.** Office 97 Version

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 sheet Calculations = 5 sheets Attach A = 3 sheets Attach B = 1 sheet Attach C = 1 sheet Total = 11 sheets	NDC 12/12/01 N.D.Clapper	12-12-01 J.D. Ludowise	KEC 12/13/01 K.E. Cook	D.F. Obenauer D.F. Obenauer	12/13/01
1	Cover = 1 sheet Calculations = 5 sheets Att. A = 3 sheets Att. B = 1 sheet Att. C = 1 sheet Total = 11 sheets	NDC 2/5/02	2-5-02	KEC 2/6/02	D.F. Obenauer	2/7/02

SUMMARY OF REVISIONS

1	Revised for reference corrections and miscellaneous typographical errors. Results are unchanged.

* Obtain Calc. No. from DIS

BHI-DE-01, EDPI-4.37-01, DE01437.03

Bechtel Hanford, Inc. **CALCULATION**

Originator N.D.Clapper NDC **Date** 2/5/02 **Calc. No.** 0100N-CA-V0044 **Rev. No.** 1
Project 100 Area Remediation **Job No.** 22192 **Checked** J.D. Ludowise JDL **Date** 2-5-02
Subject 116-N-3 to 116-N-1 Pipeline and Bypass Corridor Sample Design
Sheet No. 1 of 5

1. Purpose

Calculate the coordinates of locations of cleanup verification samples for the Shallow Zone of 116-N-3 to 116-N-1 pipeline and bypass corridor per the requirements of the *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout (DOE-RL 2000).*

2. Results Summary

Based on this Calculation, ten sample locations are identified for the Shallow Zone (See Attachments).

Contents

Sheet No.	Title	Topic/Contents
	Cover	Cover
1 of 5	Calculation Sheet 1	Purpose, Results Summary, and Contents
2 of 5	Calculation Sheet 2	Requirements, Given/Assumed Information, References, and Calculations
3 of 5	Calculation Sheet 3	Calculations (Continued)
4 of 5	Calculation Sheet 4	Calculations (Continued), Figure 1.
5 of 5	Calculation Sheet 5	Calculations (Continued)

Attachments

Number of Sheets	Attachments	Topic/Contents
3	Attachment A	Sample Locations in Trench Space Coordinates
1	Attachment B	Sample Locations in Washington State Plane Coordinates
1	Attachment C	Map of Waste Site With Sample Locations

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator N.D.Clapper NDC **Date** 2/5/02 **Calc. No.** 0100N-CA-V0044 **Rev. No.** 1

Project 100 Area Remediation **Job No.** 22192 **Checked** J.D. Ludowise JDL **Date** 2-5-02

Subject 116-N-3 to 116-N-1 Pipeline and Bypass Corridor Sample Design

Sheet No. 2 of 5

3. Requirements

Section 3.2.1.11 of the *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout* (DOE-RL 2000) requires the following:

- Use the number of sampling locations determined from the 116-N-3 Crib variance calculation
- A simple random sampling method

4. Given/Assumed Information

Assume the 116-N-3 variance calculation will determine that 10 samples are to be collected. This calculation will be revised if the variance calculation reports differently.

The coordinates of the corners of a rectangle that encloses the excavation (design rectangle):

Washington State Plane Coordinates (meters)	
Easting	Northing
571,849.00	149,508.28
571,878.81	149,583.35
571,519.63	149,725.97
571,489.82	149,650.90

Field measurements should be accurate to within 1 meter.

5. References

Stewart, J., 1991, *Calculus*, 2 ed., Brooks/Cole Publishing Co., Pacific Grove, California.

DOE-RL, 2000, *Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout, DOE/RL-2000-07, Rev. 0*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

6. Calculations

Coordinates of sampling locations can be calculated by using the procedure outlined in Section A.1 of Appendix A of DOE-RL (2000):

1. Generate a set of coordinates (X,Y) using the following equations:

$$X = X_{min} + (X_{max}-X_{min})*RND \quad \text{(Eq. 1)}$$

$$Y = Y_{min} + (Y_{max}-Y_{min})*RND \quad \text{(Eq. 2)}$$

where RND is the next unused random number between 0 and 1 in a sequence of random numbers (Attachment C).

2. If (X,Y) is located outside the sample area, return to step 1 to generate another random coordinate; Otherwise go to step 3.

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator N.D.Clapper NDC **Date** 2/5/02 **Calc. No.** 0100N-CA-V0044 **Rev. No.** 1

Project 100 Area Remediation **Job No.** 22192 **Checked** J.D. Ludowise JDL **Date** 2-5-02

Subject 116-N-3 to 116-N-1 Pipeline and Bypass Corridor Sample Design
Sheet No. 3 of 5

6. Calculations (Continued)

3. Define (X_i, Y_i) using the following steps:
   a. Round X to the nearest unit that can be located easily in the field; set this to X_i.
   b. Round Y to the nearest unit that can be located easily in the field; set this to Y_i.

4. Continue to generate the next random coordinate (X_i, Y_i).

The sampling coordinates are calculated with respect to a trench coordinate system described as follows:

- The origin of the trench coordinates is established as the eastern most corner of the design rectangle at Washington State Plane Coordinates E571878.81, N149583.35.
- The X-axis parallels the long axis of the trench
- The Y-axis parallels the short axis of the trench

The trench coordinate system is shown on Figure 1.

The trench space coordinates of the 4 corners of the trench are calculated from the Washington State Plane Coordinates using the Pythagorean Theorem. Results are shown in Table 1.

Table 1. Coordinates of design rectangle

Washington State Plane Coordinates (meters)		*Trench Space* Coordinates (meters)	
Easting	*Northing*	X	Y
571,849.00	149,508.28	0.00	80.77
571,878.81	149,583.35	0.00	0.00
571,519.63	149,725.97	386.46	0.00
571,489.82	149,650.90	386.46	80.77

The minimum and maximum X values are:

X_{min} 0.00
X_{max} 386.46

The minimum and maximum Y values are:

Y_{min} 0.00
Y_{max} 80.77

Bechtel Hanford, Inc. **CALCULATION SHEET**

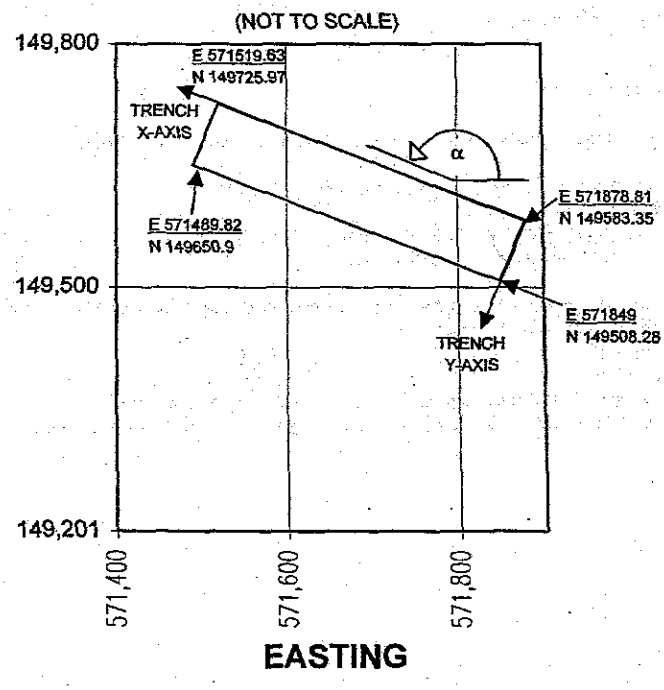
Originator N.D.Clapper NDC **Date** 12/12/01 **Calc. No.** 0100N-CA-V0044 **Rev. No.** 0

Project 100 Area Remediation **Job No.** 22192 **Checked** J.D. Ludowise **Date** 12-12-01

Subject 116-N-3 to 116-N-1 Pipeline and Bypass Corridor Sample Design
Sheet No. 4 of 5

6. Calculations (Continued).

FIGURE 1. Bypass Corridor from 116-N-3 to 116-N-1



Note: Figure 1. illustrates the coordinate rotation (α) of the design rectangle that is used in Equations 3 and 4.

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator N.D.Clapper NDC **Date** 2/5/02 **Calc. No.** 0100N-CA-V0044 **Rev. No.** 1

Project 100 Area Remediation **Job No.** 22192 **Checked** J.D. Ludowise JDL **Date** 2-5-02

Subject 116-N-3 to 116-N-1 Pipeline and Bypass Corridor Sample Design

Sheet No. 5 of 5

6. Calculations (Continued).

The coordinates in Attachment C need to be converted to Washington State Plane Coordinates. This conversion is accomplished by rotating the X-Y axes into the Washington State Plane Coordinates.

If x and y are the Easting and Northing values, respectively, and X and Y are the trench space coordinates, then the formulas for conversion are provided in Appendix E of Stewart (1991):

$$x = X\cos(\alpha) - Y\sin(\alpha) \qquad \text{(Eq. 3)}$$

$$y = X\sin(\alpha) + Y\cos(\alpha) \qquad \text{(Eq. 4)}$$

where α is the angle of rotation as shown in Figure 1.

α is calculated from the formula:

$$\alpha = \arctan[(y_2-y_1)/(x_2-x_1)] + Pi()$$

Because the site is sloping in a negative direction, Pi was added in the formula to make α a positive value.

Using the coordinates of the southeast and northeast corners of the trench excavation,

$$\alpha = \arctan[(y_2-y_1)/(x_2-x_1)] + Pi()$$

$$= \arctan[(149{,}725.97 - 149{,}583.35) / (571{,}519.63 - 571{,}878.81)]$$

$$= 2.76 \text{ radians or } 158.34 \text{ degrees}$$

Because the origin of the trench coordinate system and the Washington State Plane Coordinate system are not the same point, equations 3 and 4 need to be adjusted by this difference:

$$x = X_0 + X\cos(\alpha) - Y\sin(\alpha) \qquad \text{(Eq. 5)}$$

$$y = Y_0 + X\sin(\alpha) + Y\cos(\alpha) \qquad \text{(Eq. 6)}$$

where X_0 and Y_0 are the Washington State Plane Coordinates of the origin of the trench space coordinate system, 571,878.81 and 149,583.35 meters, respectively. The results, using equations 5 and 6 are shown in Attachment B.

Sampling Locations in Trench Space Coordinates

Attachment A			
Originator: N.D. Clapper	NDC	Date:	12/12/01
Checked: J.D. Ludowise	JDL	Date:	12-12-01
Calc. No.: 0100N-CA-V0044			
Rev.: 0		Sheet No.: 1 of 3	

The values for X_i and Y_i are calculated using Equations 1 and 2. The Microsoft Excel (R) RAND() function was used to calculate values for RND.

	Random Number = RAND()		Trench Space Coordinates, Rounded to the Nearest Meter	
Sample No.	For Calculating X Coordinate	For Calculating Y Coordinate	X	Y
1	0.1220	0.7785	47	63
2	0.0224	0.2523	9	20
3	0.0339	0.1024	13	8
4	0.8548	0.6134	330	50
5	0.8066	0.3460	312	28
6	0.1993	0.6349	77	51
7	0.0254	0.7020	10	57
8	0.6106	0.9170	236	74
9	0.6770	0.9581	262	77
10	0.9952	0.0299	385	2
11	0.8339	0.0356	322	3
12	0.1537	0.2346	59	19
13	0.0549	0.6509	21	53
14	0.3598	0.7902	139	64
15	0.4235	0.6006	164	49
16	0.9956	0.8292	385	67
17	0.5197	0.7281	201	59
18	0.9600	0.4912	371	40
19	0.3722	0.7067	144	57
20	0.7325	0.3788	283	31
21	0.4832	0.2915	187	24
22	0.7833	0.3686	303	30
23	0.4939	0.5378	191	43
24	0.6932	0.3460	268	28
25	0.3942	0.4796	152	39
26	0.2510	0.8753	97	71
27	0.3105	0.4961	120	40
28	0.3115	0.3417	120	28
29	0.5377	0.5689	208	46
30	0.0130	0.7260	5	59
31	0.3241	0.9468	125	76
32	0.8849	0.5097	342	41
33	0.3919	0.4745	151	38
34	0.8630	0.1849	334	15
35	0.5246	0.1094	203	9
36	0.0802	0.5963	31	48
37	0.4808	0.8664	186	70
38	0.8448	0.2880	326	23
39	0.9186	0.0948	355	8
40	0.3773	0.3041	146	25
41	0.8376	0.6855	324	55
42	0.8135	0.3707	314	30
43	0.1912	0.8931	74	72
44	0.0091	0.2775	4	22
45	0.8016	0.7388	310	60
46	0.0003	0.2025	0	16
47	0.2084	0.6277	81	51

Sampling Locations in Trench Space Coordinates

Attachment A	
Originator: N.D. Clapper NDC	Date: 12/12/01
Checked: J.D. Ludowise JDL	Date: 12-12-01
Calc. No.: 0100N-CA-V0044	
Rev.: 0	Sheet No.: 2 of 3

The values for X_i and Y_i are calculated using Equations 1 and 2. The Microsoft Excel (R) RAND() function was used to calculate values for RND.

Sample No.	Random Number = RAND()		Trench Space Coordinates, Rounded to the Nearest Meter	
	For Calculating X Coordinate	For Calculating Y Coordinate	X	Y
48	0.0163	0.6875	6	56
49	0.5411	0.4950	209	40
50	0.6209	0.1988	240	16
51	0.6894	0.0430	266	3
52	0.8370	0.9393	323	76
53	0.4903	0.6087	189	49
54	0.0221	0.9019	9	73
55	0.8447	0.5591	326	45
56	0.6713	0.1808	259	15
57	0.8259	0.4323	319	35
58	0.2841	0.7626	110	62
59	0.4957	0.3767	192	30
60	0.5382	0.9977	208	81
61	0.1964	0.3858	76	31
62	0.4848	0.0260	187	2
63	0.5919	0.2082	229	17
64	0.7123	0.3054	275	25
65	0.2599	0.0635	100	5
66	0.3634	0.8492	140	69
67	0.3879	0.9712	150	78
68	0.1692	0.6133	65	50
69	0.1949	0.9547	75	77
70	0.9550	0.2849	369	23
71	0.4282	0.4412	165	36
72	0.8526	0.0655	330	5
73	0.3359	0.2360	130	19
74	0.5350	0.0417	207	3
75	0.7474	0.7538	289	61
76	0.1419	0.4282	55	35
77	0.5947	0.6354	230	51
78	0.2040	0.2247	79	18
79	0.3533	0.5108	137	41
80	0.8028	0.9909	310	80
81	0.4903	0.0233	189	2
82	0.6069	0.8164	235	66
83	0.8824	0.2355	341	19
84	0.6940	0.0772	268	6
85	0.3715	0.5997	144	48
86	0.4593	0.1262	178	10
87	0.4374	0.5102	169	41
88	0.9689	0.9369	374	76
89	0.2008	0.0533	78	4
90	0.5277	0.1429	204	12
91	0.2758	0.1620	107	13
92	0.8146	0.6435	315	52
93	0.1398	0.0632	54	5
94	0.5263	0.1114	203	9

Sampling Locations in Trench Space Coordinates

Attachment A	
Originator: N.D. Clapper NDC	Date: 12/12/01
Checked: J.D. Ludowise JDL	Date: 12-12-01
Calc. No.: 0100N-CA-V0044	
Rev.: 0	Sheet No.: 3 of 3

The values for X_i and Y_i are calculated using Equations 1 and 2. The Microsoft Excel (R) RAND() function was used to calculate values for RND.

	Random Number = RAND()		Trench Space Coordinates, Rounded to the Nearest Meter	
Sample No.	For Calculating X Coordinate	For Calculating Y Coordinate	X	Y
95	0.9263	0.5262	358	42
96	0.7269	0.1164	281	9
97	0.7423	0.9886	287	80
98	0.5755	0.9971	222	81
99	0.1339	0.4825	52	39
100	0.1907	0.5500	74	44

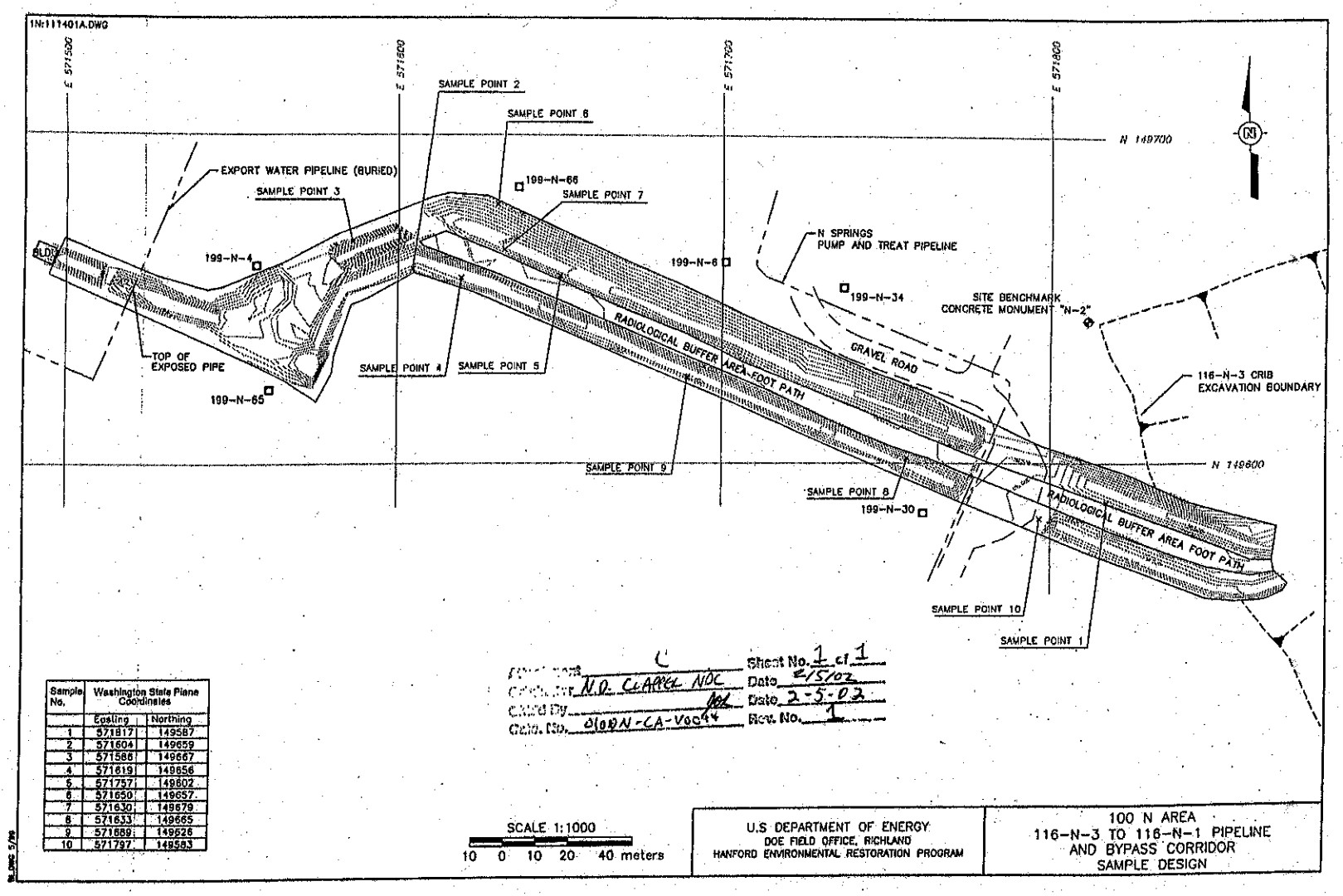
Sample Locations in Washington State Plane Coordinates

Attachment B	
Originator: N.D. Clapper	NDC Date: 2/5/02
Checked: J.D. Ludowise	JL Date: 2-5-02
Calc. No.: 0100N-CA-V0044	
Rev.: 1	Sheet No.: 1 of 1

The following table represents the 10 sample locations for the Shallow Zone Decision Unit that fell within the sample area as shown on Attachment C.

Shallow Zone

Sample No.	Sample No. from Attachment A	Trench Space Coordinates, Rounded to the Nearest Meter		Washington State Plane Coordinates		Rounded Washington State Plane Coordinates	
		X	Y	Easting	Northing	Easting	Northing
SZ-01	12	59	19	571,816.96	149,587.46	571,817	149,587
SZ-02	20	283	31	571,604.35	149,658.98	571,604	149,659
SZ-03	22	303	30	571,586.13	149,667.29	571,586	149,667
SZ-04	24	268	28	571,619.39	149,656.23	571,619	149,656
SZ-05	28	120	28	571,756.95	149,601.61	571,757	149,602
SZ-06	50	240	16	571,649.85	149,657.05	571,650	149,657
SZ-07	51	266	3	571,630.48	149,678.73	571,630	149,679
SZ-08	56	259	15	571,632.56	149,664.99	571,633	149,665
SZ-09	59	192	30	571,689.29	149,626.32	571,689	149,626
SZ-10	61	76	31	571,796.73	149,582.59	571,797	149,583



Sample No.	Washington State Plane Coordinates	
	Easting	Northing
1	571817	149587
2	571604	149659
3	571586	149667
4	571619	149656
5	571757	149602
6	571650	149657
7	571630	149679
8	571633	149665
9	571689	149626
10	571797	149583

CALCULATION COVER SHEET

Project Title:	100-NR-1 TSD Site	**Job No.**	22192
Area	100-N		
Discipline	Environmental	***Calc. No.**	0100N-CA-V0058
Subject	116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification 95% UCL Calculation		
Computer Program	Excel	**Program No.**	Excel 97

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover = 1 Sheets = 16 Total = 17	N.N. Smith-Jackson 8/9/02	J.E. Thomson 8/12/02 T.B. Miley 8/12/02	K.E. Cook 8/12/02	J.D. Fancher D. F. Obenauer 8/14/02	8/14/02

SUMMARY OF REVISIONS

* Obtain calc no. from DIS

Nov-98

DE01-437.03

Bechtel Hanford, Inc. CALCULATION SHEET

Originator	N.N. Smith-Jackson	Date	8/9/02	Calc. No.	0100N-CA-V0058	Rev. No.	0
Project	100-NR-1 TSD Site	Job No.	22192	Checked	J.E. Thomson / T.B. Miley	Date	8/12/02 / 8/12/02
Subject	116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification 95% UCL Calculation					Sheet No.	1 of 16

Purpose:
Calculate the 95% UCL to evaluate compliance with cleanup standards for the 116-N-3 combined Trench, Crib, and Pipeline. Also, calculate the carcinogenic risk for applicable nonradionuclide analytes (shallow zone only), MTCA 3-part test, if required (all nonradionuclide analytes), and the relative percent difference (RPD) for each contaminant of concern (COC).

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Page 5 of 16: Trench, Crib, and Pipeline Shallow Zone Data (Page 2)
Page 6 of 16: Nitrate MTCAStat Shallow Zone
Page 7 of 16: Pipeline Overburden Data
Page 8 of 16: Nitrate MTCAStat Overburden
Page 9 of 16: Trench and Crib Deep Zone Data (Page 1)
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Page 11 of 16: Nitrate MTCAStat Deep Zone
Page 12 of 16: Trench Split-Dup Analysis
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Page 14 of 16: Pipeline Split-Dup Analysis
Page 15 of 16: WDOH Regulator Split Analysis
Page 16 of 16: WDOE Regulator Split Analysis

Given/References:

1) Sample Results
2) Remedial Design Report/Remedial Action Work Plan (RDR/RAWP) for the 100-NR-1 Treatment, Storage, and Disposal Units, DOE/RL 2000-16, Rev. 1. All Lookup values and RAGs are taken from the RDR/RAWP unless otherwise specified.
3) Sampling and Analysis Plan for the 100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout, DOE/RL-2000-07, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) Model Toxics Control Act, Washington Administrative Code-173-340, and Statistical Guidance for Ecology Site Managers, Ecology Pub. #92-54, Washington Department of Ecology, Olympia, Washington.
5) 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).
6) EPA, 1994, USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540/R-94/013.
7) Ecology, 1996, Model Toxics Control Act Cleanup Levels and Risk Calculations (CLARC III) Update, Publication #94-145, Washington State Department of Ecology, Olympia, Washington.

Solution:
Calculation methodology is described in Ecology Pub. #92-54 and below. Use data from attached worksheets to calculate the 95% upper confidence limit (UCL) for each analyte and carcinogenic risk and to perform the MTCA 3-part test for nonradionuclides and RPD calculations for each COC.

Calculation Description:
The subject calculations were performed on data from soil verification samples from waste site 116-N-3 Trench, Crib, and Pipeline. The data were entered into an EXCEL 97 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 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:
The statistical value calculated to evaluate the effectiveness of cleanup was the 95% UCL. For nonradioactive analytes with > 50% of the data below detection limits, the maximum value for the sample data was used instead of the 95% UCL. All nonradionuclide (e.g., metals) data reported as being below detection limits were 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 usd in the calculation.

For the statistical evaluation of duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above.

For nonradionuclides the MTCA statistical guidance suggests that a test for distributional form be performed on the data, and the 95% UCL calculated on the appropriate distribution. For nonradionuclide small data sets (n < 10) and all radionuclide data sets, the calculations are performed assuming nonparametric distribution, and no test for distribution is performed. For nonradionuclide large data sets (n >= 10), a distribution test is conducted on the data set using Ecology MTCAStat software.

The estimated hazard quotient (for applicable nonradionuclide COCs) is determined by dividing the statistical value (derived in this calculation) by the MTCA B non-carcinogenic cleanup limit. The nonradionuclide carcinogenic risk, above background, is determined by dividing the statistical value by the MTCA B carcinogenic cleanup limit and then multiplying by 10^{-6}. For data sets where all values are below detection, neither of these calculations are required. For noncarcinogenic nonradionuclide COCs, only the estimated fraction of risk computation must be performed.

The MTCA 3-part test determines if:
1) the statistical 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 3-part test is performed for nonradionuclide analytes found in overburden, the shallow zone, and the deep zone (as necessary).

Bechtel Hanford, Inc.

CALCULATION SHEET

Originator	N.N. Smith-Jackson	Date	8/12/02	Calc. No. 0100N-CA-V0058	Rev. No. 0
Project	100-NR-1 TSD Site	Job No.	22192	Checked J.E. Thomson	Date 8/12/02
				T.B. Miley	8/12/02
Subject	116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification 95% UCL Calculation				Sheet No. 2 of 16

The RPD is performed when both the main value and, either the duplicate, split, or regulator 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. These detection limit requirements are located in Table 2-1 of the SAP, DOE/RL-2000-07, where they are referred to as the MDL. 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 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 540/R-94/013). 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 five 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 useability of the data is performed and presented in the applicable CVP data quality assessment.

Results:
The results presented in the summary tables that follow are for use in RESRAD dose/risk analysis and the Cleanup Verification Package (CVP) for this site.

Result Summary - Trench, Crib, and Pipeline Shallow Zone

Am-241	1.02E-01	U	pCi/g
Cs-137	4.06E-01		pCi/g
Co-60	3.87E-01		pCi/g
Eu-154	6.03E-02	U	pCi/g
Eu-155	4.22E-02	U	pCi/g
H-3 (tritium) is not a shallow zone COC			
Ni-63	-6.62E-02	U	pCi/g
Pu-239/240	2.82E-02	U	pCi/g
Sr-90	1.70E-01		pCi/g
Hg	2.00E-02	U	mg/kg
Nitrate	1.24E+00		mg/kg

MTCA Evaluation (Trench, Crib, and Pipeline Shallow Zone)

MTCA 3-Part Test:

95% UCL > Cleanup Limit? NA
> 10% above Cleanup Limit? NA
Any sample > 2X Cleanup Limit? NA

Risk Estimate:

MTCA 3-Part-Test Compliance: NA
Nonrad carcinogenic risk: NA

Because all nonradioactive analytes were below background or below detection, the MTCA 3-Part-Test and excess risk are not calculated.

Result Summary - Trench and Crib Deep Zone

Am-241	1.54E+02		pCi/g
Cs-137	4.90E+03		pCi/g
Co-60	5.58E+03		pCi/g
Eu-154	8.70E+00		pCi/g
Eu-155	6.45E+00	U	pCi/g
H-3	-7.26E-03	U	pCi/g
Ni-63	1.03E+03	U	pCi/g
Pu-239/240	2.58E+02		pCi/g
Sr-90	1.46E+03		pCi/g
Hg is not a deep zone COC			
Nitrate	3.00E+00		mg/kg

MTCA Evaluation (Trench and Crib Deep Zone)

MTCA 3-Part Test:

95% UCL > Cleanup Limit? NA
> 10% above Cleanup Limit? NA
Any sample > 2X Cleanup Limit? NA

Risk Estimate:

MTCA 3-Part-Test Compliance: NA
Nonrad carcinogenic risk: NA

Because all nitrate results were below background or below detection, the MTCA 3-Part-Test and excess risk are not calculated.

Result Summary - Pipeline Overburden

Am-241	7.12E-02	U	pCi/g
Cs-137	0 (< BG)		pCi/g
Co-60	9.46E-02		pCi/g
Eu-154	2.89E-02	U	pCi/g
Eu-155	0 (< BG)	U	pCi/g
H-3 (tritium) is not an overburden COC			
Ni-63	-6.24E-01	U	pCi/g
Pu-239/240	0 (< BG)	U	pCi/g
Sr-90	0 (< BG)	U	pCi/g
Hg	2.00E-02	U	mg/kg
Nitrate	1.18E+01		mg/kg

MTCA Evaluation (Pipeline Overburden)

MTCA 3-Part Test:

95% UCL > Cleanup Limit? NA
> 10% above Cleanup Limit? NA
Any sample > 2X Cleanup Limit? NA

Risk Estimate:

MTCA 3-Part-Test Compliance: NA
Nonrad carcinogenic risk: NA

Because all nonradioactive analytes were below background or below detection, the MTCA 3-Part-Test and excess risk are not calculated.

Split/Duplicate Results:

Trench

Relative Percent Difference (RPD) Results (Trench Shallow Zone) *

QA/QC Analysis		
Analyte	Duplicate Analysis	Split Analysis
Am-241		
Cs-137		
Co-60		
H-3 is not a Shallow Zone COC		
Eu-154		
Eu-155		
Ni-63		
Pu-239/240		
Sr-90		
Nitrate		
Hg		

* A blank box indicates the RPD did not need to be calculated. RPD calculation is required when both samples are greater than the MDA and both samples are greater than 5 times the TDL.

Relative Percent Difference (RPD) Results (Trench Deep Zone) *

QA/QC Analysis		
Analyte	Duplicate Analysis	Split Analysis
Am-241	*41.9%*	*48.4%*
Cs-137		
Co-60		
H-3		
Eu-154		
Eu-155		
Ni-63	*6.9%*	*107.8%*
Pu-239/240	*18.1%*	*54.0%*
Sr-90	*3.5%*	
Nitrate	*1.7%*	
Hg is not a Deep Zone COC		

* A blank box indicates the RPD did not need to be calculated. RPD calculation is required when both samples are greater than the MDA and both samples are greater than 5 times the TDL.

Crib

Relative Percent Difference (RPD) Results (Crib Shallow Zone) *

QA/QC Analysis		
Analyte	Duplicate Analysis	Split Analysis
Am-241		
Cs-137		
Co-60		
H-3 is not a shallow zone COC		
Eu-154		
Eu-155		
Ni-63		
Pu-239/240		
Sr-90		
Nitrate		
Hg		

* A blank box indicates the RPD did not need to be calculated. RPD calculation is required when both samples are greater than the MDA and

Relative Percent Difference (RPD) Results (Crib Deep Zone) *

QA/QC Analysis		
Analyte	Duplicate Analysis	Split Analysis
Am-241		
Cs-137	*0.6%*	*167.9%*
Co-60	*29.5%*	*165.3%*
H-3		
Eu-154		
Eu-155		
Ni-63		
Pu-239/240		*71.5%*
Sr-90	*11.4%*	
Hg is not a deep zone COC		
Nitrate		

* A blank box indicates the RPD did not need to be calculated. RPD calculation is required when both samples are greater than the MDA and both samples are

Pipeline

Relative Percent Difference (RPD) Results (Pipeline Shallow Zone) *

QA/QC Analysis		
Analyte	Duplicate Analysis	Split Analysis

Relative Percent Difference (RPD) Results (Pipeline Overburden) *

QA/QC Analysis		
Analyte	Duplicate Analysis	Split Analysis

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator	N.N. Smith-Jackson NNJ	Date: 8/9/02	Calc. No.:	0100N-CA-V0058	Rev. No.: 0
Project	100-NR-1 TSD Site	Job No.: 22192	Checked by:	J.E. Thomson JET	Date: 8/12/02
				T.B. Miley TBM	8/12/02
Subject	116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification 95% UCL Calculation				Sheet No.: 3 of 16

Regulator Splits

Washington Department of Health (WDOH)

Relative Percent Difference (RPD) Results*

QA/QC Analysis

Analyte	WDOH-N3T-SZ04 Trench	WDOH-N3C-SZ01 Crib	WDOH-N3C-SZ06 Crib	WDOH-N3C-SZ07 Crib
Am-241	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Cs-137				
Co-60				
H-3	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Eu-154				
Eu-155				
Ni-63	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Pu-239/240	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Sr-90				
Nitrate	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Hg	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*

* A blank box indicates the RPD did not need to be calculated. RPD calculation is required when both samples are greater than the MDA and both samples are greater than 5 times the TDL.

Note: WDOH did not analyze splits for the pipeline.

Washingon Department of Ecology (WDOE)

Relative Percent Difference (RPD) Results*

QA/QC Analysis

Analyte	WDOE-N3C-SZ01 Crib	WDOE-N3C-SZ06 Crib	WDOE-N3C-SZ07 Crib	WDOE-N3T-SZ04 Trench	WDOE-N3T-SZ08 Trench	WDOE-N3T-SZ09 Trench
Am-241	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Cs-137	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Co-60	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
H-3	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Eu-154	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Eu-155	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Ni-63	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Pu-239/240	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Sr-90	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Nitrate	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*	*No Split Analysis*
Hg						

* A blank box indicates the RPD did not need to be calculated. RPD calculation is required when both samples are greater than the MDA and both samples are greater than 5 times the TDL.

Note: WDOE did not analyze splits for the pipeline.

CALCULATION COVER SHEET

Project Title 100-NR-1 TSD Site **Job No.** 22192
Area 100-N Area
Discipline Environmental **Calc. No.** 0100N-CA-V0059
Subject 116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification RESRAD Calculations
Computer Program RESRAD **Program No.** Version 6.1

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0		N. N. Smith-Jackson *Approved 8/7/02*	S. W. Clark *Approved 8/7/02*	S. E. Parnell *Approved 8/8/02*	D. F. Obenauer *Approved 8/14/02* J. D. Fancher *Approved 8/14/02*	*Approved 8/14/02*
1		N. N. Smith-Jackson *Approved 11/27/02*	S. W. Clark *Approved 11/27/02*	K. E. Cook *Approved 11/27/02*	D. F. Obenauer *Approved 12/2/02* J. D. Fancher *Approved 12/2/02*	*Approved 12/2/02*
2	Cover – 1 pg Summary– 8 pgs Attn. 1 - 1 pg Attn. 2 -27 pgs Attn. 3 - 44 pgs Attn. 4 - 21 pgs Attn. 5 - 25 pgs Attn. 6 - 44 pgs Attn. 7 - 21 pgs Attn. 8 - 28 pgs Attn. 9 - 44 pgs Attn. 10 – 21 pgs Attn. 11- 28 pgs Attn. 12 – 44 pgs Attn. 13 –21 pgs Attn. 14 – 28 pgs Attn. 15 – 44 pgs Attn. 16 – 21 pgs Total– pages 471	N. N. Smith-Jackson N. Smith-Jackson 12/18/02	S. W. Clark S. W. Clark 12/18/02	S. E. Parnell S. E. Parnell 12/18/02	D. F. Obenauer D. F. Obenauer J. D. Fancher J. D. Fancher 12/19/02	12/19/02

SUMMARY OF REVISION

1	Revision of this calculation brief was necessary to include europium-154 and europium-155 concentrations for Layer II and Layer III of the Deep Zone. These concentrations are from CCN 085932, the *100-NR-1 Surbsurface Contaminant Layers* Technical Memorandum. RESRAD runs for these two layers have been rerun to include the europium-154 and europium-155 concentrations. The input values can be found in Attachments 11 and 14 of this calculation brief.
2	Revision of this calculation brief was necessary to correct the Layer III concentration for Co-60 shown in Table 3 of this calculation brief. The previous revision presented the value as 7.17E-02 pCi/g. The correct value is 7.17E-01 pCi/g. The RESRAD run for this layer has been rerun with the corrected value.

*Obtain Calc. No. from DIS

November 1998

DE01-437.03

Bechtel Hanford, Inc.

116-N-3 RESRAD CALCULATION SUMMARY

Originator:	N.N. Smith-Jackson	Date:	12/18/02	Calc. No.:	0100N-CA-V0059	Rev.:	2
Project:	100-NR-1 TSD Site	Job No:	22192	Checked:	S. W. Clark	Date:	12/18/02
Subject:	116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification RESRAD Calculations					Sheet No. 1 of 8	

PROBLEM STATEMENT:

Calculate the soil and groundwater concentrations, dose, and risk contributions from remaining radionuclide contaminants in the vadose zone soil at the 116-N-3 Trench, Crib, and Pipeline Remediation site over a period of 1,000 years.

REFERENCES:

1) Cleanup verification data from *116-N-3 Trench, Crib, and Pipeline 95% UCL Calculations for Compliance with Cleanup Standards (Shallow Zone and Deep Zone)*, Calculation No. 0100N-CA-V0058, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
2) *Remedial Design Report/Remedial Action Work Plan for the 100-NR-1 Treatment, Storage, and Disposal Units,* DOE/RL-2000-16, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, WA.
3) Radioactive and nonradioactive contaminants of concern from the *100-NR-1 Treatment, Storage, and Disposal Units During Remediation and Closeout Sampling and Analysis Plan* (100-NR-1 SAP), DOE/RL-2000-07, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington. For the purpose of these RESRAD calculations, the radioactive contaminants of concern (COCs) are americium-241, cesium-137, cobalt-60, tritium, europium-154, europium-155, tritium, nickel-63, plutonium-239/240, and strontium-90.
4) RESidual RADioactivity (RESRAD) computer code, version 6.1, 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) Calculation of relative individual Pu-239 and Pu-240 activities from the reported Pu-239/240 results per *Ratios of Plutonium Isotopes at 100 Areas Remedial Action Sites*, Calculation No. 0100B-CA-V0013, Bechtel Hanford, Inc., Richland, Washington.
6) *100-NR-1 Subsurface Contaminant Layers*, CCN 085935, 100-N Remedial Action Project Technical Memorandum from C. A. Kahler-Royer to J. D. Fancher, January 30, 2002, Bechtel Hanford, Inc., Richland, Washington.
7) *Soil Screening Guidance for Radionuclides: User's Guide,* EPA/540-R-00-007, U.S. Environmental Protection Agency, Washington, D.C., October, 2000.

SOLUTION:

1) Separate RESRAD runs were performed for the relevant vadose zone soil horizons. Table 1 shows the elevations (NGVD88) and dimensions of each soil horizon. The ground surface elevation for excavation backfill is 138.8 m. The average groundwater elevation beneath the site is 117.5 m. The average elevation of the excavation floor in the deep zone sampling

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116-N-3 RESRAD CALCULATION SUMMARY

Originator:	N.N. Smith-Jackson	Date:	12/18/02	Calc. No.:	0100N-CA-V0059	Rev.:	2
Project:	100-NR-1 TSD Site	Job No:	22192	Checked:	S. W. Clark	Date:	12/18/02
Subject:	116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification RESRAD Calculations					Sheet No. 2 of 8	

areas is 134.2 m. Attachment 1 shows the dimensions of each soil horizon and the contaminant pathways considered for dose, risk, and groundwater protection. Input factors for each run are shown in the "Summary" section of the RESRAD "Part I: Mixture Sums and Single Radionuclide Guidelines" printouts in the Attachments to this Calculation Summary.

Table 1. Dimensions and Elevations of 116-N-3 Soil Horizons

RESRAD Run #	Vadose Zone Horizon	Upper Elevation (m)	Lower Elevation (m)	Thickness (m)
1	Shallow Zone	138.8	134.2	4.6
2	Overburden	138.8	134.2	4.6
3	Deep Zone Layer I	134.2	132.2	2.0
4	Deep Zone Layer II	132.2	124.9	7.3
5	Deep Zone Layer III	124.9	117.5	7.4

2) The year where the peak dose (or concentration) occurs from each individual COC and layer is determined by a preliminary run. This year is then added for all horizons for the final RESRAD runs. For the direct exposure pathways (i.e., soil ingestion and inhalation and external radiation), the peak year occurred at year 0 (the present, year 2002). For the water dependent pathways (i.e., drinking water and food ingestion) the peak years were 7.6 for cobalt-60, 42 for cesium-137 and strontium-90, and 137 for nickel-63. The 7.6, 42, and 137-year time periods were included in all of the RESRAD runs.

METHODOLOGY:

1) Pu-239/240 Conversion: The relative individual Pu-239 and Pu-240 activities were calculated from the combined Pu-239/240 results reported. The calculations were performed in accordance with calculation brief No. 0100B-CA-V0013. The relative activities for Pu-239 and Pu-240 were calculated by multiplying the cleanup verification value for Pu-239/240 by 0.807 and 0.193, respectively. Table 2 shows the results from this calculation.

Table 2. Conversion of Pu-239/240 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	2.82E-02	2.28E-02	5.44E-03
2	Overburden	0 (<BG)	0.00E+00	0.00E+00
3	Deep Zone Layer I	2.58E+02	2.08E+02	4.98E+01
4	Deep Zone Layer II	7.44E-03	6.00E-03	1.44E-03
5	Deep Zone Layer III	1.03E-02	8.31E-03	1.99E-03

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116-N-3 RESRAD CALCULATION SUMMARY

Originator:	N.N. Smith-Jackson	Date:	12/18/02	Calc. No.:	0100N-CA-V0059	Rev.:	2
Project:	100-NR-1 TSD Site	Job No:	22192	Checked:	S. W. Clark	Date:	12/18/02
Subject:	116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification RESRAD Calculations					Sheet No. 3 of 8	

2) Runs of RESRAD Version 6.1 were completed for the vadose zone using the radionuclide concentrations shown in Table 3. RESRAD numerical output reports for dose, risk, and concentration for the shallow and deep zones are presented in the Attachments to this Calculation Summary.

Based on the conservative assumption (outlined in the RDR/RAWP) that the Deep Zone Layer I contaminant statistical value concentrations extend uniformly to groundwater, RESRAD predicts that the concentrations of americium-241, cobalt-60, cesium-137, nickel-63, plutonium-239, plutonium-240, and strontium-90 in Deep Zone Layer I will result in groundwater concentrations that exceed the groundwater RAGs. Because the assumption that the Deep Zone Layer I contaminant concentrations extend uniformly to groundwater is too conservative in the case of these contaminants, contaminant depth distributions were obtained using the data reported in CCN 085935, the *100-NR-1 Subsurface Contaminant Layers* Technical Memorandum, to more accurately describe the concentration/depth profiles for modeling using RESRAD. The cobalt-60, cesium-137, europium-154, europium-155, plutonium-239, plutonium-240, and strontium-90 concentration/depth profiles are obtained directly from Table 2-1 of CCN 085935.

Because a site specific nickel-63 concentration/depth profile is not available, the concentration/depth profile of nickel-63 was conservatively calculated by assuming that the concentrations of nickel-63 in Deep Zone Layers I, II, and III are in the same proportions as the concentrations of strontium-90 in Deep Zone Layers I, II, and III. This is conservative because nickel-63 has a higher distribution coefficient (Kd value = 30 mL/g) than strontium-90 (Kd value = 15 mL/g) and nickel-63 would therefore be expected to have proportionately lower concentrations than strontium-90 in Deep Zone Layers II and III. The same methodology was used to determine the concentrations for americium-241, however, these were conservatively calculated by assuming that the concentrations of americium-241 in Deep Zone Layers I, II, and III are in the same proportions as the concentrations of plutonium 239/240 in Deep Zone Layers I, II, and III. Both americium-241 and plutonium 239/240 have the same distribution coefficient (Kd value = 200 mL/g).

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116-N-3 RESRAD CALCULATION SUMMARY

Originator:	N.N. Smith-Jackson NSJ	Date:	12/18/02	Calc. No.:	0100N-CA-V0059	Rev.:	2
Project:	100-NR-1 TSD Site	Job No:	22192	Checked:	S. W. Clark SWC	Date:	12/18/02
Subject:	116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification RESRAD Calculations					Sheet No. 4 of 8	

Table 3. Cleanup Verification Data Set

Radionuclide COCs	Shallow Zone	Overburden	Deep Zone		
			Layer I	Layer II	Layer III
	Radionuclide Activity, pCi/g				
	Run #1	Run #2	Run #3	Run #4	Run #5
Am-241	1.02E-01	7.12E-02	1.54E+02	4.38E-03[d]	6.07E-03[d]
Co-60	3.87E-01	9.46E-02	5.58E+03	7.81E-01[b]	7.17E-01[b]
Cs-137	4.06E-01	0 (<BG)[a]	4.90E+03	2.11E-01[b]	8.32E-02[b]
Eu-154	6.03E-02	2.89E-02	8.70E+00	3.02E-01[b]	1.62E-01[b]
Eu-155	4.22E-02	0 (<BG)[a]	6.45E+00	2.33E-01[b]	9.29E-02[b]
H-3	Not SZ COC	Not OVB COC	-7.26E-03[e]	-7.26E-03[e]	-7.26E-03[e]
Ni-63	-6.62E-02[e]	-6.24E-01[e]	1.03E+03	8.26E+01[c]	8.12E+00[c]
Pu-239	2.28E-02	0 (<BG)[a]	2.08E+02	6.00E-03[b]	8.31E-03[b]
Pu-240	5.44E-03	0 (<BG)[a]	4.98E+01	1.44E-03[b]	1.99E-03[b]
Sr-90	1.70E-01	0 (<BG)[a]	1.46E+03	1.17E+02[b]	1.15E+01[b]

[a] Value was not input into RESRAD because the concentration is below Hanford site background.
[b] The Deep Zone Layer II and Layer III Co-60, Cs-137, Eu-154, Eu-155, Pu-239, Pu-240, and Sr-90 concentrations are from CCN 085935, the *100-NR-1 Subsurface Contaminant Layers* Technical Memorandum.
[c] The Deep Zone Layer II and Layer III Ni-63 concentrations were conservatively assumed to be in direct proportion to the Deep Zone Layer II and Layer III Sr-90 concentrations.
[d] The Deep Zone Layer II and Layer III Am-241 concentrations were conservatively assumed to be in direct proportion with Deep Zone Layer II and III Pu-239 and Pu-240 concentrations.
[e] RESRAD does not accept negative values. When results are negative, zero is used as the input value.

RESULTS:

1) **Radionuclide "All Pathways" Dose Rate:** The "all pathways" (maximum) dose rates are shown in Table 4. The maximum dose rate of 5.95 mrem/yr is from the shallow zone and occurs at year 0 (the present).

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116-N-3 RESRAD CALCULATION SUMMARY

Originator:	N.N. Smith-Jackson NSJ	Date:	12/18/02	Calc. No.:	0100N-CA-V0059	Rev.:	2
Project:	100-NR-1 TSD Site	Job No:	22192	Checked:	S. W. Clark SWC	Date:	12/18/02
Subject:	116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification RESRAD Calculations					Sheet No. 5 of 8	

Table 4. All Pathways[a] Dose Rate (mrem/yr)

RESRAD Run #	Vadose Zone Horizons	"All Pathways" Dose Contributions in mrem/yr at Each Time Slice (yr)									
		0	1	3	7.6	16	42	47	137	300	1000
1	Shallow Zone	5.95E+00	5.40E+00	4.50E+00	3.07E+00	1.78E+00	7.05E-01	6.23E-01	1.06E-01	3.32E-02	1.58E-02
3	Deep Zone, Layer I	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4	Deep Zone, Layer II	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5	Deep Zone, Layer III	0.00E+00	3.89E-02	1.12E-01	2.54E-01	4.37E-01	6.16E-01	6.12E-01	2.08E-01	9.67E-03	1.07E-05
Total All Pathways Dose Rate (mrem/yr)		5.95E+00	5.44E+00	4.61E+00	3.32E+00	2.22E+00	1.32E+00	1.24E+00	3.14E-01	4.29E-02	1.58E-02
2	Overburden[b]	1.11E+00	9.87E-1	7.75E-01	4.51E-01	1.80E-01	3.30E-02	2.93E-02	2.07E-02	1.58E-02	5.06E-03

[a] The direct exposure pathways used to obtain these values are External Gamma, Inhalation, Plant Ingestion, Meat Ingestion, Milk Ingestion, Aquatic Foods and Soil Ingestion. Drinking Water was not used in the calculation because groundwater will not be used for consumption.
[b] Dose rates attributed to the overburden are not included in the total dose.

2) Radionuclide Excess Cancer Risk

The radionuclide excess cancer risk results are shown on Table 5. The maximum risk (5.81×10^{-5}) occurs at year 0 and is primarily from shallow zone soils.

Table 5. Radionuclide Excess Cancer Risk

RESRAD Run #	Vadose Zone Horizons	Excess Cancer Risk at Each Time Slice (yr)									
		0	1	3	7.6	16	42	47	137	300	1000
1	Shallow Zone	5.26E-05	4.88E-05	4.25E-05	3.21E-05	2.16E-05	9.97E-06	8.81E-06	1.12E-06	9.95E-08	3.50E-08
3	Deep Zone, Layer I	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4	Deep Zone, Layer II	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5	Deep Zone, Layer III	5.48E-06	5.76E-06	6.26E-06	7.20E-06	8.27E-06	8.40E-06	8.13E-06	2.37E-06	1.16E-07	3.32E-10
Total Excess Cancer Risk		5.81E-05	5.46E-05	4.88E-05	3.93E-05	2.99E-05	1.84E-05	1.69E-05	3.49E-06	2.16E-07	3.53E-08
2	Overburden[b]	7.16E-06	6.31-06	4.96E-06	2.89E-06	1.13E-06	1.34E-07	1.08E-07	5.60E-08	4.28E-08	1.37E-08

[a] The direct exposure pathways used to obtain these values are External Gamma, Inhalation, Plant Ingestion, Meat Ingestion, Milk Ingestion, Aquatic Foods and Soil Ingestion. Drinking Water was not used in the calculation because groundwater will not be used for consumption.
[b] Excess cancer risk attributed to the overburden are not included in the total excess cancer risk.

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116-N-3 RESRAD CALCULATION SUMMARY

Originator:	N.N. Smith-Jackson NNSJ	Date:	12/18/02	Calc. No.:	0100N-CA-V0059	Rev.:	2
Project:	100-NR-1 TSD Site	Job No:	22192	Checked:	S. W. Clark	Date:	12/18/02
Subject:	116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification RESRAD Calculations					Sheet No. 6 of 8	

3) Radionuclide Groundwater Protection

The radionuclide concentrations in groundwater calculated by the RESRAD model are summarized in Table 6. Only concentrations are presented here. Of the radionuclide contaminants of concern, only nickel-63, and strontium-90 were calculated to reach groundwater in the 1,000 years of the RESRAD model. These two radionuclide contaminants are calculated to impact groundwater at concentrations below the applicable remedial action goals (RAGs) from the Soil Screening Guidance for Radionuclides: User's Guide.

Table 6. RESRAD Estimated Groundwater (Well Water) Concentrations.

Radio-nuclide	Vadose Zone Horizon	Groundwater Concentration in pCi/L at Each Time Slice (yr)										RAG
		0	1	3	7.6	16	42	47	137	300	1000	
Am-241	Total	0	0	0	0	0	0	0	0	0	0	15
	Overburden [a]	0	0	0	0	0	0	0	0	0	0	
Co-60	Total	0	0	0	0	0	0	0	0	0	0	100
	Overburden [a]	0	0	0	0	0	0	0	0	0	0	
Cs-137	Total	0	0	0	0	0	0	0	0	0	0	60
	Overburden [a]	0	0	0	0	0	0	0	0	0	0	
H-3	Total	0	0	0	0	0	0	0	0	0	0	20,000
	Overburden [a]	Not an Overburden COC										
Eu-154	Total	0	0	0	0	0	0	0	0	0	0	60
	Overburden [a]	0	0	0	0	0	0	0	0	0	0	
Eu-155	Total	0	0	0	0	0	0	0	0	0	0	600
	Overburden [a]	0	0	0	0	0	0	0	0	0	0	
Ni-63	SZ	0	0	0	0	0	0	0	0	0	0	50
	DZ-I	0	0	0	0	0	0	0	0	0	0	
	DZ-II	0	0	0	0	0	0	0	0	0	0	
	DZ-III	0	3.44E-02	1.02E-01	2.50E-01	4.94E-01	1.08E+00	1.16E+00	1.76E+00	1.18E+00	2.46E-02	
	Total	0	3.44E-02	1.02E-01	2.50E-01	4.94E-01	1.08E+00	1.16E+00	1.76E+00	1.18E+00	2.46E-02	
	Overburden [a]	0	0	0	0	0	0	0	0	0	0	
Pu-239	Total	0	0	0	0	0	0	0	0	0	0	15
	Overburden [a]	0	0	0	0	0	0	0	0	0	0	
Pu-240	Total	0	0	0	0	0	0	0	0	0	0	15
	Overburden [a]	0	0	0	0	0	0	0	0	0	0	
Sr-90	SZ	0	0	0	0	0	0	0	0	0	0	8
	DZ-I	0	0	0	0	0	0	0	0	0	0	
	DZ-II	0	0	0	0	0	0	0	0	0	0	
	DZ-III	0	3.50E-01	1.00E+00	2.27E+00	3.91E+00	5.51E+00	5.47E+00	1.85E+00	8.21E-02	5.42E-09	
	Total	0	3.50E-01	1.00E+00	2.27E+00	3.91E+00	5.51E+00	5.47E+00	1.85E+00	8.21E-02	5.42E-09	
	Overburden [a]	0	0	0	0	0	0	0	0	0	0	

[a] Groundwater concentrations attributed to the overburden are not included in the total estimated groundwater concentration amount.

Bechtel Hanford, Inc.

116-N-3 RESRAD CALCULATION SUMMARY

Originator:	N.N. Smith-Jackson NNJ	Date:	12/19/02	Calc. No.:	0100N-CA-V0059	Rev.:	2
Project:	100-NR-1 TSD Site	Job No:	22192	Checked:	S. W. Clark SWC	Date:	8/18/03
Subject:	116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification RESRAD Calculations					Sheet No. 7 of 8	

CONCLUSIONS:

- The maximum dose rate for the 116-N-3 trench site is 5.95 mrem/yr and occurs at year zero (year 2002).
- The dominant pathway for the dose rate at the year of maximum dose is direct external exposure.
- The primary radionuclide contributing to the dose rate at the year of maximum dose is cobalt-60.
- None of the 116-N-3 site COCs are projected to exceed remedial action goals (RAGs) within the 1,000 years of the RESRAD evaluation.
- Maximum excess lifetime cancer risk (5.81×10^{-5}) occurs at year zero, and is primarily contributed from the shallow zone.
- Of the contaminants of concern, nickel-63 and strontium-90 are calculated to reach groundwater within the 1,000 years of the RESRAD model run. These radionuclides reach groundwater at concentrations below the RAGs.

ATTACHMENTS:

1. Graphic showing 116-N-3 Cleanup Verification Model (1 page)
2. RESRAD Output: 116-N-3 – Shallow Zone (Run #1), Part I: Mixture Sums and Single Radionuclide Guidelines (27 pages)
3. RESRAD Output: 116-N-3 – Shallow Zone (Run #1), Part III: Intake Quantities and Health Risk Factors (44 pages)
4. RESRAD Output: 116-N-3 – Shallow Zone (Run #1), Part IV: Concentration of Radionuclides (21 pages)
5. RESRAD Output: 116-N-3 – Overburden (Run #2), Part I: Mixture Sums and Single Radionuclide Guidelines (25 pages)
6. RESRAD Output: 116-N-3 – Overburden (Run #2), Part III: Intake Quantities and Health Risk Factors (44 pages)
7. RESRAD Output: 116-N-3 – Overburden (Run #2), Part IV: Concentration of Radionuclides (21 pages)
8. RESRAD Output: 116-N-3 – Deep Zone Layer I (Run #3), Part I: Mixture Sums and Single Radionuclide Guidelines (28 pages)
9. RESRAD Output: 116-N-3 – Deep Zone Layer I (Run #3), Part III: Intake Quantities and Health Risk Factors (44 pages)
10. RESRAD Output: 116-N-3 – Deep Zone Layer I (Run #3), Part IV: Concentration of Radionuclides (21 pages)

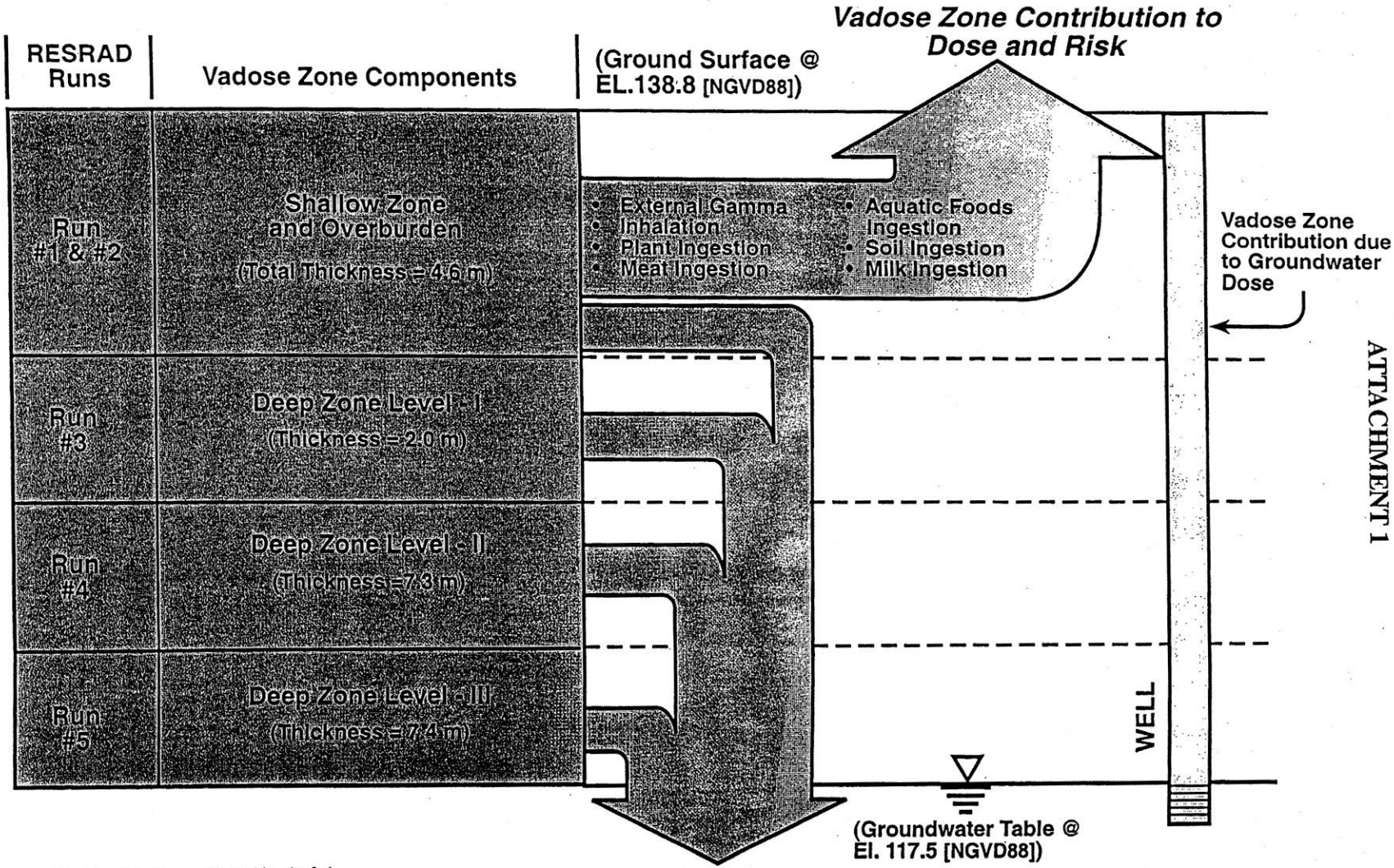
Bechtel Hanford, Inc.

116-N-3 RESRAD CALCULATION SUMMARY

Originator:	N.N. Smith-Jackson NSJ	Date:	12/18/02	Calc. No.:	0100N-CA-V0059	Rev.:	2
Project:	100-NR-1 TSD Site	Job No:	22192	Checked:	S. W. Clark SWC	Date:	12/18/02
Subject:	116-N-3 Combined Trench, Crib, and Pipeline Cleanup Verification RESRAD Calculations					Sheet No. 8 of 8	

11. RESRAD Output: 116-N-3 – Deep Zone Layer II (Run #4), Part I: Mixture Sums and Single Radionuclide Guidelines (28 pages)
12. RESRAD Output: 116-N-3 – Deep Zone Layer II (Run #4), Part III: Intake Quantities and Health Risk Factors (44 pages)
13. RESRAD Output: 116-N-3 – Deep Zone Layer II (Run #4), Part IV: Concentration of Radionuclides (21 pages)
14. RESRAD Output: 116-N-3 – Deep Zone Layer III (Run #5), Part I: Mixture Sums and Single Radionuclide Guidelines (28 pages)
15. RESRAD Output: 116-N-3 – Deep Zone Layer III (Run #5), Part III: Intake Quantities and Health Risk Factors (44 pages)
16. RESRAD Output: 116-N-3 – Deep Zone Layer III (Run #5), Part IV: Concentration of Radionuclides (21 pages)

116-N-3 Trench, Crib and Pipeline Cleanup Verification Model



Attachment 1 Sheet No. 1 of 1
Originator N.N. Smith-Jackson Date 11/27/02
Chk'd By S. W. Clark Date 11/27/02
Calc. No. 0100N-CA-V0059 Rev. No. 1

ATTACHMENT 1

CALCULATION COVER SHEET

Project Title:	100-NR-1 TSD Site	**Job No.**	22192
Area	100-N Area		
Discipline	Environmental	***Calc. No.**	0100N-CA-V0060
Subject	116-N-3 Trench, Crib, and Pipeline Comparison to Drinking Water Standards		
Computer Program	Excel	**Program No.**	Excel 97

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover - 1 Calculations - 3 Total - 4	N. N. Smith-Jackson N. Smith-Jackson 8/7/02	S. W. Clark 8/7/02	S. E. Parnell 8/8/02	D.F. Obenauer D.F. Obenauer J.D. Fanther J.D. Fanther	8/14/02 8/14/02

SUMMARY OF REVISIONS

*Obtain Calc. No. from DIS

November 1998

DE01437.03

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator	N. N. Smith-Jackson	Date	7/1/02	Calc. No.	0100N-CA-V0060	Rev. No.	0
Project	100-NR-1 TSD Site	Job No.	22192	Checked	S. W. Clark	Date	8/7/02
Subject	116-N-3 Trench, Crib, and Pipeline Comparison to Drinking Water Standards					Sheet No.	1 of 3

Purpose:
Compare RESRAD derived groundwater radionuclide concentrations to MCLs . Compare alpha emitter dose contribution to the maximum allowable gross particle activity of 15 pCi/L (Safe Drinking Water Act, 40 CFR Part 141, Subpart B, 141.51). Compare beta/gamma emitter dose contribution to the maximum allowable dose of 4 mrem/yr (National Primary Drinking Water Regulations, 40 CFR Part 141, Subpart B, 141.16), as calculated using NBS Handbook 69 individual organ-dose calulation methodology and EPA-570/9-76-003 total organ-dose calulation methodology.

Table of Contents:
1. Calculation Summary
2. Summed Concentration of Radionuclides
3. Cumulative Dose Comparison

Given/References:
1) RESRAD derived groundwater radionuclide concentrations from Calculation 0100N-CA-V0059.

2) Radionuclide concentrations in water corresponding to 4 mrem/year (C4 mrem/yr) from Calculation 0100X-CA-V0025 or as determined from references in item 5.

3) MCLs obtained from: *Soil Screening Guidance for Radionuclides: User's Guide*, EPA/540-R-00-007, October, 2000, U.S. Environmental Protection Agency, Washington D.C.

4) Maximum allowable gross particle activity (alpha emitters) and maximum allowable dose (beta/gamma emitters) from: 40 CFR 141, "National Primary Drinking Water Regulation," *Code of Federal Regulations*, as amended.

5) Individual organ-dose caclulation methodology from: NBS 1963, *Maximum Permissible Body Burdens and Maximum Permissible Concetrations of Radionuclides in Air or Water for Occupational Exposure*, NBS Handbook 69, as amended, U.S. Department of Commerce, Washington D.C., and *National Interim Primary Drinking Water Regulations*, EPA-570/9-76-003, U.S. Environmental Protection Agency, Office of Water Supply, Washington D.C.

Solution:
1. The site data for the calculation are the groundwater concentrations for the COCs (daughter products are not considered) over time from the RESRAD groundwater (GW) concentration file.

2. If the site conceptual model breaks the contamination into multiple layers with differing concentrations, then the GW concentrations from the various model runs are added (for each time interval) to provide the concentration data for comparison to the individual MCLs and the dose calculation for the beta and gamma emitters.

3. Compare the summed concentrations for each radionuclide to the GW MCL given in the Soil Screening Guidance for Radionuclides: User's Guide.

4. The summed concentrations for the alpha emitters (Am-241 and Pu-239/240) is added to see if they meet the 15 pCi/l limit specified in 40 CFR 141.15.

5. The cumulative dose for each organ for all beta and gamma emitting COCs (Co-60, Cs-137, Eu-152, Eu-154, Eu-155, Ni-63, Pu-239/240 and Sr-90) at time t is calculated separately using the corresponding to 4 mRem/year dose (C4) and the sum of fractions equation shown below (from EPA-570/9-76-003). The organs for which doses need to be computed are total body, bone, liver and gastrointestinal tract [lower large intestine] (GI(LLI)). The individual organ doses are compared to 4 mrem/yr.

Doseorgan x (t) = [ConcA(t)/C4A(x) + ConcB(t)/C4B(x) + ...] x (4 mrem/yr)

where:
Doseorgan x (t) is the total dose to organ x in mrem/yr
ConcA(t) is the concentration of isotope A at time t in pCi/L
C4A(x) is the 4 mrem/yr dose equivalent concentration for organ x of isotope A at time t in pCi/L
If the dose for organ x < 4 mrem/yr, then the standard is met.

Conclusions:
The summed concentrations for each radionuclide are less than the GW MCL given in the Soil Screening Guidance for Radionuclides: User's Guide.

The summed concentrations for the alpha emitting COCs are less than the 15 pCi/l limit specified in 40 CFR 141.15.

The cumulative dose for each total body, bone, liver and gastrointestinal tract for all beta and gamma emitting COCs is less than 4 mrem/yr (using EPA-570/9-76-003 total dose calculation methodology).

Bechtel Hanford, Inc. **CALCULATION SHEET**

Originator	N. N. Smith-Jackson	Date 9/16/02	Calc. No. 0100N-CA-V0060		Rev. No. 0
Project	100-NR-1 TSD Site	Job 22192	Checked S. W. Clark		Date 9/17/02
Subject	116-N-3 Trench, Crib, and Pipeline Comparison to Drinking Water Standards				Sheet No. 2 of 3

Comparison of the summed concentrations for each radionuclide to the GW MCL
Data derived from RESRAD modelling, units are pCi/L

Alpha Emitters

Radionuclide	Time (years) 0	1	3	7.6	16	42	47	137	300	1000	MCL	Exceeds MCL?	Peak Conc.	Year of Peak Conc.
Am-241	0	0	0	0	0	0	0	0	0	0	15	No	0	0
Pu-239	0	0	0	0	0	0	0	0	0	0	15	No	0	0
Pu-240	0	0	0	0	0	0	0	0	0	0	15	No	0	0
Gross Alpha	0	0	0	0	0	0	0	0	0	0	15	No	0	0

Beta and Gamma Emitters

Radionuclide	Time (years) 0	1	3	7.6	16	42	47	137	300	1000	MCL	Exceeds MCL?	Peak Conc.	Year of Peak Conc.
Co-60	0	0	0	0	0	0	0	0	0	0	100	No	0	0
Cs-137	0	0	0	0	0	0	0	0	0	0	60	No	0	0
H-3	0	0	0	0	0	0	0	0	0	0	20,000	No	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	60	No	0	0
EU-155	0	0	0	0	0	0	0	0	0	0	600	No	0	0
Ni-63	0	3.44E-02	1.02E-01	2.50E-01	4.94E-01	1.08E+00	1.16E+00	1.76E+00	1.18E+00	2.46E-02	50	No	1.76E+00	137
Sr-90	0	3.50E-01	1.00E+00	2.27E+00	3.91E+00	5.51E+00	5.47E+00	1.85E+00	8.21E-02	5.42E-09	8	No	5.51E+00	42

Bechtel Hanford, Inc. **CALCULATION SHEET**

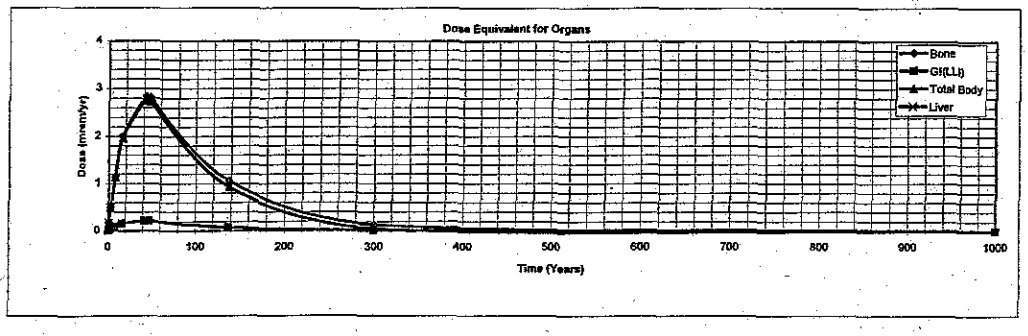
Originator	N. N. Smith-Jackson NSJ	Date 9/7/02	Calc. No. 0100N-CA-V0060		Rev. No. 0
Project	100-NR-1 TSD Site	Job 22192	Checked S. W. Clark SWC		Date 8/7/02
Subject	116-N-3 Trench, Crib, and Pipeline Comparison to Drinking Water Standards				Sheet No. 43 of 6

Comparison of the summed concentrations for each radionuclide to the GW MCL
Data derived from RESRAD modelling, units are pCi/L.

Radionuclide	Time (years) 0	1	3	7.6	16	42	47	137	300	1000	Organ	C_4	Exceeds 4 mrem/yr?	Peak Conc.	Year of Peak Conc.
Co-60	0	0	0	0	0	0	0	0	0	0	GI(LLI)	100	No	0	0
											Total Body	900	No		
											Liver	3000	No		
Cs-137	0	0	0	0	0	0	0	0	0	0	Bone	80	No	0	0
											GI(LLI)	2000	No		
											Total Body	200	No		
											Liver	60	No		
Ni-63	0.00E+00	3.44E-02	1.02E-01	2.50E-01	4.94E-01	1.08E+00	1.16E+00	1.76E+00	1.18E+00	2.46E-02	Bone	50	No	1.76E+00	137
											GI(LLI)	3000	No		
											Total Body	2000	No		
											Liver	600	No		
H-3	0	0	0	0	0	0	0	0	0	0	Total Body	20000	No	0	0
Eu-154	0	0	0	0	0	0	0	0	0	0	Bone	5000	No	0	0
											GI(LLI)	60	No		
											Total Body	70000	No		
											Liver	60000	No		
Eu-155	0	0	0	0	0	0	0	0	0	0	Bone	100000	No	0	0
											GI(LLI)	600	No		
											Total Body	900000	No		
											Liver	600000	No		
Sr-90	0	3.50E-01	1.00E+00	2.27E+00	3.91E+00	5.51E+00	5.47E+00	1.85E+00	8.21E-02	5.42E-09	Bone	8	No	5.51E+00	42
											GI(LLI)	100	No		
											Total Body	8	No		

Cumulative dose for each organ (with time)

Organ	Time (years) 0	1	3	7.6	16	42	47	137	300	1000	Exceeds 4 mrem/yr?	Peak Conc.	Year of Peak Conc.
Bone	0.00E+00	1.78E-01	5.08E-01	1.16E+00	1.99E+00	2.84E+00	2.83E+00	1.07E+00	1.35E-01	1.97E-03	No	2.84E+00	42
GI(LLI)	0.00E+00	1.40E-02	4.01E-02	9.11E-02	1.57E-01	2.22E-01	2.20E-01	7.63E-02	4.86E-03	3.28E-05	No	2.22E-01	42
Total Body	0.00E+00	1.75E-01	5.00E-01	1.14E+00	1.96E+00	2.76E+00	2.74E+00	9.29E-01	4.34E-02	4.92E-05	No	2.76E+00	42
Liver	0.00E+00	1.75E-01	5.01E-01	1.14E+00	1.96E+00	2.76E+00	2.74E+00	9.37E-01	4.89E-02	1.64E-04	No	2.76E+00	42



Technical Memorandum 085935

100-N Remedial Action Project

100-NR-1 Subsurface Contaminant Layers

Prepared for: J. D. Fancher X5-60 Concurrence: 2/1/01

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Project File H9-01
100-N Project Files X5-60
Document and Information Services H0-09

Date: January 30, 2001

1. Purpose

The purpose of this technical memorandum is to construct a three-layer model to be used as input for RESRAD modeling. Borehole sample results indicate both the 116-N-1 (1301-N) and 116-N-3 (1325-N) waste sites will have contaminants remaining after excavation is complete. RESRAD modeling is needed to determine if these remaining contaminants will exceed ROD requirements for groundwater protection compliance.

2. Conclusions

A model of subsurface contaminants was prepared. The data were sufficient to prepare the model. Two radionuclides (Ni-63 and H-3) that are deep zone contaminants of concern (DOE-RL, 2000) do not have borehole data. Additional work may be needed to determine modeling inputs for these constituents. Table 2-1 is a summary of the decayed data for each site, according to layer.

Table 2-1. Summary of Average Decayed Data by Layer

Isotope	Average for 116-N-1 Layer B (pCi/g)	Average for 116-N-1 Layer C (pCi/g)	Average for 116-N-3 Layer B (pCi/g)	Average for 116-N-3 Layer C (pCi/g)
Cs-137	22.4	0.998	0.211	0.0832
Co-60	2.46	0.545	0.781	0.717
Eu-152	-0.0169	0.00999	0.767	0.00144
Eu-154	0.868	1.08	0.302	0.162
Eu-155	0.809	0.673	0.233	0.0929
Pu-238	0.0374	0.00163	0.00373	0.00566
Pu-239/240	0.0824	-0.00286	0.00744	0.0103
Sr-90	791	78.3	117	11.5
U-235	0.0478	0.0231	0.00677	0.0291
U-238	0.495	0.422	0.489	0.418

3. Introduction and Background

In November and December of 1995, samples were collected from selected borehole locations at the 116-N-1 and the 116-N-3 waste sites. These data are presented in *1301-N and 1325-N Liquid Waste Disposal Facilities Limited Field Investigation Report* (DOE-RL 1996) and reproduced in Table 3-1 (please find the tables and figures at the end of the memo). Data for 116-N-1 are from boreholes 199-N-107A and 199-N-108A, and data for 116-N-3 are from borehole 199-N-109A.

4. Decay Calculation

Five years have elapsed since the samples were collected and the radionuclides have undergone radioactive decay. Therefore, the data shown in Table 3-1 were decayed to December 2000 according to the equation shown below. Decay parameters that were used in the calculation are shown in Table 4-1. The final activity for an isotope equals the initial activity as determined from the borehole isotope data, multiplied by the decay factor. The final activities for the samples collected in 1995 are shown in Table 5-1.

$$A = A_0 e^{-\lambda t}$$

where:
A = Final activity (pCi/g)
A_0 = Initial activity (pCi/g)
e = Base of natural logarithms (2.72)
t = Elapsed time (years)
λ = Decay constant ($0.693/(T_{1/2})$)
$T_{1/2}$ = Half life of isotope (years)

5. Decayed Data

The borehole data from 1995 were decayed to 2000 and are shown in Table 5-1.

6. Decayed Data Sorted by Depth

The decayed data were sorted into 116-N-1 data and 116-N-3 data, and then sorted by elevation into three layers.

Layer A is the surface sediments and shallow subsurface soils including the concentrated layer associated with 116-N-1 and 116-N-3. Layer B is the middle depth of the vadose zone above the boundary of the old groundwater mound associated with the former operations-era water table. Layer C is the deep vadose zone above the saturated zone (the current water table) including the old groundwater mound associated with the former operations-era water table. The layers were based on the potential for human exposure, the distribution of contaminants in the soil column, and hydrogeologic features.

Report (DOE-RL, 1996). Table 5-2 lists elevations for each borehole. The border elevations of the layers differ from borehole to borehole as a result of differences in elevation, contaminant concentration, and hydrogeologic features. Since boreholes 199-N-107A and 199-N-108A both apply to 116-N-1, the elevations that Table 5-2 lists were averaged. There were gaps in the elevations listed in Table 5-2 for the bottom of one layer and the top of the next layer. This occurred for all three boreholes. Because of this, these elevations were averaged to get a single elevation to be used as the elevation of the border between the layers. The elevation of the border between Layers A and B for 116-N-1 is 134.2 m NAVD88. The elevation of the border between Layers B and C for 116-N-1 is 125.3 NAVD88. The elevation of the border between Layers A and B for 116-N-3 is 132.2 m NAVD88. The elevation of the border between Layers B and C for 116-N-3 is 124.9 NAVD88.

The uppermost layer is called Layer A. The RESRAD calculation for this layer is to be determined after verification samples have been collected. Layer A will be based on the 95% UCL of closeout samples collected on the bottom (floor) of the crib and trench and decayed data from Table 5-1 that would fall in Layer A.

Layer B is the middle layer and Layer C is the bottom layer. Decayed concentrations of isotopes were averaged for each layer. Data with U or J qualifiers were used. Additionally, no data was used that did not have an associated elevation. Please see Tables 6-1 through 6-4, at the end of the memo. The average values for each isotope for layers B and C for each site are summarized in Table 2-1, at the beginning of the memo. Figure 6-1 and 6-2 are graphic representations of the three-layer model.

7. Discussion and Conclusions

One of the purposes of this technical memorandum was to calculate the concentrations for other contaminants suspected to be present, such as Ni-63 and tritium. The following is a discussion of the effort to calculate the concentrations for these two isotopes.

Tritium is a deep zone contaminant in the groundwater. Efforts to correlate tritium in soils to other radionuclides in soils has proven unsuccessful. Additional work may be needed to evaluate tritium in deep zone soils. According to *Hanford Site Groundwater Monitoring for Fiscal Year 1999* (PNNL, 2000),

> "The 1301-N and 1325-N facilities contaminated the groundwater with tritium, which forms a widespread plume at levels exceeding the 20,000 pCi/L drinking water standard. The core of the plume (i.e., the highest concentration) was formerly beneath the 1325-N facility and has migrated to the north and northwest. The highest concentrations of tritium currently are near the Columbia River. Tritium is also present in upgradient wells 199-N-74 and 199-N-52. The current upgradient tritium is believed to have been moved inland by mounding during 1325-N operations. Tritium concentrations are declining in most 100-N Area wells. The general decline is expected to continue because of plume migration and radioactive decay."

Nickel-63 has not exceeded maximum contaminant levels or drinking water standards at the 100-N Area, according to Table A.3 in *Hanford Site Groundwater Monitoring for Fiscal Year 1999* (PNNL, 2000). Efforts to correlate Ni-63 in soils to other radionuclides in soils are ongoing. Additional work may be needed to evaluate Ni-63 in the deep zone in soils.

8. References

DOE-RL, 1996, *1301-N and 1325-N Liquid Waste Disposal Facilities Limited Field Investigation Report,* DOE/RL-96-11, Draft A, U. S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000, *SAP for the 100-NR-1 TSD Units During Remediation and Closeout,* DOE/RL-2000-07, Rev. 0, U. S. Department of Energy, Richland Operations Office, Richland, Washington.

PNNL, 2000, *Hanford Site Groundwater Monitoring for Fiscal Year 1999,* Editors: M. J. Hartman, L. F. Morasch, W. D. Webber, February 2000, PNNL-13116, Pacific Northwest National Laboratory, Richland, Washington.

Table 3-1. Borehole Data from 1995
Page 1 of2

Borehole	Sample ID	Sample Date	NAV D88 Elev-ation (m)	Am-241 (pCi/g)	Cs-137 (pCi/g)		Co-60 (pCi/g)		Eu-152 (pCi/g)		Eu-154 (pCi/g)		Eu-155 (pCi/g)		Pu-238 (pCi/g)		Pu-239/240 (pCi/g)		Sr-90 (pCi/g)		U-235 (pCi/g)		U-238 (pCi/g)	
199-N-107A	B0GGC3 *	8/25/95	NA	17,300	102,000		56,300		NR		11,800		4120		NR		12,700		92,299		NR		NR	
199-N-107A	B0GLF4	11/29/95	138.4	856	12,100		107,000		NR		1,030		355		NR		NR		3,250		NR		NR	
199-N-107A	B0GLF5	11/30/95	137.8	1,130	15,100		132,000		NR		1,370		304		222	u	689		12,600		NR		NR	
199-N-107A	B0GLF7	12/5/95	134.5	NR	2,790		23.9		NR		0.978	u	5.55	u	NR		NR		1,170		NR		NR	
199-N-107A	B0GLF6	12/5/95	132.6	NR	5.81		5.82		NR		0.557	u	2.01	u	NR		NR		1,550		NR		NR	
199-N-107A	B0GLF8	12/5/95	132.6	NR	5.69		5.25		NR		0.567	u	1.85	u	NR		NR		1,350		NR		NR	
199-N-107A	B0GLF9	12/6/95	129.3	NR	0.143	u	1.2		NR		0.286	u	0.716	u	NR		NR		1,080		NR		NR	
199-N-107A	B0GLG0	12/6/95	126.2	NR	NR		0.786		NR		0.294	u	0.332	u	NR		NR		188		NR		NR	
199-N-107A	B0GLG1	12/8/95	123.8	NR	0.41	u	1.15		NR		0.524	u	0.703	u	NR		NR		63.1		NR		NR	
199-N-107A	B0HIV6	12/8/95	120.4	NR	0.421	u	0.709		NR		0.49	u	0.697	u	NR		NR		54.6		NR		NR	
199-N-107A	B0GL88	11/29/95	138.4	1,110	15,800		139,000		2.85	u	990		207		226		1,590		9,560		0.677	u	-0.226	u
119-N-107A	B0GL89	11/30/95	137.8	1,050	12,500		120,000		71.7	u	807		141		465		3,340		19,700		-0.672	u	9.99	u
199-N-107A	B0GL91	12/5/95	132.6	NR	2.46		4.96		0.0936	u	0.155	u	0.0209	u	-0.00126	u	0.023	u	1,530		0.023	u	0.363	
199-N-107A	B0GL92	12/5/95	132.6	NR	6.01		5.57		-0.207	u	0.147	u	0.133	u	0.00823	u	0.0708		1,310		0.004	u	0.441	
199-N-107A	B0GL95	12/8/95	123.8	NR	0.0144	u	1.29		0.0341	u	0.0133	u	0.0133	u	0.00339	u	-0.00156	u	50		0.019	u	0.364	
199-N-107A	B0GL94	12/8/95	NA	NR	0.0116	u	-0.00425	u	0.0453	u	-0.0017	u	0.0359	u	-0.00082	u	0.00472	u	0.0771	u	0.004	u	0.0127	u
199-N-108A	B0GLD2	11/9/95	136.0	NR	3,200		522		NR		9.05	u	16.1	u	NR		NR		139		NR		NR	
199-N-108A	B0GLD5	11/9/95	135.1	NR	15,700		3,300		NR		18.3	u	24.1	u	11.2		73.7		785		NR		NR	
199-N-108A	B0GLD3	11/10/95	133.2	NR	108		10.4		NR		3.99	u	6.09	u	NR		NR		1,410		NR		NR	
199-N-108A	B0GLD4	11/10/95	133.2	NR	84.9		14.2		NR		3.64	u	4.21	u	NR		NR		1,380		NR		NR	
199-N-108A	B0GLD6	11/10/95	132.0	NR	24.1		3.53		NR		2.2	u	3.18	u	NR		NR		195		NR		NR	
199-N-108A	B0GLD7	11/10/95	130.6	NR	1.34	u	0.999	u	NR		1.61	u	1.66	u	NR		NR		119		NR		NR	
199-N-108A	B0GLD8	11/13/95	127.4	NR	1.73	u	0.832	u	NR		2.24	u	1.98	u	NR		NR		24.6		NR		NR	
199-N-108A	B0GLD9	11/15/95	126.2	NR	2.27	u	0.976	u	NR		3.11	u	2.12	u	NR		NR		4.33		NR		NR	
199-N-108A	B0GLF0	11/15/95	124.7	NR	1.7	u	1.37	u	NR		3.76	u	2.68	u	NR		NR		1.38		NR		NR	
199-N-108A	B0GLF1	11/15/95	122.4	NR	2.52	u	1.77	u	NR		3.74	u	2.62	u	NR		NR		239		NR		NR	
199-N-108A	B0GLF2	11/16/95	121.4	NR	2.06	u	0.983	u	NR		1.92	u	2.21	u	NR		NR		24.7		NR		NR	
199-N-108A	B0GLF3	11/16/95	119.5	NR	1.86	u	0.604	u	NR		2.41	u	1.8	u	NR		NR		129		NR		NR	
199-N-108A	B0GL71	11/9/95	135.8	6.55	6,770		1,200		0.833	u	8.17		2.36		1.17	u	12.6		768		-0.111	u	1.74	u
199-N-108A	B0GL73	11/10/95	133.2	NR	44.3		7.1		0.00937	u	0.178	u	0.013	u	0.105	u	0.0211	u	1,430		0.076	u	0.343	u
199-N-108A	B0GL75	11/10/95	133.2	NR	65.8		9.2		0.0632	u	0.232		0.112	u	0.0862	u	0.301	u	1,740		0.104	u	0.842	
199-N-108A	B0GL81	11/15/95	127.4	NR	0.00704	u	0.547		-0.0682	u	0.0979	u	-0.00806	u	-0.00376	u	-0.00376	u	57.9		0.032	u	0.487	
199-N-108A	B0GL86	11/16/95	121.4	NR	-0.0205	u	0.535		-0.00833	u	-0.0225	u	0.109	u	0	u	-0.00416	u	144		0.027	u	0.48	
199-N-108A	B0GL79 (EB)	11/15/95	NA	NR	0.0135	u	-0.0278	u	-0.0386	u	0.00875	u	-0.0316	u	-0.00608	u	-0.00187	u	0.274		-0.001	u	0.0892	
199-N-109A	B0HIV7	12/19/95	136.0	6.51	371		225		NR		1.05	u	1.37	u	NR		NR		1,080		NR		NR	
199-N-109A	B0HIV8	12/20/95	135.4	NR	0.211	u	3.83		NR		0.322	u	0.677	u	NR		NR		866		NR		NR	
199-N-109A	B0HIV9	12/20/95	133.2	NR	0.14	u	1.65		NR		0.287	u	0.448	u	NR		NR		331		NR		NR	
199-N-109A	B0HIW1	12/22/95	131.1	NR	0.498	u	1.73		NR		1.2	u	1.05	u	NR		NR		193		NR		NR	

Table 3-1. Borehole Data from 1995
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Borehole	Sample ID	Sample Date	NAVD88 Elevation (m)	Am-241 (pCi/g)		Cs-137 (pCi/g)		Co-60 (pCi/g)		Eu-152 (pCi/g)		Eu-154 (pCi/g)		Eu-155 (pCi/g)		Pu-238 (pCi/g)		Pu-239/240 (pCi/g)		Sr-90 (pCi/g)		U-235 (pCi/g)		U-238 (pCi/g)	
199-N-109A	B0H1W2 (DUP)	12/22/95	131.1	NR		0.415	u	1.95		NR		0.654	u	1.05	u	NR		NR		147		NR		NR	
199-N-109A	B0H1W3	12/22/95	129.6	NR		0.512	u	2.78		NR		0.681	u	0.826	u	NR		NR		127		NR		NR	
199-N-109A	B0H1W4	12/27/95	126.5	NR		0.14	u	0.542		NR		0.264	u	0.264	u	NR		NR		2.34		NR		NR	
199-N-109A	B0H1W5	12/27/95	123.5	NR		0.151	u	1.25		NR		0.34	u	0.293	u	NR		NR		4.61		NR		NR	
199-N-109A	B0H5N9	12/28/95	120.3	NR		0.144	u	1.42		NR		0.311	u	0.288	u	NR		NR		18.1		NR		NR	
199-N-109A	B0GL97	12/19/95	136.0	14.2		573		379		-0.315	u	2.86		2.02		3.81		24.1		1,340		-0.21	uj	0.776	u
199-N-109A	B0GL99	12/20/95	135.4	NR		0.522		4.51		-0.116	u	0.00621	u	0.0156	u	0	u	0.385	u	1,230		0.085	uj	0.564	u
199-N-109A	B0GLB1	12/20/95	133.2	NR		0.143		2.37		-0.0339	u	0.106	u	0.0136	u	0.0751	u	0.15	u	401		0.033	uj	0.44	
199-N-109A	B0GLB3	12/22/95	131.1	NR		0.0587		1.57		2.05		0.164	u	0.0912	u	0	u	0.0246	u	226		-0.004	uj	0.435	
199-N-109A	B0GLB4	12/22/95	131.1	NR		0.0337	u	1.43		0.703		0.129	u	-0.0231	u	0.0142	u	-0.00228	u	200		0.008	uj	0.531	
199-N-109A	B0GLB6	12/27/95	126.5	NR		0.00348	u	0.546		0.216		0.0456	u	0.0212	u	-0.00257	u	0	u	27.7		0.017	uj	0.5	
199-N-109A	B0GLC0	12/28/95	120.3	NR		-0.0148	u	1.48		0.00186	u	0.0676	u	-0.0203	u	0.00589	u	0.0103	u	16		0.029	uj	0.418	
199-N-109A	B0GLB8	12/27/95	NA	NR		-0.00721	u	-0.00818	u	0.0472	u	-0.00481	u	-0.00461	u	-0.00105	u	-0.00105	u	-0.013	u	0.003	uj	0.0278	

* Sample was collected from soil on a boulder removed from the base of the crib.
U indicates analyte is below the detection limits of the methods and instruments used (undetected).
J indicates the associated value is an estimated quantity.
NR = Not Requested

Table 4-1. Decay Factors.

Isotope	e	$T_{1/2}$ in years	Elapsed Time in years	Decay Factor, $e^{-\lambda t}$
Co-60	2.72	5.271	5	0.517997
Sr-90	2.72	29.12	5	0.88775
Cs-137	2.72	30	5	0.890856
Eu-152	2.72	13.6	5	0.774963
Eu-154	2.72	8.8	5	0.674355
Eu-155	2.72	4.96	5	0.497067
Pu-238	2.72	87.78	5	0.961271
Pu-239	2.72	24065	5	0.999856
Am-241	2.72	432.2	5	0.99201

Table 5-1. Decayed Data
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Borehole	Sample ID	Sample Date	NAVD88 Elevation (m)	Am-241 (pCi/g)	Cs-137 (pCi/g)	Co-60 (pCi/g)	Eu-152 (pCi/g)	Eu-154 (pCi/g)	Eu-155 (pCi/g)	Pu-238 (pCi/g)	Pu-239/240 (pCi/g)	Sr-90 (pCi/g)	U-235 (pCi/g)	U-238 (pCi/g)
199-N-107A	B0GGC3 *	8/25/95	NA	17200	90900	29200	NR	7960	2050	NR	12700	81900	NR	NR
199-N-107A	B0GLF4	11/29/95	138.4	849	10800	55400	NR	695	176	NR	NR	2890	NR	NR
199-N-107A	B0GLF5	11/30/95	137.8	1120	13500	68400	NR	924	151	213 u	689	11200	NR	NR
199-N-107A	B0GLF7	12/5/95	134.5	NR	24900	12.4	NR	0.660 u	2.76 u	NR	NR	1040	NR	NR
199-N-107A	B0GLF6	12/5/95	132.6	NR	5.18	3.015	NR	0.376 u	0.999 u	NR	NR	1380	NR	NR
199-N-107A	B0GLF8	12/5/95	132.6	NR	5.09	2.72	NR	0.382 u	0.920 u	NR	NR	1200	NR	NR
199-N-107A	B0GLF9	12/6/95	129.3	NR	0.127 u	0.622	NR	0.193 u	0.356 u	NR	NR	959	NR	NR
199-N-107A	B0GLG0	12/6/95	126.2	NR	NR	0.407	NR	0.198 u	0.165 u	NR	NR	167	NR	NR
199-N-107A	B0GLG1	12/8/95	123.8	NR	0.365 u	0.596	NR	0.353 u	0.349 u	NR	NR	56.0	NR	NR
199-N-107A	B0HIV6	12/8/95	120.4	NR	0.375 u	0.367	NR	0.330 u	0.346 u	NR	NR	48.5	NR	NR
199-N-107A	B0GL88	11/29/95	138.4	1101	14100	72000	2.21 u	668	103	217	1590	8490	0.677 u	-0.226 u
199-N-107A	B0GL89	11/30/95	137.8	1042	11100	62200	55.6 u	544	70.1	447	3340	17500	-0.672 u	9.99 u
199-N-107A	B0GL91	12/5/95	132.6	NR	2.19	2.57	0.0725 u	0.105 u	0.0104 u	-0.00121 u	0.0230 u	1360	0.0227 u	0.363
199-N-107A	B0GL92	12/5/95	132.6	NR	5.35	2.89	-0.160 u	0.0991 u	0.0661 u	0.00791 u	0.0708	1160	0.00386 u	0.441
199-N-107A	B0GL95	12/8/95	123.8	NR	0.0128 u	0.668	0.0264 u	0.00897 u	0.00661 u	0.00326 u	-0.00156 u	44.4	0.0193 u	0.364
199-N-107A	B0GL94	12/8/95	NA	NR	0.0103 u	-0.0022 u	0.0351 u	-0.00115 u	0.0178 u	-0.00079 u	0.00472 u	0.0684 u	0.00388 u	0.0127 u
199-N-108A	B0GLD2	11/9/95	136.0	NR	2850	270	NR	6.10 u	8.00 u	NR	NR	123	NR	NR
199-N-108A	B0GLD5	11/9/95	135.1	NR	14000	1710	NR	12.3 u	12.0 u	10.8	73.7	697	NR	NR
199-N-108A	B0GLD3	11/10/95	133.2	NR	96.2	5.39	NR	2.69 u	3.03 u	NR	NR	1250	NR	NR
199-N-108A	B0GLD4	11/10/95	133.2	NR	75.6	7.36	NR	2.45 u	2.09 u	NR	NR	1230	NR	NR
199-N-108A	B0GLD6	11/10/95	132.0	NR	21.5	1.83	NR	1.48 u	1.58 u	NR	NR	173	NR	NR
199-N-108A	B0GLD7	11/10/95	130.6	NR	1.19 u	0.517 u	NR	1.09 u	0.825 u	NR	NR	106	NR	NR
199-N-108A	B0GLD8	11/15/95	127.4	NR	1.54 u	0.431 u	NR	1.51 u	0.984 u	NR	NR	21.8	NR	NR
199-N-108A	B0GLD9	11/15/95	126.2	NR	2.02 u	0.506 u	NR	2.10 u	1.05 u	NR	NR	3.84	NR	NR
199-N-108A	B0GLF0	11/15/95	124.7	NR	1.51 u	0.710 u	NR	2.54 u	1.33 u	NR	NR	1.23	NR	NR
199-N-108A	B0GLF1	11/15/95	122.4	NR	2.24 u	0.917 u	NR	2.52 u	1.30 u	NR	NR	212	NR	NR
199-N-108A	B0GLF2	11/16/95	121.4	NR	1.84 u	0.509 u	NR	1.29 u	1.10 u	NR	NR	21.9	NR	NR
199-N-108A	B0GLF3	11/16/95	119.5	NR	1.66 u	0.313 u	NR	1.63 u	0.895 u	NR	NR	115	NR	NR
199-N-108A	B0GL71	11/9/95	135.8	6.50	6030	622	0.646 u	5.51	1.17	1.12 u	12.6	682	-0.111 u	1.74 u
199-N-108A	B0GL73	11/10/95	133.2	NR	39.5	3.68	0.00726 u	0.120 u	0.00646 u	0.101 u	0.0211 u	1270	0.0762 u	0.343 u
199-N-108A	B0GL75	11/10/95	133.2	NR	58.6	4.77	0.0490 u	0.156	0.0557 u	0.0829 u	0.301 u	1545	0.104 u	0.842
199-N-108A	B0GL81	11/15/95	127.4	NR	0.00627 u	0.283	-0.0529 u	0.0660 u	-0.00401 u	-0.00361 u	-0.00376 u	51.4	0.0324 u	0.487
199-N-108A	B0GL86	11/16/95	121.4	NR	-0.0183 u	0.277	-0.00646 u	-0.0152 u	0.0542 u	0 u	-0.00416 u	128	0.0268 u	0.48
199-N-108A	B0GL79 (EB)	11/15/95	NA	NR	0.0120 u	-0.0144 u	-0.0299 u	0.00590 u	-0.0157 u	-0.00584 u	-0.00187 u	0.243	-0.00146 u	0.0892
199-N-109A	B0HIV7	12/19/95	136.0	6.46	331	117	NR	0.708 u	0.681 u	NR	NR	959	NR	NR
199-N-109A	B0HIV8	12/20/95	135.4	NR	0.188 u	1.98	NR	0.217 u	0.337 u	NR	NR	769	NR	NR
199-N-109A	B0HIV9	12/20/95	133.2	NR	0.125 u	0.855	NR	0.194 u	0.223 u	NR	NR	294	NR	NR
199-N-109A	B0HIW1	12/22/95	131.1	NR	0.444 u	0.896	NR	0.809 u	0.522 u	NR	NR	171	NR	NR

Table 5-1. Decayed Data
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Borehole	Sample ID	Sample Date	NAVD88 Elevation (m)	Am-241 (pCi/g)		Cs-137 (pCi/g)		Co-60 (pCi/g)		Eu-152 (pCi/g)		Eu-154 (pCi/g)		Eu-155 (pCi/g)		Pu-238 (pCi/g)		Pu-239/240 (pCi/g)		Sr-90 (pCi/g)		U-235 (pCi/g)		U-238 (pCi/g)	
199-N-109A	B0H1W2 (DUP)	12/22/95	131.1	NR		0.370	u	1.01		NR		0.441	u	0.522	u	NR		NR		130		NR		NR	
199-N-109A	B0H1W3	12/22/95	129.6	NR		0.456	u	1.44		NR		0.459	u	0.411	u	NR		NR		113		NR		NR	
199-N-109A	B0H1W4	12/27/95	126.5	NR		0.125	u	0.281		NR		0.178	u	0.131	u	NR		NR		2.08		NR		NR	
199-N-109A	B0H1W5	12/27/95	123.5	NR		0.135	u	0.647		NR		0.229	u	0.146	u	NR		NR		4.09		NR		NR	
199-N-109A	B0H5N9	12/28/95	120.3	NR		0.128	u	0.736		NR		0.210	u	0.143	u	NR		NR		16.1		NR		NR	
199-N-109A	B0GL97	12/19/95	136.0	14.1		510		196		-0.244	u	1.93		1.00		3.66		24.1		1190		-0.21	uj	0.776	u
199-N-109A	B0GL99	12/20/95	135.4	NR		0.465		2.34		-0.0899	u	0.00419	u	0.00775	u	0	u	0.385	u	1090		0.0846	uj	0.564	u
199-N-109A	B0GLB1	12/20/95	133.2	NR		0.127		1.23		-0.0263	u	0.0715	u	0.00676	u	0.0722	u	0.150	u	356		0.0333	uj	0.44	
199-N-109A	B0GLB3	12/22/95	131.1	NR		0.0523		0.813		1.59		0.111	u	0.0453	u	0	u	0.0246	u	201		-0.00422	uj	0.435	
199-N-109A	B0GLB4	12/22/95	131.1	NR		0.0300	u	0.741		0.545		0.0870	u	-0.0115	u	0.0137	u	-0.00228	u	178		0.00763	uj	0.531	
199-N-109A	B0GLB6	12/27/95	126.5	NR		0.0031	u	0.283		0.167		0.0308	u	0.0105	u	-0.00247	u	0	u	24.6		0.0169	uj	0.5	
199-N-109A	B0GLC0	12/28/95	120.3	NR		-0.0132	u	0.767		0.00144	u	0.0456	u	-0.0101	u	0.00566	u	0.0103	u	14.2		0.0291	uj	0.418	
199-N-109A	B0GLB8	12/27/95	NA	NR		-0.00642	u	-0.00424	u	0.0366	u	-0.00324	u	-0.00229	u	-0.00101	u	-0.00105	u	-0.0115	u	0.00324	uj	0.0278	

* Sample was collected from soil on a boulder removed from the base of the crib.
U indicates analyte is below the detection limits of the methods and instruments used (undetected).
J indicates the associated value is an estimated quantity.
NR = Not Requested

Table 6-1. Decayed Data for 116-N-1 Layer B

Borehole	Sample ID	Sample Date	NAVD88 Elevation (m)	Am-241 (pCi/g)		Cs-137 (pCi/g)		Co-60 (pCi/g)		Eu-152 (pCi/g)		Eu-154 (pCi/g)		Eu-155 (pCi/g)		Pu-238 (pCi/g)		Pu-239/240 (pCi/g)		Sr-90 (pCi/g)		U-235 (pCi/g)		U-238 (pCi/g)	
199-N-108A	B0GLD3	11/10/95	133.2	NR		96.2		5.39		NR		2.69	u	3.03	u	NR		NR		1250		NR		NR	
199-N-108A	B0GLD4	11/10/95	133.2	NR		75.6		7.36		NR		2.45	u	2.09	u	NR		NR		1230		NR		NR	
199-N-108A	B0GL73	11/10/95	133.2	NR		39.5		3.68		0.00726	u	0.120	u	0.00646	u	0.101	u	0.0211	u	1270		0.0762	u	0.343	
199-N-108A	B0GL75	11/10/95	133.2	NR		58.6		4.77		0.0490	u	0.156		0.0557	u	0.0829	u	0.301	u	1540		0.104	u	0.842	
199-N-107A	B0GLF6	12/5/95	132.6	NR		5.18		3.01		NR		0.376	u	0.999	u	NR		NR		1380		NR		NR	
199-N-107A	B0GLF8	12/5/95	132.6	NR		5.07		2.72		NR		0.382	u	0.920	u	NR		NR		1200		NR		NR	
199-N-107A	B0GL91	12/5/95	132.6	NR		2.19		2.57		0.0725	u	0.105	u	0.0104	u	-0.00121	u	0.0230	u	1360		0.0227	u	0.363	
199-N-107A	B0GL92	12/5/95	132.6	NR		5.35		2.89		-0.160	u	0.0991	u	0.0661	u	0.00791	u	0.0708		1160		0.00386	u	0.441	
199-N-108A	B0GLD6	11/10/95	132.0	NR		21.5		1.83		NR		1.48	u	1.58	u	NR		NR		173		NR		NR	
199-N-108A	B0GLD7	11/10/95	130.6	NR		1.19	u	0.517	u	NR		1.09	u	0.825	u	NR		NR		106		NR		NR	
199-N-107A	B0GLF9	12/6/95	129.3	NR		0.127	u	0.622		NR		0.193	u	0.356	u	NR		NR		959		NR		NR	
199-N-108A	B0GLD8	11/15/95	127.4	NR		1.54	u	0.431	u	NR		1.51	u	0.984	u	NR		NR		21.8		NR		NR	
199-N-108A	B0GL81	11/15/95	127.4	NR		0.00627	u	0.283		-0.0529	u	0.0660	u	-0.00401	u	-0.00361	u	-0.00376	u	51.4		0.0324	u	0.487	
199-N-108A	B0GLD9	11/15/95	126.2	NR		2.02	u	0.506	u	NR		2.10	u	1.05	u	NR		NR		3.84		NR		NR	
199-N-107A	B0GLG0	12/6/95	126.2	NR		NR		0.407		NR		0.198	u	0.165	u	NR		NR		167		NR		NR	
AVERAGE						22.4		2.46		-0.0169		0.868		0.809		0.0374		0.0824		791		0.0478		0.495	

U indicates analyte is below the detection limits of the methods and instruments used (undetected).
J indicates the associated value is an estimated quantity.
NR = Not Requested

085935

Table 6-2. Decayed Data for 116-N-1 Layer C

Borehole	Sample ID	Sample Date	NAV D88 Elev-ation (m)	Am-241 (pCi/g)		Cs-137 (pCi/g)		Co-60 (pCi/g)		Eu-152 (pCi/g)		Eu-154 (pCi/g)		Eu-155 (pCi/g)		Pu-238 (pCi/g)		Pu-239/240 (pCi/g)		Sr-90 (pCi/g)		U-235 (pCi/g)		U-238 (pCi/g)	
199-N-108A	B0GLF0	11/15/95	124.7	NR		1.51	u	0.710	u	NR		2.54	u	1.33	u	NR		NR		1.23		NR		NR	
199-N-107A	B0GL95	12/8/95	123.8	NR		0.0128	u	0.668		0.0264	u	0.00897	u	0.00661	u	0.00326	u	-0.00156	u	44.4		0.0193	u	0.364	
199-N-107A	B0GLG1	12/8/95	123.8	NR		0.365	u	0.596		NR		0.353	u	0.349	u	NR		NR		56.0		NR		NR	
199-N-108A	B0GLF1	11/15/95	122.4	NR		2.24	u	0.917	u	NR		2.52	u	1.30	u	NR		NR		212		NR		NR	
199-N-108A	B0GL86	11/16/95	121.4	NR		-0.0183	u	0.277		-0.00646	u	-0.0152	u	0.0542	u	0	u	-0.00416	u	128		0.0268	u	0.48	
199-N-108A	B0GLF2	11/16/95	121.4	NR		1.84	u	0.509	u	NR		1.29	u	1.10	u	NR		NR		21.9		NR		NR	
199-N-107A	B0HIV6	12/8/95	120.4	NR		0.375	u	0.367		NR		0.330	u	0.346	u	NR		NR		48.5		NR		NR	
199-N-108A	B0GLF3	11/16/95	119.5	NR		1.66	u	0.313	u	NR		1.63	u	0.895	u	NR		NR		115		NR		NR	
AVERAGE						0.998		0.545		0.00999		1.08		0.673		0.00163		-0.00286		78.3		0.0231		0.422	

U indicates analyte is below the detection limits of the methods and instruments used (undetected).
J indicates the associated value is an estimated quantity.
NR = Not Requested

Table 6-3. Decayed Data for 116-N-3 Layer B

Borehole	Sample ID	Sample Date	NAV D88 Elev-ation (m)	Am-241 (pCi/g)		Cs-137 (pCi/g)		Co-60 (pCi/g)		Eu-152 (pCi/g)		Eu-154 (pCi/g)		Eu-155 (pCi/g)		Pu-238 (pCi/g)		Pu-239/240 (pCi/g)		Sr-90 (pCi/g)		U-235 (pCi/g)		U-238 (pCi/g)	
199-N-109A	B0H1W1	12/22/95	131.1	NR		0.444	u	0.896		NR		0.809	u	0.522	u	NR		NR		171		NR		NR	
199-N-109A	B0H1W2 (DUP)	12/22/95	131.1	NR		0.370	u	1.01		NR		0.441	u	0.522	u	NR		NR		130		NR		NR	
199-N-109A	B0GLB3	12/22/95	131.1	NR		0.0523		0.813		1.59		0.111	u	0.0453	u	0	u	0.0246	u	201		-0.00422	uj	0.435	
199-N-109A	B0GLB4	12/22/95	131.1	NR		0.0300	u	0.741		0.545		0.0870	u	-0.0115	u	0.0137	u	-0.00228	u	178		0.00763	uj	0.531	
199-N-109A	B0H1W3	12/22/95	129.6	NR		0.456	u	1.44		NR		0.459	u	0.411	u	NR		NR		113		NR		NR	
199-N-109A	B0H1W4	12/27/95	126.5	NR		0.125	u	0.281		NR		0.178	u	0.131	u	NR		NR		2.08		NR		NR	
199-N-109A	B0GLB6	12/27/95	126.5	NR		0.0031	u	0.283		0.167		0.0308	u	0.0105	u	-0.00247	u	0	u	24.6		0.0169	uj	0.5	
AVERAGE						0.211		0.781		0.767		0.302		0.233		0.00373		0.00744		117		0.00677		0.489	

U indicates analyte is below the detection limits of the methods and instruments used (undetected).
J indicates the associated value is an estimated quantity.
NR = Not Requested

085935

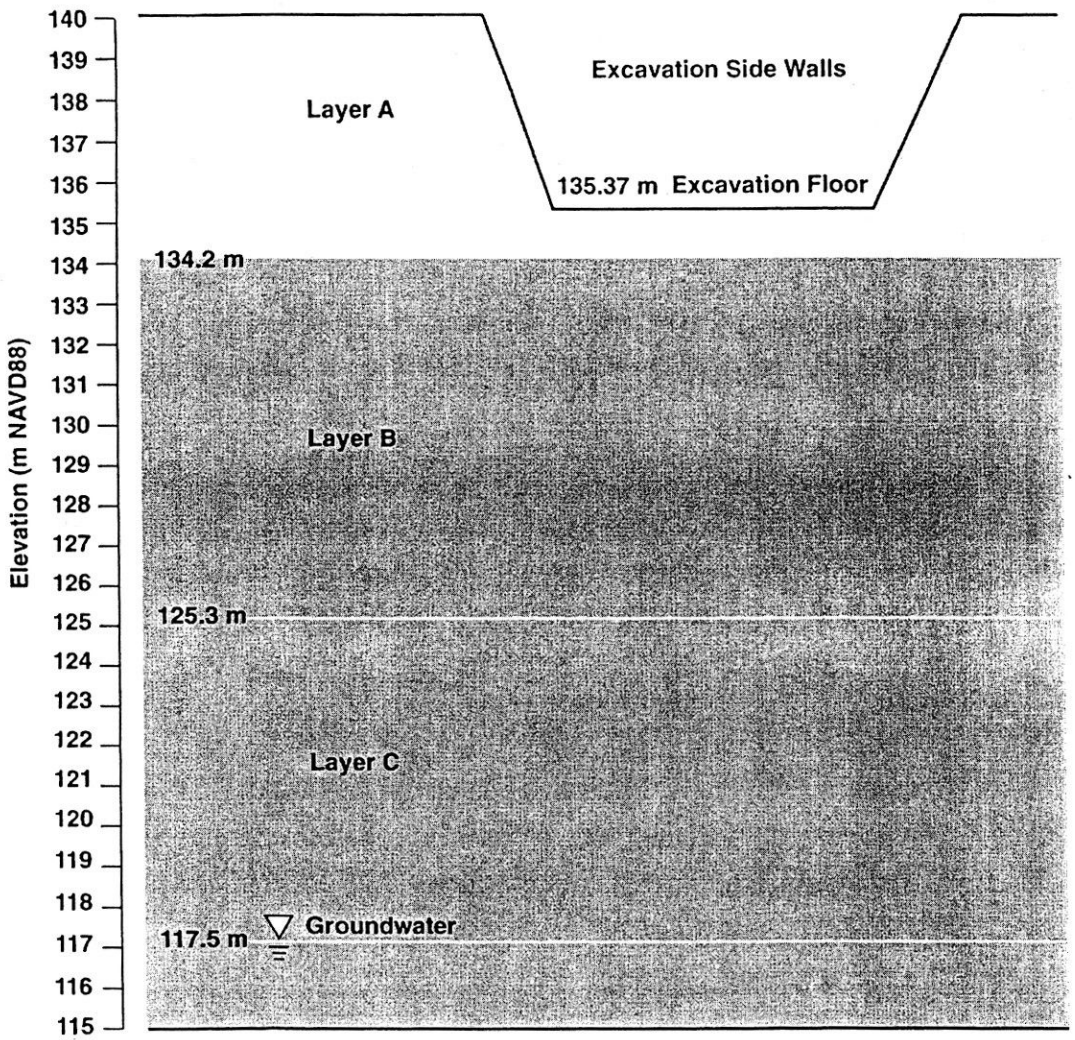
Table 6-4. Decayed Data for 116-N-3 Layer C

Borehole	Sample ID	Sample Date	NAVD88 Elevation (m)	Am-241 (pCi/g)		Cs-137 (pCi/g)		Co-60 (pCi/g)		Eu-152 (pCi/g)		Eu-154 (pCi/g)		Eu-155 (pCi/g)		Pu-238 (pCi/g)		Pu-239/240 (pCi/g)		Sr-90 (pCi/g)		U-235 (pCi/g)		U-238 (pCi/g)	
199-N-109A	B0H1W5	12/27/95	123.5	NR		0.135	u	0.647		NR		0.229	u	0.146	u	NR		NR		4.09		NR		NR	
199-N-109A	B0H5N9	12/28/95	120.3	NR		0.128	u	0.736		NR		0.210	u	0.143	u	NR		NR		16.1		NR		NR	
199-N-109A	B0GLC0	12/28/95	120.3	NR		-0.0132	u	0.767		0.00144	u	0.0456	u	-0.0101	u	0.00566	u	0.0103	u	14.2		0.0291	uj	0.418	
AVERAGE						0.0832		0.717		0.00144		0.162		0.0929		0.00566		0.0103		11.5		0.0291		0.418	

U indicates analyte is below the detection limits of the methods and instruments used (undetected).
J indicates the associated value is an estimated quantity.
NR = Not Requested

085935

Figure 6-1. 116-N-1 Subsurface Model



Note: The bottom of the excavation for the 116-N-1 crib is 135.37 m, while the trench is 133.54 m, therefore the more conservative crib elevation is used.

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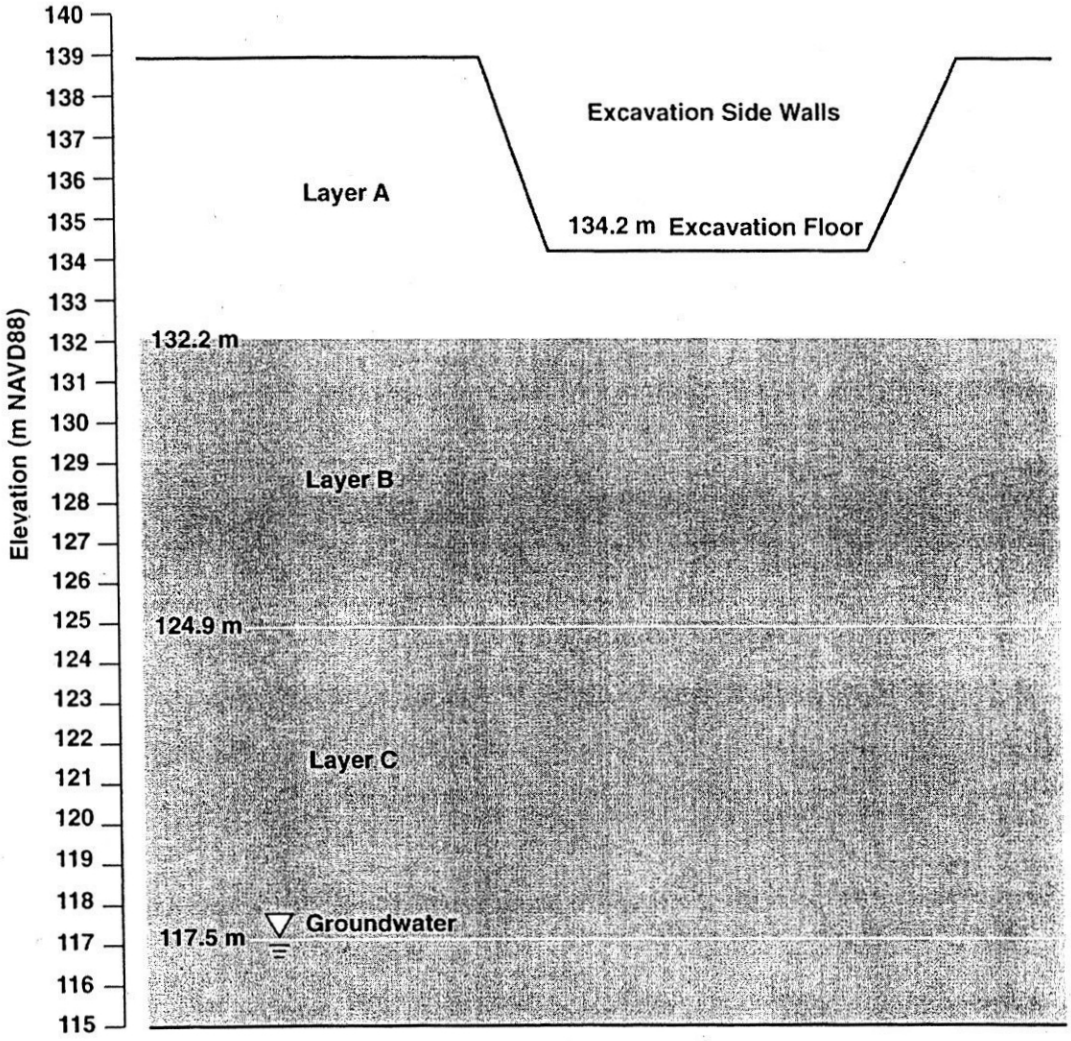
Figure 6-2. 116-N-3 Subsurface Model



Note: The bottom of the excavation for the 116-N-3 crib is 134.2 m, while the trench is 133.0 m, therefore the more conservative crib elevation is used.

E0101111.2

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