Cleanup Verification Package for the 118-F-2 Burial Ground

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

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EXECUTIVE SUMMARY

This cleanup verification package documents completion of remedial action, sampling activities, and compliance with cleanup criteria for the 118-F-2 Burial Ground. The 118-F-2 Burial Ground, part of the 100-FR-2 Operable Unit, is located in the 100-F Area of the Hanford Site in southeastern Washington State. This burial ground, formerly called Solid Waste Burial Ground No. 1, was the original solid waste disposal site for the 100-F Area. Eight trenches contained miscellaneous solid waste from the 105-F Reactor and one trench contained solid waste from the biology facilities. The burial ground was in operation between 1945 and 1965.

Remediation of the 118-F-2 Burial Ground began on January 17, 2006, and was completed on August 8, 2007. Remedial action activities involved removing the uncontaminated overburden, the buried contaminated debris, and the underlying contaminated soil. All contaminated materials were disposed of at the Environmental Restoration Disposal Facility.

Following excavation, verification sampling was performed to determine if the remedial action was adequate to support site closure. Results of the verification sampling, laboratory analyses, data evaluations, and modeling for the 118-F-2 Burial Ground indicate that all remedial action objectives for direct exposure, protection of groundwater, and protection of the Columbia River have been met (see Table ES-1).

Soil cleanup levels were established in the *Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, and 100-KR-2 Operable Units, Hanford Site (100 Area Burial Grounds), Benton County, Washington* (Burial Ground ROD) (EPA 2000) based on a limited ecological risk assessment. Although not required by the Burial Ground ROD, a comparison against ecological risk screening levels has been made for the site contaminants of concern/contaminants of potential concern (COCs/COPCs). Screening levels were not exceeded for the site constituents, with the exception of antimony, boron, manganese, selenium, and vanadium. Exceedance of

**Table ES-1. Summary of Remedial Action Goals for the
118-F-2 Burial Ground. (2 Pages)**

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?	Ref.
Direct Exposure – Radionuclides	Attain 15 mrem/yr dose rate above background over 1,000 years.	Maximum dose rate calculated by RESRAD is 1.13 mrem/yr.	Yes	a
Direct Exposure – Nonradionuclides	Attain individual COC/COPC RAGs.	All individual COC/COPC concentrations are below the direct exposure criteria.	Yes	b
Nonradionuclide Risk Requirements	Attain hazard quotient of <1 for all individual noncarcinogens.	All individual hazard quotients are <1.	Yes	c
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient (6.1×10^{-3}) is <1.		c
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	All individual excess carcinogenic risk values are $<1 \times 10^{-6}$.		c
	Attain a total excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The cumulative excess carcinogenic risk value (1.6×10^{-6}) is $<1 \times 10^{-5}$.		c
Groundwater/River Protection – Radionuclides	Attain single COC/COPC groundwater and river protection RAGs.	Cesium-137 is calculated to reach groundwater in the 1,000 years of the RESRAD model run; however, at concentrations significantly below the groundwater and Columbia River RAGs. Therefore, residual concentrations achieve the remedial action objectives.	Yes	a
	Attain national primary drinking water regulations: ^d 4-mrem/yr (beta/gamma) dose rate to target receptor/organs.	All organ specific doses are below the 4-mrem/yr dose standard.		e
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25 th of the derived concentration guide for DOE Order 5400.5. ^f	RESRAD modeling indicates that the alpha-emitting COCs will not impact groundwater.	Yes	e
	Meet total uranium standard of 21.2 pCi/L. ^g	Isotopic uranium concentrations are below background.	Yes	b

**Table ES-1. Summary of Remedial Action Goals for the
118-F-2 Burial Ground. (2 Pages)**

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?	Ref.
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Residual concentrations of selenium slightly exceed soil RAGs for the protection of the Columbia River. However, selenium is not predicted to migrate to the river at concentrations exceeding river criteria within 1,000 years. Therefore, residual concentrations achieve the remedial action objectives for river protection.	Yes	h
Other Supporting Information	Sample design calculation brief.			i

^a 118-F-2 Burial Ground Cleanup Verification RESRAD Calculation Brief, 0100F-CA-V0286, Rev. 0 (Appendix C).

^b 118-F-2 Cleanup Verification 95% UCL Calculations, 0100F-CA-V0285, Rev. 1 (Appendix C).

^c 118-F-2 Hazard Quotient and Carcinogenic Risk Calculations, 0100F-CA-V0295, Rev. 0 (Appendix C).

^d "National Primary Drinking Water Regulations" (40 Code of Federal Regulations 141).

^e 118-F-2 Burial Ground Comparison to Drinking Water Standards (MCL) Calculation, 0100F-CA-V0287, Rev. 1 (Appendix C).

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

^g Based on the isotopic distribution of uranium in the 100 Areas, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).

^h Based on the 100 Area Analogous Sites RESRAD Calculations (BHI 2005), selenium is not expected to migrate more than 1 m (3.3 ft) vertically in 1,000 years (based on the soil-partitioning coefficient distribution of 150 mL/g). The vadose zone underlying the excavated area is approximately 4 m (13 ft) thick.

ⁱ 118-F-2 Burial Ground Sample Design Shallow Zone / Stockpiles (ACL/BCL) Sampling Plan, 0100F-CA-V0284, Rev. 0 (Appendix C).

ACL = above cleanup level

BCL = below cleanup level

COC = contaminant of concern

COPC = contaminant of potential concern

MCL = maximum contaminant level (drinking water standard)

RAG = remedial action goal

RESRAD = RESidual RADioactivity (dose model)

screening values does not necessarily indicate the existence of risk to ecological receptors. It is believed that exceedance of screening values for these constituents does not pose a risk to ecological receptors because the concentrations are below site background levels, within the range of Hanford Site background levels, or consistent with those seen elsewhere at the Hanford Site (when no established background value is available).

This evaluation supports a reclassification of this waste site to Interim Closed Out, in accordance with the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989) and the *Tri-Party Agreement Handbook Management Procedures*, Waste Site Reclassification Guideline TPA-MP-14 (DOE-RL 2007b). A copy of the waste site reclassification form is included as Attachment ES-1.

Attachment ES-1. Waste Site Reclassification Form.

WASTE SITE RECLASSIFICATION FORM		
Date Submitted: <u>10/03/07</u>	Operable Unit(s): <u>100-FR-2</u>	Control Number: 2007-021
Originator: <u>L. M. Dittmer</u>	Waste Site Code: <u>118-F-2</u>	
Phone: <u>372-9227</u>	Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☒ No Action ☐ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	
This form documents agreement among parties listed authorizing classification of the subject unit as Closed Out, Interim Closed Out, No Action, RCRA Postclosure, Rejected, or Consolidated. This form also authorizes backfill of the waste management unit, if appropriate, for Closed Out and Interim Closed Out units. Final removal from the NPL of No Action and Closed Out waste management units will occur at a future date.		
<u>Description of current waste site condition:</u> The 118-F-2 Burial Ground, formerly called Solid Waste Burial Ground No. 1, was the original solid waste disposal site for the 100-F Area. This burial ground contained eight trenches with miscellaneous solid waste from the 105-F Reactor and one trench with solid waste from the biology facilities. The site has been remediated and presently exists as an open excavation. Remediation, verification sampling, and RESidual RADioactivity (RESRAD) modeling have been performed in accordance with remedial action objectives and goals established by the <i>Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, and 100-KR-2 Operable Units, Hanford Site (100 Area Burial Grounds), Benton County, Washington</i> (Burial Ground ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington. The selected remedy involved (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility at the 200 Area of the Hanford Site, (3) demonstrating through verification sampling and RESRAD modeling that cleanup goals have been achieved, and (4) proposing the site for reclassification as Interim Closed Out. <u>Basis for reclassification:</u> In accordance with this evaluation, the verification sampling and modeling results support a reclassification of this site to Interim Closed Out. The current site conditions achieve the remedial action objectives established in the Burial Ground ROD. The results show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Site contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required. The basis for reclassification is described in detail in the <i>Cleanup Verification Package for the 118-F-2 Burial Ground</i> (CVP-2007-00002), Washington Closure Hanford, Richland, Washington. <u>Waste Site Controls:</u> Engineered Controls: Yes ☐ No ☒ Institutional Controls: Yes ☐ No ☒ O&M requirements: Yes ☐ No ☒ If any of the Waste Site Controls are checked Yes specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents.		
S. L. Charboneau DOE Federal Project Director (printed)	 Signature	<u>11/28/07</u> Date
NA Ecology Project Manager (printed)	 Signature	 Date
R. A. Lobos EPA Project Manager (printed)	 Signature	<u>2/08/08</u> Date

CONTENTS

1.0	STATEMENT OF PROTECTIVENESS	1
2.0	BACKGROUND AND GENERAL SITE INFORMATION	1
3.0	REMEDIAL ACTION SUMMARY	4
3.1	EXCAVATION AND DISPOSAL INFORMATION	4
3.2	WASTE INFORMATION	4
3.3	FIELD SCREENING	6
4.0	SAMPLING ACTIVITIES	6
4.1	CONTAMINANTS OF CONCERN FOR VERIFICATION SAMPLING	6
4.2	CONTAMINANTS OF POTENTIAL CONCERN FOR FOCUSED SAMPLING	7
4.3	SAMPLING DESIGN SELECTION AND BASIS	7
4.3.1	Decision Unit Sampling	7
4.3.2	Focused Sampling	8
5.0	SAMPLING RESULTS	9
6.0	DATA EVALUATION	16
6.1	COMPARISON OF SAMPLE DATA TO RAGS	17
6.2	COMPARISON OF SAMPLE DATA TO ECOLOGICAL RISK SCREENING LEVELS	17
6.3	HUMAN HEALTH RISK EVALUATION FOR NONRADIONUCLIDES	17
6.4	WAC THREE-PART TEST FOR NONRADIONUCLIDES	18
6.5	RESRAD MODELING FOR RADIONUCLIDES	18
6.5.1	Attainment of Radionuclide Direct Exposure RAG	18
6.5.2	Attainment of Radionuclide Excess Lifetime Cancer Risk Goal	19
6.5.3	Attainment of Radionuclide Groundwater and River Protection RAGS	19
7.0	DATA QUALITY ASSESSMENT	20
8.0	SUMMARY FOR WASTE SITE RECLASSIFICATION	20
9.0	REFERENCES	21

APPENDICES

A	REMEDIAL ACTION PHOTOGRAPHS	A-i
B	RADIOLOGICAL SURVEYS	B-i
C	CALCULATIONS	C-i
D	FOCUSED SAMPLING RESULTS	D-i
E	DATA QUALITY ASSESSMENT	E-i

FIGURES

1.	Location of the 118-F-2 Burial Ground.	2
2.	Geophysical Investigation Results at the 118-F-2 Burial Ground.	3
3.	118-F-2 Burial Ground Post-Excavation Photograph (taken August 2007).	5
4.	Location of Focused Soil Samples at the 118-F-2 Burial Ground.	10

TABLES

1.	118-F-2 Focused Sample Summary.....	8
2.	Comparison of Statistical Contaminant Concentrations to Action Levels for the 118-F-2 Shallow Zone Excavation Verification Sampling.....	11
3.	Comparison of Statistical Contaminant Concentrations to Action Levels for the 118-F-2 Overburden Stockpile Verification Sampling.....	12
4.	Comparison of Statistical Contaminant Concentrations to Action Levels for the 118-F-2 Staging Pile (ACL) Footprint Verification Sampling.....	13
5.	Comparison of Maximum Contaminant Concentrations to Action Levels for the 118-F-2 Focused Sampling.....	15

ACRONYMS AND ABBREVIATIONS

ACL	above cleanup level
ANL	Argonne National Laboratory
CFR	<i>Code of Federal Regulations</i>
COC	contaminant of concern
COPC	contaminant of potential concern
DOE	U.S. Department of Energy
DQA	data quality assessment
EPA	U.S. Environmental Protection Agency
GPERS	Global Positioning Environmental Radiological Surveyor
MCL	maximum contaminant level (drinking water standard)
RAG	remedial action goal
RDR/RAWP	remedial design report/remedial action work plan
RESRAD	RESidual RADioactivity dose assessment model
ROD	Record of Decision
SAP	sampling and analysis plan
SDG	sample delivery group
UCL	upper confidence limit
WAC	<i>Washington Administrative Code</i>

1.0 STATEMENT OF PROTECTIVENESS

This report demonstrates that the 118-F-2 Burial Ground was remediated in accordance with the *Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-2, 100-HR-2, and 100-KR-2 Operable Units, Hanford Site (100 Area Burial Grounds), Benton County, Washington* (Burial Ground ROD) (EPA 2000), and meets the objectives and goals for interim closure as established in the Burial Ground ROD and the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005).

The results of verification sampling show that residual contaminant concentrations do not preclude any future uses (as bounded by the rural-residential scenario) and allow for unrestricted use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Site contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are not required.

2.0 BACKGROUND AND GENERAL SITE INFORMATION

The 118-F-2 Burial Ground is located in the 100-FR-2 Operable Unit of the Hanford Site approximately 450 m (1,475 ft) west of the 105-F Reactor Building (Figure 1). It was the original solid waste disposal site for the 100-F Area and operated from 1945 to 1965 to receive miscellaneous solid waste from the 105-F Reactor and the biology facilities (DeFord 1993). This burial ground measured 112 m long by 99 m wide by 6 m deep (368 by 326 by 20 ft) and contained nine trenches, eight of which received low-level radioactive material, including waste generated during maintenance of the reactor effluent system, and one of which received waste from biological experiments (Herman 1965, DeFord 1993). The nine trenches measured approximately 76 m long by 6 m wide (250 by 20 ft). Also located in this burial ground were several cylindrical sleeves/caissons measuring 5.5 m long by 1.8 m in diameter (18 ft by 6 ft) that were used for the disposal of animal carcasses and liquid waste from the 108-F Biological Laboratory.

A geophysical survey was performed over the site in March 2002 (Bergstrom et al. 2002) to locate and map the trenches and other surface and subsurface anomalies. The boundary of the burial ground was marked with posts, but most of the trenches could not be clearly distinguished. However, distinct debris areas and numerous anomalies were noted. The geophysical survey results are shown in Figure 2.

Figure 1. Location of the 118-F-2 Burial Ground.

Figure 2. Geophysical Investigation Results at the 118-F-2 Burial Ground.

3.0 REMEDIAL ACTION SUMMARY

This section contains specific information about the excavation and disposal activities for the 118-F-2 Burial Grounds. It also contains information about the types of wastes encountered in the burial ground and the field screening conducted.

3.1 EXCAVATION AND DISPOSAL INFORMATION

Remedial action of the 118-F-2 Burial Ground began on January 17, 2006, and was completed on August 8, 2007. Excavation of the site involved removing the uncontaminated overburden, the buried contaminated debris, and the underlying contaminated soil. Approximately 4,020 bank cubic meters (BCM) (5,260 bank cubic yards [BCY]) of uncontaminated overburden soil was removed and stockpiled near the excavation for subsequent use as backfill. Waste and contaminated soil was removed, staged south of the burial ground, sorted, characterized, and size-reduced (as needed). Approximately 16,100 BCM (21,100 BCY) of waste, including contaminated soil and debris, was disposed at the Environmental Restoration Disposal Facility. At the conclusion of remediation activities, the elevation at the deepest part of the excavation was approximately 117.4 m (385 ft) above mean sea level with a maximum depth of approximately 4.6 m (15 ft) below original surrounding ground surface. The remediation excavation was approximately 14,197 m² (152,815 ft²) in area. A post-remediation aerial photograph is shown in Figure 3.

3.2 WASTE INFORMATION

The remedial action at the 118-F-2 Burial Ground resulted in nine excavated areas, referred to as Trenches A through I. The waste encountered in each of the trenches was as follows:

- Trench A. Contained 11 steel caissons (cylindrical tubes/pipes), approximately 0.9 m (3 ft) in diameter and 4.3 m (14 ft) long that were buried vertically. The caissons contained animal and laboratory-type wastes including carcass remains (bones, fur), bottles, jars, sawdust, ash, and cardboard.
- Trenches B and C. Contained reactor-related waste including aluminum fuel spacers, splines, equipment, machinery, reactor hardware, laboratory-type bottles, a compressed gas-type cylinder, piping, sheet metal, concrete, wood timbers, and other miscellaneous debris. Also located in the northern portions of both trenches were several breached, corroded 208-L (55-gal) drums, one of which contained a small amount of organic solvent.
- Trench D. This trench is an extension of Trenches B and C and contained miscellaneous debris (piping, tubing, concrete) and reactor hardware.

**Figure 3. 118-F-2 Burial Ground Post-Excavation Photograph
(taken August 2007).**

- Trench E. Contained empty steel tanks, an empty lead box, and miscellaneous metallic debris.
- Trench F. Contained some animal and laboratory-type wastes including glass bottles and jars and miscellaneous metallic debris.
- Trenches G and I. Contained miscellaneous metallic and concrete debris.
- Trench H. Contained perforated spacers and general metallic debris.

Photographs of waste excavated from the 118-F-2 Burial Ground are provided in Appendix A.

3.3 FIELD SCREENING

Radiological field screening was conducted during and after the site remedial actions as specified in the *100 Area Burial Grounds Remedial Action Sampling and Analysis Plan* (Burial Ground SAP) (DOE-RL 2001). Field screening was used to guide the excavation to quickly assess the presence and level of contamination. Field screening at the site included using a Global Positioning Environmental Radiological Surveyor (GPERS) with instrumentation specific to the detection of radiation associated with gamma-emitting radionuclides. The radiological surveys for the 118-F-2 Burial Ground are provided in Appendix B.

Several areas of concentrated elevated radiological activity requiring additional remediation were identified using the GPERS. The highest concentrations were located in Trenches F, H, and I, the northeast corner of Trench C, and in the staging pile footprint (Figures B-5, B-6, B-7, B-11, and B-13). Additional remediation was performed targeting the “hot spots.” These areas were resurveyed to confirm that waste site excavation was complete (Figures B-8, B-9, B-10, B-14, and B-17).

Radiological field screening was performed for the interstitial land between the remediated trenches in order to support waste site close-out. The GPERS surveys are provided in Appendix B. No significant levels of radiological activity were detected and, therefore, no further remediation was required.

4.0 SAMPLING ACTIVITIES

Following remediation and field screening of the 118-F-2 Burial Ground, verification sampling was conducted between May and July 31, 2007. Verification sampling is performed to collect data to determine if the remedial action goals (RAGs) have been met. RAGs are the specific numeric goals against which the verification data are evaluated to demonstrate attainment of the remedial action objectives as established in the Burial Ground ROD (EPA 2000) and the RDR/RAWP (DOE-RL 2005). The following subsections provide additional discussion of the information used to develop the contaminants of concern (COCs) and contaminants of potential concern (COPCs) for verification and focused sampling, as well as the sampling design selection and basis.

4.1 CONTAMINANTS OF CONCERN FOR VERIFICATION SAMPLING

The Burial Ground SAP (DOE-RL 2001) identifies the COCs for the 118-F-2 Burial Ground as cobalt-60, nickel-63, strontium-90, cesium-137, europium-152, europium-154, uranium-238, plutonium-238, plutonium-239/240, chromium, lead, and mercury. In-process characterization samples were analyzed for these COCs and for a wide range of metals, semivolatile organic compounds, polychlorinated biphenyls, pesticides, gamma-energy-emitting isotopes, gross alpha, and gross beta. Based on

in-process characterization results, no additional COCs were identified for the burial ground. The analytical results of in-process and waste characterization sampling are located in the Administrative Record under sample delivery groups (SDGs) K0390, K0433, K0436, K0455, and K0592.

4.2 CONTAMINANTS OF POTENTIAL CONCERN FOR FOCUSED SAMPLING

During remediation activities, several distinct waste forms and locations were encountered at the 118-F-2 Burial Ground. These include Trenches A and F where animal and/or laboratory waste was excavated; Trenches B and C where breached drums were found; and Trenches G, H, and I where miscellaneous debris was excavated. In-process and waste characterization sampling at these areas indicated the presence of specific contamination; therefore, focused samples were collected and analyzed for the following COPCs: carbon-14, tritium, nickel-63, and strontium-90, from samples collected from the animal and/or laboratory waste areas; total petroleum hydrocarbons and semivolatile organic compounds from samples collected from the breached drum areas; and all site COCs from samples collected from the general debris areas. The analytical results of in-process and waste characterization sampling are located in the Administrative Record under SDGs K0390, K0433, K0436, K0455, and K0592.

4.3 SAMPLING DESIGN SELECTION AND BASIS

This section describes the basis for selection of an appropriate sample design and the determination of the number of verification samples to collect at the 118-F-2 Burial Ground.

4.3.1 Decision Unit Sampling

The sampling strategy for the 118-F-2 Burial Ground is identified in the Burial Ground SAP (DOE-RL 2001) and specifies that the site be divided into decision units (e.g., shallow zone and deep zone) based on the size of the site. The SAP also specifies the number of verification samples to collect in each decision unit. The division of the site into decision units is also a function of the applicable RAGs. The direct exposure, groundwater protection, and river protection RAGs are applicable to soils within 4.6 m (15 ft) of the ground surface. This soil zone is referred to as the shallow zone. The groundwater protection and river protection RAGs are applicable to soils greater than 4.6 m (15 ft) below the ground surface. This soil zone is referred to as the deep zone.

The 118-F-2 Burial Ground contains three decision units: (1) shallow zone excavation decision unit, which includes the nine trench excavations and area between them, (2) overburden stockpiles, which combines three overburden stockpile areas (also referred to as below cleanup level [BCL] stockpiles) into one decision unit, and (3) staging pile (above cleanup level [ACL]) footprint, which includes the area where the waste was staged prior to removal for disposal. The calculation of the number of verification samples to collect in each of the decision units resulted in four composite

samples per decision unit. This calculation, and the sample locations, is located in the sample design calculation in Appendix C. All of these decision units will be closed out using the more restrictive shallow zone cleanup criteria.

4.3.2 Focused Sampling

For the 118-F-2 Burial Ground, four areas within the excavation were identified with distinctive waste forms where focused samples were collected. These include two areas where breached, corroded drums with petroleum solvent-type impacted soils were excavated, the experimental animal farm caisson excavation, and a trench containing experimental animal farm waste. In addition, focused samples were collected from three areas that contained a large inventory of debris. A total of 15 discrete soil verification samples (i.e., focused samples) were collected on July 30, 2007, in addition to the statistical cleanup verification samples identified above. Table 1 provides a description of the focused samples collected, the corresponding COPCs, and the coordinate locations. The locations of the focused soil samples are provided in Figure 4, and the analytical results are provided in Appendix D.

Table 1. 118-F-2 Focused Sample Summary. (2 Pages)

Sample Location	Sample Number	Trench Location and Associated Anomaly	Coordinate Locations ^a	COPCs
1	J15DV7	Trench A, animal laboratory waste caisson	N 147559.2 E 579860.8	Carbon-14, tritium, nickel-63, strontium-90
2	J15DV8	Trench A, animal laboratory waste caisson	N 147554.1 E 579860.6	Carbon-14, tritium, nickel-63, strontium-90
3	J15DV9	Trench A, animal laboratory waste caisson	N 147547.8 E 579860.4	Carbon-14, tritium, nickel-63, strontium-90
4	J15DW0	Trench F, animal laboratory waste caisson	N 147484.0 E 579902.4	Carbon-14, tritium, nickel-63, strontium-90
5	J15DW1	Trench F, animal laboratory waste caisson	N 147482.8 E 579915.2	Carbon-14, tritium, nickel-63, strontium-90
6	J15DW2	Trench F, animal laboratory waste caisson	N 147485.6 E 579937.5	Carbon-14, tritium, nickel-63, strontium-90
7	J15DW3	Trench B, breached drums	N 147556.3 E 579896.0	TPH, SVOA
8	J15DW4	Trench B, breached drums	N 147552.4 E 579892.0	TPH, SVOA
9	J15DW5	Trench B, breached drums	N 147554.5 E 579901.2	TPH, SVOA
10	J15DW6	Trench C, breached drums	N 147547.2 E 579934.1	TPH, SVOA
11	J15DW7	Trench C, breached drums	N 147542.7 E 579939.1	TPH, SVOA
12	J15DW8	Trench C, breached drums	N 147545.0 E 579946.3	TPH, SVOA

Table 1. 118-F-2 Focused Sample Summary. (2 Pages)

Sample Location	Sample Number	Trench Location and Associated Anomaly	Coordinate Locations ^a	COPCs
13	J15DW9	Trench H, general debris area	N 147464.4 E 579911.7	ICP metals ^b , GEA, nickel-63, strontium-90, plutonium-238, plutonium-239/240, uranium-233/234, uranium-235, uranium-238
14	J15DX0	Trench I, general debris area	N 147464.9 E 579937.8	ICP metals ^b , GEA, nickel-63, strontium-90, plutonium-238, plutonium-239/240, uranium-233/234, uranium-235, uranium-238
15	J15DX1	Trench G, general debris area	N 147479.3 E 579953.5	ICP metals ^b , GEA, nickel-63, strontium-90, plutonium-238, plutonium-239/240, uranium-233/234, uranium-235, uranium-238

Source: Field logbook EFL-1174-3 (WCH 2007)

^a Washington State Plane, South Zone Meters

^b Samples were analyzed for the expanded ICP metal list including antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, vanadium, silver, and zinc.

COPC = contaminant of potential concern

GEA = gamma energy analysis

ICP = inductively coupled plasma

SVOA = semivolatile organic analysis

TPH = total petroleum hydrocarbons

5.0 SAMPLING RESULTS

The verification samples were submitted to offsite laboratories for analysis using approved U.S. Environmental Protection Agency (EPA) analytical methods, as required per the Burial Ground SAP (DOE-RL 2001). The laboratory-reported data results from the verification sampling were used in the statistical calculations and are included with the 95% upper confidence limit (UCL) calculations in Appendix C. The laboratory-reported data for the focused samples are provided in Appendix D.

The primary statistical calculation to evaluate compliance with cleanup standards is the 95% UCL on the arithmetic mean of the data. The 95% UCL values for each COC are computed for each of the 118-F-2 Burial Ground decision units as specified by the RDR/RAWP (DOE-RL 2005), with calculations provided in Appendix C. When a nonradionuclide COC was detected in fewer than 50% of the verification samples collected, the maximum detected value was used for comparison against the RAGs. Evaluation of the verification data from the focused samples was performed by direct comparison of the sample result for each COPC against cleanup criteria.

Figure 4. Location of Focused Soil Samples at the 118-F-2 Burial Ground.

Comparisons of the statistical and maximum results for site COCs with the RAGs (cleanup criteria) for each of the 118-F-2 Burial Ground decision units (shallow zone excavation, overburden stockpiles, and staging pile [ACL] footprint) are listed in Tables 2, 3, and 4. Comparison of the maximum results for detected COPCs with the RAGs from the focused sampling are listed in Table 5. Calculated cleanup levels are not presented in the *Cleanup Levels and Risk Calculations (CLARC) Database* (Ecology 2005) under the *Washington Administrative Code* (WAC) 173-340-740(3) for aluminum, calcium, iron, magnesium, potassium, silicon, and sodium; therefore, these constituents are not considered site COCs/COPCs. Potassium-40, radium-226, radium-228, thorium-228, and thorium-232 were detected in samples collected at the site, but are not considered within the statistical calculations. These isotopes are naturally occurring, not related to the operational history of the site, and/or were detected below background levels.

Table 2. Comparison of Statistical Contaminant Concentrations to Action Levels for the 118-F-2 Shallow Zone Excavation Verification Sampling. (2 Pages)

COC	Statistical Result (pCi/g)	Generic Site Lookup Values ^a (pCi/g)			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value ^b	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.069	6.2	1,465 ^c	1,465 ^c	No	--
Cobalt-60	0.017 U	1.4	13,900 ^c	13,900 ^c	No	--
Europium-152	0.044 U	3.3	-- ^d	-- ^d	No	--
Europium-154	0.059 U	3.0	-- ^d	-- ^d	No	--
Nickel-63	-1.071 U	4,013 ^c	83 ^c	83 ^c	No	--
Plutonium-238	0.083 U	37.4	-- ^d	-- ^d	No	--
Plutonium-239/240	0.210	33.9	-- ^d	-- ^d	No	--
Strontium-90	0.12 U	4.5	27.6 ^c	27.6 ^c	No	--
Uranium-233/234	0 (<BG)	1.1 ^e	1.1 ^e	1.1 ^e	No	--
Uranium-238	0 (<BG)	1.1 ^e	1.1 ^e	1.1 ^e	No	--

Table 2. Comparison of Statistical Contaminant Concentrations to Action Levels for the 118-F-2 Shallow Zone Excavation Verification Sampling. (2 Pages)

COC	Statistical Result (mg/kg)	Remedial Action Goals ^a (mg/kg)			Does the Statistical Result Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Chromium	10.4 (<BG)	80,000	18.5 ^f	18.5 ^f	No	--
Lead	5.7 (<BG)	353	10.2 ^f	10.2 ^f	No	--
Mercury	0.02 U (<BG)	24	0.33 ^f	0.33 ^f	No	--

^a Lookup values, RAGs, and/or background values obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005) or calculated per WAC 173-340-720, 173-340-730, or 173-340-740, Method B, 1996, unless otherwise noted.

^b Activity corresponding to a single-radionuclide 15 mrem/yr exposure as calculated using the RESRAD model (DOE-RL 2005).

^c Revised lookup value per *100 Area Radionuclide and Nonradionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision* (BHI 2004).

^d No value—RESRAD modeling (DOE-RL 2005) predicts the contaminant will not impact groundwater within 1,000 years.

^e The calculated value is below the Hanford-Site specific statistical soil background activity. The value presented is the Hanford Site-specific statistical soil background activity (DOE-RL 1996).

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

-- = not applicable

BG = background

COC = contaminant of concern

RAG = remedial action goal

RESRAD = RESidual RADioactivity (dose-assessment model)

U = undetected (in all samples in the data set)

WAC = Washington Administrative Code

Table 3. Comparison of Statistical Contaminant Concentrations to Action Levels for the 118-F-2 Overburden Stockpiles Verification Sampling. (2 Pages)

COC	Statistical Result (pCi/g)	Generic Site Lookup Values ^a (pCi/g)			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value ^b	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0 (<BG)	6.2	1,465 ^c	1,465 ^c	No	--
Cobalt-60	0.008 U	1.4	13,900 ^c	13,900 ^c	No	--
Europium-152	0.039 U	3.3	-- ^d	-- ^d	No	--
Europium-154	0.021 U	3.0	-- ^d	-- ^d	No	--
Nickel-63	0.53 U	4,013 ^c	83 ^c	83 ^c	No	--
Plutonium-238	0.035 U	37.4	-- ^d	-- ^d	No	--
Plutonium-239/240	0 (<BG)	33.9	-- ^d	-- ^d	No	--
Strontium-90	0 (<BG)	4.5	27.6 ^c	27.6 ^c	No	--
Uranium-233/234	0 (<BG)	1.1 ^e	1.1 ^e	1.1 ^e	No	--
Uranium-238	0 (<BG)	1.1 ^e	1.1 ^e	1.1 ^e	No	--

Table 3. Comparison of Statistical Contaminant Concentrations to Action Levels for the 118-F-2 Overburden Stockpiles Verification Sampling. (2 Pages)

COC/COPC	Statistical Result (mg/kg)	Remedial Action Goals ^a (mg/kg)			Does the Statistical Result Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Chromium	8.4 (<BG)	80,000	18.5 ^f	18.5 ^f	No	--
Lead	4.5 (<BG)	353	10.2 ^f	10.2 ^f	No	--
Mercury	0.02 U (<BG)	24	0.33 ^f	0.33 ^f	No	--
Selenium ^g	1.4	400	5	1	Yes	Yes ^h

^a Lookup values, RAGs, and/or background values obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005) or calculated per WAC 173-340-720, 173-340-730, or 173-340-740, Method B, 1996, unless otherwise noted.

^b Activity corresponding to a single-radionuclide 15 mrem/yr exposure as calculated using the RESRAD model (DOE-RL 2005).

^c Revised lookup value per *100 Area Radionuclide and Nonradionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision* (BHI 2004).

^d No value—RESRAD modeling predicts the contaminant will not impact groundwater within 1,000 years.

^e The calculated value is below the Hanford-Site specific statistical soil background activity. The value presented is the Hanford Site-specific statistical soil background activity (DOE-RL 1996).

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

^g Hanford Site-specific background not available. Value is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

^h Based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005), selenium is not expected to migrate more than 1 m (3.3 ft) vertically in 1,000 years (based on the soil-partitioning coefficient distribution of 150 mL/g). The vadose zone underlying the excavated area is approximately 4 m (13 ft) thick.

-- = not applicable

BG = background

COC = contaminant of concern

COPC = contaminant of potential concern

RAG = remedial action goal

RESRAD = RESidual RADioactivity (dose-assessment model)

U = undetected (in all samples in the data set)

WAC = Washington Administrative Code

Table 4. Comparison of Statistical Contaminant Concentrations to Action Levels for the 118-F-2 Staging Pile (ACL) Footprint Verification Sampling. (2 Pages)

COC	Statistical Result (pCi/g)	Generic Site Lookup Values ^a (pCi/g)			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value ^b	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.434	6.2	1,465 ^c	1,465 ^c	No	--
Cobalt-60	0.019 U	1.4	13,900 ^c	13,900 ^c	No	--
Europium-152	0.037 U	3.3	-- ^d	-- ^d	No	--
Europium-154	0.054 U	3.0	-- ^d	-- ^d	No	--
Nickel-63	0.316 U	4,013 ^c	83 ^c	83 ^c	No	--

Table 4. Comparison of Statistical Contaminant Concentrations to Action Levels for the 118-F-2 Staging Pile (ACL) Footprint Verification Sampling. (2 Pages)

COC	Statistical Result (pCi/g)	Generic Site Lookup Values ^a (pCi/g)			Does the Statistical Result Exceed Lookup Values?	Does the Statistical Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value ^b	Groundwater Protection Lookup Value	River Protection Lookup Value		
Plutonium-238	0.33	37.4	-- ^d	-- ^d	No	--
Plutonium-239/240	0.061 U	33.9	-- ^d	-- ^d	No	--
Strontium-90	0.25 U	4.5	27.6 ^c	27.6 ^c	No	--
Uranium-233/234	0 (<BG)	1.1 ^e	1.1 ^e	1.1 ^e	No	--
Uranium-238	0 (<BG)	1.1 ^e	1.1 ^e	1.1 ^e	No	--
COC/COPC	Statistical Result (mg/kg)	Remedial Action Goals ^a (mg/kg)			Does the Statistical Result Exceed RAGs?	Does the Statistical Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Chromium	7.8 (<BG)	80,000	18.5 ^f	18.5 ^f	No	--
Lead	4.5 (<BG)	353	10.2 ^f	10.2 ^f	No	--
Mercury	0.02 U (<BG)	24	0.33 ^f	0.33 ^f	No	--
Selenium ^g	1.4	400	5	1	Yes	Yes ^h

^a Lookup values, RAGs, and/or background values obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005) or calculated per WAC 173-340-720, 173-340-730, or 173-340-740, Method B, 1996, unless otherwise noted.

^b Activity corresponding to a single-radionuclide 15 mrem/yr exposure as calculated using the RESRAD model (DOE-RL 2005).

^c Revised lookup value per *100 Area Radionuclide and Nonradionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision* (BHI 2004).

^d No value—RESRAD modeling predicts the contaminant will not impact groundwater within 1,000 years.

^e The calculated value is below the Hanford-Site specific statistical soil background activity. The value presented is the Hanford Site-specific statistical soil background activity (DOE-RL 1996).

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

^g Hanford Site-specific background not available. Value is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).

^h Based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005), selenium is not expected to migrate more than 1 m (3.3 ft) vertically in 1,000 years (based on the soil-partitioning coefficient distribution of 150 mL/g). The vadose zone underlying the excavated area is approximately 4 m (13 ft) thick.

-- = not applicable

ACL = above cleanup level

BG = background

COC = contaminant of concern

COPC = contaminant of potential concern

RAG = remedial action goal

RESRAD = RESidual RADIOactivity (dose-assessment model)

U = undetected (in all samples in the data set)

WAC = Washington Administrative Code

Table 5. Comparison of Maximum Contaminant Concentrations to Action Levels for the 118-F-2 Focused Sampling. (2 Pages)

COPC	Maximum Result (pCi/g)	Generic Site Lookup Values ^a (pCi/g)			Does the Result Exceed Lookup Values?	Does the Result Pass RESRAD Modeling?
		Shallow Zone Lookup Value ^b	Groundwater Protection Lookup Value	River Protection Lookup Value		
Cesium-137	0.062	6.2	1,465 ^c	1,465 ^c	No	--
Europium-152	0.135	3.3	-- ^d	-- ^d	No	--
Nickel-63	5.07	4,013 ^c	83 ^c	83 ^c	No	--
Uranium-233/234	0.519 (<BG)	1.1 ^e	1.1 ^e	1.1 ^e	No	--
Uranium-238	0.433 (<BG)	1.1 ^e	1.1 ^e	1.1 ^e	No	--
COPC	Maximum Result (mg/kg)	Remedial Action Goals ^a (mg/kg)			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Antimony	0.78 (<BG)	32	5 ^f	5 ^f	No	--
Arsenic	1.5 (<BG)	20	20	20	No	--
Barium	58.8 (<BG)	5,600	132 ^f	224	No	--
Beryllium	0.37 (<BG)	10.4 ^g	1.51 ^f	1.51 ^f	No	--
Boron ^h	1.2	16,000	320	-- ⁱ	No	--
Cadmium ^j	0.22 (<BG)	13.9 ^g	0.81 ^f	0.81 ^f	No	--
Chromium (total)	6.6 (<BG)	80,000	18.5 ^f	18.5 ^f	No	--
Cobalt	6.8 (<BG)	1,600	32	-- ⁱ	No	--
Copper	10.4 (<BG)	2,960	59.2	22.0 ^f	No	--
Lead	3.8 (<BG)	353	10.2 ^f	10.2 ^f	No	--
Manganese	274 (<BG)	11,200	512 ^f	512 ^f	No	--
Molybdenum ^h	0.48	400	8	-- ⁱ	No	--
Nickel	10.7 (<BG)	1,600	19.1 ^f	27.4	No	--
Vanadium	56.8 (<BG)	560	85.1 ^f	-- ⁱ	No	--
Zinc	40.9 (<BG)	24,000	480	67.8 ^f	No	--
Benzo(a)anthracene	0.039	0.33 ^k	0.33 ^k	0.33 ^k	No	--
Benzo(a)pyrene	0.029	0.33 ^k	0.33 ^k	0.33 ^k	No	--
Benzo(b)fluoranthene	0.037	0.33 ^k	0.33 ^k	0.33 ^k	No	--
Benzo(g,h,i)perylene ^l	0.027	2,400	48	192	No	--
Benzo(k)fluoranthene	0.049	0.33 ^k	0.33 ^k	0.33 ^k	No	--
bis(2-Ethylhexyl) phthalate	0.090	71.4	0.625	0.36	No	--

Table 5. Comparison of Maximum Contaminant Concentrations to Action Levels for the 118-F-2 Focused Sampling. (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals ^a (mg/kg)			Does the Result Exceed RAGs?	Does the Result Pass RESRAD Modeling?
		Direct Exposure	Soil Cleanup Level for Groundwater Protection	Soil Cleanup Level for River Protection		
Butylbenzylphthalate	0.023	16,000	320	250	No	--
Chrysene	0.061	0.33 ^k	1.2	0.33 ^k	No	--
Di-n-butylphthalate	0.044	8,000	160	540	No	--
Fluorene	0.079	3,200	64	260	No	--
Indeno(1,2,3-cd) pyrene	0.022	1.37	0.33 ^k	0.33 ^k	No	--
Pyrene	0.073	2,400	48	192	No	--

- ^a Lookup values, RAGs, and/or background values obtained from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005) or calculated per WAC 173-340-720, 173-340-730, or 173-340-740, Method B, 1996, unless otherwise noted.
- ^b Activity corresponding to a single-radionuclide 15 mrem/yr exposure as calculated using the RESRAD model (DOE-RL 2005).
- ^c Revised lookup value per *100 Area Radionuclide and Nonradionuclide Lookup Values for the 1995 Interim Remedial Action Record of Decision* (BHI 2004).
- ^d No value—RESRAD modeling predicts the contaminant will not impact groundwater within 1,000 years.
- ^e The calculated value is below the Hanford-Site specific statistical soil background activity. The value presented is the Hanford Site-specific statistical soil background activity (DOE-RL 1996).
- ^f Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-700[4][d]) (1996).
- ^g Carcinogenic cleanup level calculated based on the inhalation exposure pathway per WAC 173-340-750[3], 1996 (Method B for air quality) and an airborne particulate mass loading rate of 0.0001 g/m³ (WDOH 1997).
- ^h No Hanford Site-specific or Washington State background value available.
- ⁱ No cleanup level is available from the *Cleanup Levels and Risk Calculations (CLARC) Database* (Ecology 2005), and no bioconcentration factor or ambient water quality criteria values are available to calculate cleanup levels (WAC 173-340-730(3)(a)(iii), 1996 [Method B for surface waters]).
- ^j Hanford Site-specific background value is not available; not evaluated during background study. Value used is from *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994).
- ^k Where cleanup levels are less than the RDL, cleanup levels default to the RDL (WAC 173-340-707[2], 1996, and DOE-RL 2005).
- ^l Toxicity data for this chemical are not available. Cleanup levels are based on surrogate chemical pyrene.
- = not applicable
BG = background
COPC = contaminant of potential concern
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose-assessment model)
RDL = required detection limit
WAC = Washington Administrative Code

6.0 DATA EVALUATION

This section demonstrates that remedial actions at the 118-F-2 Burial Ground have achieved the applicable RAGs, comply with ecological screening levels, and comply with applicable nonradionuclide risk requirements and WAC 173-340-740(7)(e) three-part test criteria. This section also describes the RESidual RADioactivity (RESRAD) modeling performed that predicts the dose rate, the excess lifetime cancer risk, and the impact on groundwater and the river from residual radionuclide COC concentrations.

6.1 COMPARISON OF SAMPLE DATA TO RAGS

Evaluation of the results listed in Tables 2, 3, 4, and 5 from the verification sampling at the 118-F-2 Burial Ground indicates that all COC/COPCs were undetected and/or quantified below RAGs and lookup values, except for selenium. Residual concentrations of selenium in the overburden stockpiles and the staging pile (ACL) footprint decision units (1.4 mg/kg, in both decision units) slightly exceed the soil RAG for river protection (1 mg/kg). Data were not collected on the vertical extent of contamination for this area, but given the soil-partitioning distribution coefficient for selenium (150 mL/g), this contaminant would not be expected to migrate more than 1 m (3.3 ft) vertically in 1,000 years (BHI 2005). The vadose zone underlying the 118-F-2 Burial Ground excavation is approximately 4 m (13 ft) thick. Therefore, residual concentrations of this contaminant are predicted to be protective of the Columbia River.

6.2 COMPARISON OF SAMPLE DATA TO ECOLOGICAL RISK SCREENING LEVELS

Soil cleanup levels were established in the Burial Ground ROD (EPA 2000) based on a limited ecological risk assessment. Although not required by the Burial Ground ROD, a comparison against ecological risk screening levels has been made for the site COCs/COPCs. Screening levels were not exceeded for the site constituents, with the exception of antimony, boron, manganese, selenium, and vanadium. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. It is believed that the presence of these constituents does not pose a risk to ecological receptors because the concentrations of antimony, manganese, and vanadium are below site background levels, selenium is within the range of Hanford Site background levels, and boron concentrations are consistent with those seen elsewhere at the Hanford Site (no established background value is available for boron).

A baseline risk assessment for the river corridor portion of the Hanford Site began in 2004, which includes a more complete quantitative ecological risk assessment. That baseline risk assessment will be used as part of the final closeout decision for this site. Draft A of the baseline risk assessment concludes that no ecological risks are associated with Hanford contaminants of potential concern at upland remediated waste sites and riparian operational soil areas (DOE-RL 2007a).

6.3 HUMAN HEALTH RISK EVALUATION FOR NONRADIONUCLIDES

The human health risk evaluations are calculated for nonradionuclide COCs/COPCs only per WAC 173-340-740(3)(a)(iii)(A) and (B). The requirements include a hazard quotient of less than 1.0 for all individual noncarcinogens, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1×10^{-6} , and a cumulative excess carcinogenic risk of less than 1×10^{-5} . The details of the hazard quotient calculations are provided in Appendix C.

Hazard quotient calculations were performed for the 118-F-2 Burial Ground using the highest of the focused and statistical values from all sampling areas. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. All individual hazard quotients are below 1.0, and all individual excess carcinogenic risk values are below 1×10^{-6} . The cumulative hazard quotient for the 118-F-2 is 6.1×10^{-3} and the cumulative excess carcinogenic risk value is 1.6×10^{-6} , satisfying the criteria of less than 1.0 and less than 1×10^{-5} , respectively. Therefore, nonradionuclide risk requirements are met.

6.4 WAC THREE-PART TEST FOR NONRADIONUCLIDES

When using a statistical sampling approach, a RAG requirement for nonradionuclides is the WAC 173-340-740(7)(e) three-part test. The WAC 173-340 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% of the data set.

The application of the three-part test for the 118-F-2 Burial Ground is included in the 95% UCL calculation (Appendix C). The results of this evaluation indicate that all residual COC/COPC concentrations pass the three-part test, except for selenium, which fails two components of the three-part when compared to the most stringent RAG (soil RAG for the protection of the Columbia River). However, based on RESRAD modeling (BHI 2005), as described above, selenium will not migrate to the Columbia River in 1,000 years. Selenium satisfies the three-part test criteria in comparison to the direct exposure RAG. Therefore, the requirements of the three-part test are met.

6.5 RESRAD MODELING FOR RADIONUCLIDES

For radionuclide contaminants, RESRAD (ANL 2005) modeling is used to determine contaminant migration and to predict the dose rate, the excess lifetime cancer risk, and the impact on groundwater and the river from residual radionuclide COC concentrations (DOE-RL 2005). For the 118-F-2 Burial Ground, the individual radionuclide cleanup statistical values were entered into the RESRAD computer code with the results included in the RESRAD calculations in Appendix C, as well as summarized below.

6.5.1 Attainment of Radionuclide Direct Exposure RAG

The direct exposure RAG for radionuclide COCs is expressed in terms of an allowable radiation dose rate above background, which is 15 mrem/yr over 1,000 years. For the 118-F-2 Burial Ground, separate RESRAD runs were performed for each of the decision units (shallow zone excavation, overburden stockpiles, and staging pile [ACL] footprint). The maximum dose rate calculated by RESRAD occurs at the present year (2007) and is 1.13 mrem/yr (from the staging pile [ACL] footprint). The maximum dose rate in

1,000 years decreases to 0.0826 mrem/yr (from the shallow zone excavation); therefore, this requirement is attained.

6.5.2 Attainment of Radionuclide Excess Lifetime Cancer Risk Goal

The “National Oil and Hazardous Substances Pollution Contingency Plan” (40 *Code of Federal Regulations* [CFR] 300) presents a target range for residual radionuclide risk of 10^{-4} to 10^{-6} . The RESRAD model calculates the excess lifetime cancer risk associated with the estimated radiation dose rates. For the 118-F-2 Burial Ground, the maximum excess lifetime cancer risk occurs at the present year (2007) and is 1.64×10^{-5} (from the staging pile [ACL] footprint). The maximum excess lifetime cancer risk in 1,000 years decreases to 1.60×10^{-7} (from the shallow zone excavation); therefore, this requirement is attained.

6.5.3 Attainment of Radionuclide Groundwater and River Protection RAGS

The attainment of groundwater and river protection RAGs for radionuclides is determined by four criteria: 1) attain single COC groundwater and river RAGs, 2) attain “National Primary Drinking Water Regulations” (40 CFR 141) 4 mrem/yr (beta/gamma) dose standard to target receptor/organ; 3) meet drinking water standards for non-uranium alpha-emitters (the more stringent of 15 pCi/L maximum contaminant level [MCL] or 1/25th of the derived concentration guide [DOE Order 5400.5]); and 4) meet total uranium standard of 21.2 pCi/L.

The first criterion is determined by comparing peak concentrations of radionuclide COCs to the RAGs. The peak concentration is the maximum predicted value from the three decision units, as shown in the MCL calculation in Appendix C. Of the radionuclide COCs for the 118-F-2 Burial Ground, only cesium-137 is calculated by the RESRAD model to reach groundwater in the 1,000 years; however, at a concentration significantly below the RAGs. The peak concentration of cesium-137 reaching the groundwater from the shallow zone excavation, overburden stockpiles, and staging pile (ACL) footprint is predicted to occur in year 43 at 0.0178 pCi/L (from the staging pile [ACL] footprint). Both the groundwater and river protection RAGs for cesium-137 are 60 pCi/L, therefore, this criterion is attained.

The second criterion, attainment of the National Primary Drinking Water Regulations 4 mrem/yr (beta/gamma) above background dose standard to target receptor/organ, is demonstrated in the MCL calculation provided in Appendix C. The results predict a maximum dose of 0.00119 mrem/yr dose to any organ (total body, bone, liver, and gastrointestinal track [lower large intestine]) within the 1,000 years of the evaluation period. Therefore, this criterion is attained.

The third criterion, meet drinking water standards for non-uranium alpha-emitters (the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide [DOE Order 5400.5]) is demonstrated in the MCL calculation in Appendix C. The results indicate that the alpha-emitting COCs (plutonium-238 and plutonium-239/240) will not impact groundwater. Therefore, concentrations are less than the maximum allowable gross particle activity.

For the last criterion, meet total uranium standard of 21.2 pCi/L, no uranium isotopes were detected above background levels in the 118-F-2 Burial Ground verification samples. Therefore, this standard is met.

7.0 DATA QUALITY ASSESSMENT

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 118-F-2 Burial Ground established 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 design was sufficient for the purpose of clean site verification. The detailed DQA is presented in Appendix E.

8.0 SUMMARY FOR WASTE SITE RECLASSIFICATION

This cleanup verification package demonstrates that remedial action at the 118-F-2 Burial Ground has achieved the remedial action objectives and corresponding RAGs established in the Burial Ground ROD (EPA 2000) and RDR/RAWP (DOE-RL 2005). The remaining soils at this site have been sampled, analyzed, and modeled. The results indicate that the residual concentrations of COCs/COPCs at this site do not preclude any future uses (as bounded by a rural-residential scenario) and allow for unrestricted use of the shallow-zone soils (i.e., surface to 4.6 m [15 ft]) deep). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River. Site contamination did not extend into the deep zone soils; therefore, institutional controls to prevent uncontrolled drilling or excavation into deep zone are not required.

In accordance with this evaluation, the verification sampling and modeling results support a reclassification of the 118-F-2 Burial Ground to Interim Closed Out.

9.0 REFERENCES

- 40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations*, as amended.
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APPENDIX A
REMEDIATION PHOTOGRAPHS

Photograph A-1. 118-F-2 Trench A Caissons.

Photograph A-2. 118-F-2 Trench A Caissons.

Photograph A-3. Trench A Caisson Contents.

Photograph A-4. Hardware/Machinery from Trenches B and C (taken June 2006).

Photograph A-5. Drum and Compressed Gas-Type Cylinder from Trench B.

Photograph A-6. Laboratory-Type Bottle from Trench C.

Photograph A-7. Debris from Trench C.

Photograph A-8. Empty Steel Tanks and Debris from Trench E.

Photograph A-9. Empty Lead Box from Trench E.

Photograph A-10. Debris from Trench H.

APPENDIX B
RADIOLOGICAL SURVEYS

Figure B-1. Radiological Survey of 118-F-2 Overburden Stockpile.

Figure B-2. Radiological Survey of 118-F-2 Interstitial Areas.

Figure B-3. Radiological Survey of 118-F-2 Interstitial Areas.

Figure B-4. Radiological Survey of 118-F-2 Trench A.

**Figure B-5. Radiological Survey of 118-F-2 Trenches B, C, and F.
(Surveys Following Additional Material Removal are Provided in
Figures B-6, B-8, B-10, and B-13.)**

Figure B-6. Radiological Survey of 118-F-2 Trenches F, H, and I.
(Surveys Following Additional Material Removal are Provided in
Figures B-9 and B-14.)

**Figure B-7. Radiological Survey of 118-F-2 Staging Pile Footprint.
(Surveys Following Additional Material Removal are Provided in Figure B-11.)**

Figure B-8. Radiological Survey of 118-F-2 Trenches B and C.

Figure B-9. Radiological Survey of 118-F-2 Trenches H and I.

Figure B-10. Radiological Survey of 118-F-2 Trench B.

**Figure B-11. Radiological Survey of 118-F-2 Staging Pile Footprint.
(Surveys Following Additional Material Removal are Provided in Figure B-17.)**

Figure B-12. Radiological Survey of 118-F-2 Trench E.

Figure B-13. Radiological Survey of 118-F-2 Trench C.
(Surveys Following Additional Material Removal are Provided in Figure B-17.)

Figure B-14. Radiological Survey of 118-F-2 Trench F.

Figure B-15. Radiological Survey of 118-F-2 Staging Pile Footprint.

Figure B-16. Radiological Survey of 118-F-2 Overburden Stockpile.

Figure B-17. Radiological Survey of 118-F-2 Northeast Corner of Trench C and Staging Pile Footprint.

APPENDIX C
CALCULATIONS

DISCLAIMER FOR CALCULATIONS

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

APPENDIX C
CALCULATIONS

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

118-F-2 Burial Ground Sample Design Shallow Zone / Stockpiles (ACL/BCL) Sampling Plan, 0100F-CA-V0284, Rev. 0..... C-1

118-F-2 Cleanup Verification 95% UCL Calculations, 0100F-CA-V0285, Rev. 1 ..... C-11

118-F-2 Hazard Quotient and Carcinogenic Risk Calculations, 0100F-CA-V0295, Rev. 0 ..... C-35

118-F-2 Burial Ground Cleanup Verification RESRAD Calculation Brief, 0100F-CA-V0286, Rev. 0..... C-39

118-F-2 Burial Ground Comparison to Drinking Water Standards (MCL) Calculation, 0100F-CA-V0287, Rev. 1 ..... C-169

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

CALCULATION COVER SHEET

Project Title: 118-F-2 Burial Ground Sample Design Job No. **14655**

Area: 100-F

Discipline: Environmental Engineering *Calculation No: 0100F-CA-V0284

Subject: Shallow Zone / Stockpiles (ACL/BCL) Sampling Plan

Computer Program: Excel, Autodesk World, and Autodesk Land Map Program No: Excel 2003, World R2, and Land Map 2004

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Total = 8 Shts	<i>G. Cruz</i> G. Cruz 7-17-07	<i>B.A. Christensen</i> B.A. Christensen 2007-7-25	N/A	<i>S.W. Callison</i> S.W. Callison 7-26-07	7-26-07

SUMMARY OF REVISION

Washington Closure Hanford

CALCULATION SHEET

Originator G. Cruz Date 7/17/2007 Calc. No. 0100F-CA-V0284 Rev. No. 0
Project 118-F-2 Burial Ground Sample Design Job No. 14655 Checked BAC Date 2007.7.25
Subject Shallow Zone / Stockpiles (ACL/BCL) Sampling Plan Sheet No. 1 of 2

1	Problem:	Calculate and display required sampling nodes in concurrence with 100 Area Burial Grounds Remedial Action Sampling
2		and Analysis Plan, DOE/RL-2001-35 Rev. 0, for verification and closure.
3		
4	Given:	-SAP (DOE/RL-2001-35 Rev. 0) requirements
5		-Shallow Sampling Area (Surface area of each zone determined from Autodesk Land Map program,
6		Attachment 3, Sht 1 of 3, CAD file 1F:071707A, 118-F-2 Burial Ground Shallow Zone Sampling Plan)
7		Attachment 3, Sht 2 of 3, CAD file 1F:071707B, 118-F-2 Burial Ground Stockpile (ACL) Sampling Plan)
8		Attachment 3, Sht 3 of 3, CAD file 1F:071707C, 118-F-2 Burial Ground Stockpile (BCL) Sampling Plan)
9		
10		
11		
12		
13		
14		
15	Sample Design Approach:	
16	Shallow Zone:	-Develop a grid of 16 sample nodes
17		-Use table III-4 and III-5 of the SAP to determine which four of the sixteen nodes will be sampled
18		to collect clean up verification samples
19		
20	Overburden:	-Develop a grid of 16 sample nodes
21		-Use table III-4 and III-5 of the SAP to determine which four of the sixteen nodes will be sampled
22		to collect clean up verification samples
23		
24	Deep Zone:	-Develop a grid of 16 sample nodes
25		-Use table III-4 and III-5 of the SAP to determine which four of the sixteen nodes will be sampled
26		to collect clean up verification samples
27		
28	Determination of Shallow Zone Sampling Grid:	
29		
30		Refer to tables III-4 and III-5 sampling frequency Attachment 2,
31		Number of Decision Subunits Based on Area, DOE/RL-2001-35 Rev. 0
32		
33	Total Area:	5461.71 m ²
34	Area of Each Decision Subunits:	5461.71 m ²
35		
36	Area of Each Sampling Area:	1365.42 m ²
37		
38	Area of Each Sample Node:	85.33 m ²
39		
40	Nodes to be Sampled (as determined from Attachment 1, Table A-1, Sample Grid Point Lookup Table)	
41		Attachment 3, Sht 1 of 3, 118-F-2 Burial Ground Shallow Zone Sampling Plan,
42		for Sample Location Table
43		
44		
45		
46		

Washington Closure Hanford

CALCULATION SHEET

Originator G. Cruz Date 7/17/2007 Calc. No. 0100F-CA-V0284 Rev. No. 0
Project 118-F-2 Burial Ground Sample Design Job No. 14655 Checked BKC Date 2007.7.25
Subject Shallow Zone / Stockpiles (ACL/BCL) Sampling Plan Sheet No. 2 of 3

1									
2									
3	Determination of Stockpile (ACL) Sampling Grid:								
4									
5	Refer to tables III-4 and III-5 sampling frequency Attachment 2,								
6	Number of Decision Subunits Based on Area, DOE/RL-2001-35 Rev. 0								
7									
8	Total Area:					4592.20	m ²		
9	Area of Each Decision Subunits:					4592.20	m ²		
10									
11	Area of Each Sampling Area:					1148.05	m ²		
12									
13	Area of Each Sample Node:					71.75	m ²		
14									
15	Nodes to be Sampled (as determined from Attachment 1, Table A-1, Sample Grid Point Lookup Table)								
16		Attachment 3, Sht 2 of 3, 118-F-2 Burial Ground Stockpile (ACL) Sampling Plan,							
17		for Sample Location Table							
18									
19									
20									
21									
22	Determination of Stockpile (BCL) Sampling Grid:								
23									
24	Refer to tables III-4 and III-5 sampling frequency Attachment 2,								
25	Number of Decision Subunits Based on Area, DOE/RL-2001-35 Rev. 0								
26									
27	Total Area:					4143.18	m ²		
28	Area of Each Decision Subunits:					4143.18	m ²		
29									
30	Area of Each Sampling Area:					1035.79	m ²		
31									
32	Area of Each Sample Node:					64.73	m ²		
33									
34	Nodes to be Sampled (as determined from Attachment 1, Table A-1, Sample Grid Point Lookup Table)								
35		Attachment 3, Sht 3 of 3, 118-F-2 Burial Ground Stockpile (BCL) Sampling Plan,							
36		for Sample Location Table							
37									
38									
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40									
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46									

Washington Closure Hanford

Originator G. Cruz Date 7/17/2007 Calc. No. 0100F-CA-V0284 Rev. No. 0
Project 118-F-2 Burial Ground Sample Design Job No. 14655 Checked BKC Date 2007.7.25
Subject Shallow Zone / Stockpiles (ACL/BCL) Sampling Plan Sheet No 1 of 1

ATTACHMENT 1

Sample Grid Point Lookup Table.

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

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

Washington Closure Hanford

Originator G. Cruz Date 7/17/2007 Calc. No. 0100F-CA-V0284 Rev. No. 0
Project 118-F-2 Burial Ground Sample Design Job No. 14655 Checked BKC Date 2007-7-25
Subject Shallow Zone / Stockpiles (ACL/BCL) Sampling Plan Sheet No. 1 of 1

ATTACHMENT 2

Table III-4. Number of Decision Subunits Based on Area

Decision Units ^a	Waste Site Size	Number of Decision Units
Site verification (shallow) 0 to 4.6m (15 ft)	Small area of exposed surface after excavation $\leq 9290 \text{ m}^2 (\leq 100,000 \text{ ft}^2)$	1
	Medium area of exposed surface after excavation $> 9290 \text{ m}^2$ but $\leq 37161 \text{ m}^2$ $(> 100,000 \text{ ft}^2$ but $\leq 400,000 \text{ ft}^2)$	4
	Large area of exposed surface after excavation $> 37161 \text{ m}^2 (> 400,000 \text{ ft}^2)$	8
Site verification (deep) $> 4.6\text{m} (> 15 \text{ ft})$	Small area of exposed surface after excavation $\leq 9290 \text{ m}^2 (\leq 100,000 \text{ ft}^2)$	1
	Medium area of exposed surface after excavation $> 9290 \text{ m}^2$ but $\leq 37161 \text{ m}^2$ $(> 100,000 \text{ ft}^2$ but $\leq 400,000 \text{ ft}^2)$	4
	Large area of exposed surface after excavation $> 37161 \text{ m}^2 (> 400,000 \text{ ft}^2)$	8
Overburden/layback piles	Small area of exposed surface after excavation $\leq 9290 \text{ m}^2 (\leq 100,000 \text{ ft}^2)$	1
	Medium area of exposed surface after excavation $> 9290 \text{ m}^2$ but $\leq 37161 \text{ m}^2$ $(> 100,000 \text{ ft}^2$ but $\leq 400,000 \text{ ft}^2)$	4
	Large area of exposed surface after excavation $> 37161 \text{ m}^2 (> 400,000 \text{ ft}^2)$	8

^a The shallow zone, deep zone, and overburden each represent single decision units. Because sites may not have a deep zone, there may be two or three decision units.
Note: 1.) Metric equivalents added to original SAP table.

Table III-5. Sampling Frequency Based on Size of Remediated Waste Site.

Exposed Surface Area After Excavation	Number of Decision Subunits	Number of Blocks	Number of Discreet Samples	Number of Composite Samples
Small site $\leq 9290 \text{ m}^2 (\leq 100,000 \text{ ft}^2)$	1	4	16	4
Medium site $> 9290 \text{ m}^2 (> 100,000 \text{ ft}^2)$ but $\leq 37161 \text{ m}^2 (\leq 400,000 \text{ ft}^2)$	4	16	64	16
Large site $\leq 37161 \text{ m}^2 (> 400,000 \text{ ft}^2)$	8	32	128	32

Note: 2.) The term "sample areas" is used interchangeably with "blocks" in this sample design.
3.) Metric equivalents corrected from original SAP table.

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E 579850

N 147500

NOTES

1. SHALLOW ZONE NODE AREAS ARE APPROXIMATELY 85.33 SQUARE METERS.
2. SAMPLES ARE TAKEN FROM THE APPROXIMATE CENTER OF EACH NODE.
3. THE SHALLOW ZONE CONSISTS OF SAMPLING AREAS A1, A2, A3 AND A4 WITHIN DECISION SUBUNIT 1.

LEGEND

SAMPLE LOCATION TABLE

DECISION SUBUNIT	SAMPLING AREA	SAMPLE NODE	NORTHING	EASTING
1	A1	A1-3	147549.13	579860.33
		A1-4A	147543.61	579859.23
		A1-4B	147552.59	579882.66
		A1-10	147548.57	579890.27
		A1-16	147501.51	579890.84
	A2	A2-3	147544.28	579901.12
		A2-6	147518.69	579901.14
		A2-7	147509.53	579901.15
		A2-15	147498.31	579923.22
		A3-1	147551.69	579930.69
	A3	A3-2	147544.72	579930.42
		A3-4	147532.04	579930.10
		A3-11	147535.93	579942.60
		A4-3	147537.30	579952.65
		A4-4	147528.03	579952.97
	A4	A4-7A	147499.80	579952.86
		A4-7B	147489.63	579882.79
		A4-12	147484.34	579920.08

Attachment 3 Sheet No. 1 of 3
Originator G. CRUZ Date 7-17-07
Chk'd By BAC Date 2-27-08
Calc. No. 0100F-CA-V0284 Rev. No. 0

ATTACHMENT 3

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

100-F AREA
118-F-2 BURIAL GROUND
SHALLOW ZONE SAMPLING PLAN

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

100-F AREA
118-F-2 BURIAL GROUND
STOCKPILE (ACL) SAMPLING PLAN

NOTES

1. STOCKPILE NODE AREAS ARE APPROXIMATELY 71.75 SQUARE METERS.
2. SAMPLES ARE TAKEN FROM THE APPROXIMATE CENTER OF EACH NODE.
3. THE STOCKPILE CONSISTS OF SAMPLING AREAS A1, A2, A3 AND A4 WITHIN DECISION SUBUNIT 1.

LEGEND

VERIFICATION SAMPLING NODE

SAMPLE LOCATION TABLE

DECISION SUBUNIT	SAMPLING AREA	SAMPLE NODE	NORTHING	EASTING
1	A1	A1-3	147430.80	579882.16
		A1-4	147424.14	579882.17
		A1-10	147437.64	579892.88
		A1-16	147397.66	579893.03
	A2	A2-3	147431.26	579903.69
		A2-6	147411.26	579903.66
		A2-7	147404.51	579903.64
		A2-15	147404.06	579914.44
	A3	A3-1	147444.24	579925.00
		A3-2	147437.42	579925.06
		A3-4	147423.97	579925.17
		A3-11	147431.24	579935.91
	A4	A4-3	147430.97	579946.71
		A4-4	147424.29	579946.73
		A4-7	147404.29	579946.80
		A4-12	147424.39	579957.52

Attachment 3 Sheet No. 2 of 3
Originator G-CR02 Date 7-17-07
Chkd By BAC Date 2007-7-25
Calc. No. 0100F-CA-V0284 Rev. No. 0

ATTACHMENT 3

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SCALE 1:600
6 0 6 12 24 meters

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

100-F AREA
118-F-2 BURIAL GROUND
STOCKPILE (BCL) SAMPLING PLAN

NOTES

1. STOCKPILE NODE AREAS ARE APPROXIMATELY 64.73 SQUARE METERS.
2. SAMPLES ARE TAKEN FROM THE APPROXIMATE CENTER OF EACH NODE.
3. THE STOCKPILE CONSISTS OF SAMPLING AREAS A1, A2, A3 AND A4 WITHIN DECISION SUBUNIT 1.

LEGEND

VERIFICATION SAMPLING NODE

SAMPLE LOCATION TABLE

DECISION SUBUNIT	SAMPLING AREA	SAMPLE NODE	NORTHING	EASTING
1	A1	A1-3A	147587.67	579935.36
		A1-3B	147582.52	579942.91
		A1-4	147579.26	579946.23
		A1-10	147527.34	580003.79
	A2	A1-16	147527.69	580029.24
		A2-3	147507.76	579995.62
		A2-6	147515.11	580007.07
		A2-7	147508.99	580007.03
	A3	A2-15	147508.88	580028.30
		A3-1	147496.57	579992.98
		A3-2	147490.26	579992.16
		A3-4	147479.65	579990.42
	A4	A3-11	147485.69	580015.06
		A4-3	147463.40	579985.44
		A4-4	147458.37	579985.27
		A4-7	147463.60	579998.31
		A4-12	147457.63	580010.14

Attachment 3 Sheet No. 3 of 3
Originator G. CRZ Date 7-17-07
Checked By BAC Date 2007-7-25
Calc. No. 0100F-CA-V0244 Rev. No. 0

ATTACHMENT 3

CALCULATION COVER SHEET

Project Title: 100-F Field Remediation

Job No. **14655**

Area: 100-F

Discipline: Environmental

*Calculation No: 0100F-CA-V0285

Subject: 118-F-2 Cleanup Verification 95% UCL Calculations

Computer Program: Excel

Program No: Excel 2003

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

Committed Calculation ☒

Preliminary ☐

Superseded ☐

Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Total = 24	K. A. Anselm	J. M. Capron	N/A	S. W. Callison	8/16/2007
1	Total = 24	J. M. Capron	T. M. Blakley	N/A	S. W. Callison	
		<i>J. M. Capron</i>	<i>T. M. Blakley</i>		<i>SW Call</i>	<i>9-18-07</i>

SUMMARY OF REVISION

1	Revised Attachment 1, Sheet 6, to include "J" qualifiers to Antimony per third-party validation. Added results of split data to Attachment 1, all sheets, and revised Sheets 4 and 11 to include split analysis. Removed risk calculations from Sheets 8 and 10 to include in a separate calculation and corrected 3-part test compliance statement. Revised Sheets 1 through 3 to remove reference to risk calculations. Replaced cover page in entirety.

CALCULATION SHEET

Washington Closure Hanford

Originator <u>J. M. Capron</u>	Date <u>09/15/07</u>	Calc. No. <u>0100F-CA-V0285</u>	Rev. No. <u>1</u>
Project <u>Field Remediation</u>	Job No. <u>14655</u>	Checked <u>T. M. Blakley</u>	Date <u>9/17/07</u>
Subject <u>118-F-2 Cleanup Verification 95% UCL Calculations</u>			Sheet No. <u>1 of 13</u>

Summary

Purpose:

This document contains calculations based on analytical results from data collected at the 118-F-2 Burial Ground waste site. The calculations in this document include 1) calculation of the 95% upper confidence limit (UCL) values to evaluate compliance with cleanup standards, 2) performance of the *Washington Administrative Code* (WAC) 173-340-740(7)(e) 3-part test for each nonradionuclide COC, as required, and 3) calculation of the relative percent difference (RPD) for primary-duplicate and primary-split sample pairs, as necessary.

Table of Contents:

Sheets 1 to 4 - Summary
Sheets 5 to 6 - Shallow Zone Excavation Sampling Data and Statistical Computations
Sheets 7 to 8 - Overburden/BCL Stockpile Sampling Data and Statistical Computations
Sheets 9 to 10 - Staging Pile (ACL) Footprint Sampling Data and Statistical Computations
Sheets 11 to 13 - Split/Duplicate Analysis
Attachment 1 - 118-F-2 Verification Sampling Results (10 sheets)

Given/References:

- 1) Sample Results (Attachment 1).
- 2) Background values and remedial action goals (RAGs) are from DOE-RL (2005), DOE-RL (2001b), and Ecology (2005).
- 3) DOE-RL, 2001a, *100 Area Burial Grounds Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-2001-35, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- 4) DOE-RL, 2001b, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- 5) DOE-RL, 2005, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- 6) Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
- 7) Ecology, 1993, *Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-detection Limit or Below-PQL Values (Censored Data Sets)*, Publication #92-54, Washington Department of Ecology, Olympia, Washington.
- 8) Ecology, 2005, *Cleanup Levels and Risk Calculations (CLARC) Database*, Washington State Department of Ecology, Olympia, Washington, <<https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx>>.
- 9) EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013, U.S. Environmental Protection Agency, Washington, D.C.
- 10) WAC 173-340, 1996, "Model Toxic Control Act - Cleanup," *Washington Administrative Code*.

Solution:

Calculation methodology is described in Ecology publications (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2005). Use data from attached worksheets to calculate the 95% UCL, perform the WAC 173-340-740(7)(e) 3-part test for nonradionuclides, and calculate the RPD, as required.

Calculation Description:

The subject calculations were performed on data from soil verification samples from the subject waste site. The data were entered into an EXCEL 2003 spreadsheet and calculations performed by using the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP (DOE-RL 2005) is documented by this calculation. Duplicate and split RPD results are used in evaluation of data quality within the cleanup verification package (CVP) for this site.

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *Jmc* Date 09/15/07 Calc. No. 0100F-CA-V0285 Rev. No. 1
Project Field Remediation Job No. 14655 Checked T. M. Blakley *TMB* Date 9/17/07
Subject 118-F-2 Cleanup Verification 95% UCL Calculations Sheet No. 2 of 13

Summary (continued)

Methodology:

Calculations were performed for all analytes identified as site COCs (DOE-RL 2001a). Selenium is also included based on detections above background levels in the overburden/BCL stockpile and the staging pile (ACL) footprint. No calculations were performed for other reported analytes because all are in the range of typical background values and/or are excluded from consideration as COCs based on analogous site information. For nonradioactive COCs with $\leq 50\%$ of the data below detection limits and all radionuclide analytes, the statistical value calculated to evaluate the effectiveness of cleanup is the 95% UCL. For nonradioactive COCs with $> 50\%$ of the data below detection limits, the maximum detected value for the data set is used instead of the 95% UCL.

All nonradionuclide data reported as being undetected are set to $\frac{1}{2}$ the detection limit value for calculation of the statistics (Ecology 1993). For radionuclide data, calculation of the statistics is done using the reported value. In cases where the laboratory does not report a value below the minimum detectable activity (MDA), half of the MDA is used in the calculation. For the statistical evaluation of duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above.

For nonradionuclides, the WAC 173-340 statistical guidance suggests that a test for distributional form be performed on the data and the 95% UCL calculated on the appropriate distribution using Ecology software. For nonradionuclide small data sets ($n < 10$) and all radionuclide data sets, as for the subject site, the calculations are performed assuming nonparametric distribution, so no tests for distribution are performed.

The WAC 173-340-740(7)(e) 3-part test is performed for nonradionuclide analytes only and determines if:

- 1) the 95% UCL exceeds the most stringent cleanup limit for each COC,
- 2) greater than 10% of the raw data exceed the most stringent cleanup limit for each COC,
- 3) the maximum value of the raw data set exceeds two times the most stringent cleanup limit for each COC.

The RPD values are evaluated for analytes detected in a primary-duplicate or primary-split sample pair for the purposes of data quality assessment within the CVP (where direct evaluation of the attached data showed that a given analyte was undetected in the primary, duplicate, and split samples, no further calculations were performed). The RPD is calculated when both the primary value and the duplicate (or split) value for a given analyte are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method and is listed in Table II-2 of the SAP (DOE-RL 2001a). 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

When an analyte is detected in the primary or duplicate (split) sample, but was quantified at less than 5 times the TDL in one or both samples, an additional parameter is evaluated. In this case, if the difference between the primary and duplicate (or split) results exceed a control limit of 2 times the TDL, further assessment regarding the usability of the data is performed. This assessment is provided in the data quality assessment section of the CVP.

For quality assurance/quality control (QA/QC) split and duplicate RPD calculations, a value less than 30% indicates the data compare favorably. For regulatory splits, a threshold of 35% is used (EPA 1994). If the RPD is greater than 30% (or 35% for regulatory split data), further investigation regarding the usability of the data is performed. Additional discussion is provided in the data quality assessment section of the CVP, as necessary. No regulatory split samples were collect at this site.

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JMC*
 Project Field Remediation
 Subject 118-F-2 Cleanup Verification 95% UCL Calculations

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 Job No. 14655

Calc. No. 0100F-CA-V0285
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Rev. No. 1
 Date 9/17/07
 Sheet No. 3 of 13

Summary (continued)

Results:

The information presented in the following tables include the summary of the results of the 95% UCL calculations for each decision unit (Shallow Zone Excavation, Overburden/BCL Stockpile, and Staging Pile (ACL) Footprint), the WAC 173-340-740(7)(e) 3-part test evaluation, the risk calculations, and the RPD calculations, and are for use in risk analysis and the CVP for this site.

Results Summary:

Analyte	Shallow Zone Excavation		Overburden/ BCL Stockpile		Staging Pile (ACL) Footprint		Units
	Result	Qualifier	Result	Qualifier	Result	Qualifier	
Cesium-137	0.069		0 (< BG)		0.434		pCi/g
Cobalt-60	0.017	U	0.008	U	0.019	U	pCi/g
Europium-152	0.044	U	0.039	U	0.037	U	pCi/g
Europium-154	0.059	U	0.021	U	0.054	U	pCi/g
Nickel-63	-1.071	U	0.53	U	0.316	U	pCi/g
Plutonium-238	0.083	U	0.035	U	0.33		pCi/g
Plutonium-239/240	0.210		0 (< BG)	U	0.061	U	pCi/g
Strontium-90	0.12	U	0 (< BG)	U	0.25	U	pCi/g
Uranium-233/234	0 (< BG)		0 (< BG)		0 (< BG)		pCi/g
Uranium-238	0 (< BG)		0 (< BG)		0 (< BG)		pCi/g
Chromium	10.4		8.4		7.8		mg/kg
Lead	5.7		4.5		4.5		mg/kg
Mercury ^a	0.02	U	0.02	U	0.02	U	mg/kg
Selenium ^a	NA		1.4		1.4		mg/kg

^aFor nonradionuclides, where > 50% of a data set is below detection limits, the statistical value defaults to the maximum detected value in the data set.

WAC 173-340 3-Part Test for most stringent RAG:

Requirement	Shallow Zone Excavation	Overburden/ BCL Stockpile	Staging Pile (ACL) Footprint
95% UCL > Cleanup Limit?	NO	YES ^a	YES ^a
> 10% above Cleanup Limit?	NO	YES ^a	YES ^a
Any sample > 2x Cleanup Limit?	NO	NO	NO

^aBecause of the "yes" answers to the 3-part test for selenium, a detailed assessment using RESRAD will be performed and included in the CVP. The data set meets the 3-part test criteria when compared to the direct exposure cleanup level.

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron *JMC*
Project Field Remediation
Subject 118-F-2 Cleanup Verification 95% UCL Calculations

Date 09/15/07
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Rev. No. 1
Date 9/17/07
Sheet No. 4 of 13

1 Summary (continued)

3 Relative Percent Difference Results^a - QA/QC Analysis

Analyte	Shallow Zone Excavation		Overburden/ BCL Stockpile		Staging Pile (ACL) Footprint	
	Duplicate Analysis ^b	Split Analysis ^b	Duplicate Analysis ^b	Split Analysis ^b	Duplicate Analysis ^b	Split Analysis ^b
Potassium-40	4.4%		0.9%		20%	
Aluminum	15%	45%	19%	42%	7.8%	39%
Calcium	15%	35%	3.9%	14%	3.0%	21%
Chromium			27%	36%	11%	36%
Copper	23%	10%	7.5%	2.9%	0.8%	4.0%
Iron	1.3%	19%	17%	23%	3.0%	33%
Magnesium	13%	40%	21%	30%	8.7%	32%
Manganese	8.5%	16%	6.7%	34%	13%	9.1%
Silicon	27%	61%	47%	33%	6.1%	128%
Sodium						16%
Vanadium	17%	41%	24%	46%	3.1%	44%
Zinc	10%	22%	11%	6.8%	11%	26%

18 ^aRelative percent difference evaluation was not required for analytes/sample-pairs not included in this table.

19 ^bThe significance of relative percent difference values is discussed within the CVP for this site.

22 Abbreviations/Acronyms:

23 The following abbreviations and/or acronyms are used in this calculation:

24 ACL = above cleanup level	N = spike sample recovery is outside control limits
25 B = results is less than reporting limit	NA = not applicable
26 BCL = below cleanup level	PQL = practical quantitation limit
27 BG = background	Q = qualifier
28 C = method blank contamination	QA/QC = quality assurance/quality control
29 COC = contaminant of concern	RAG = remedial action goal
30 COPC = contaminant of potential concern	RDL = required detection limit
31 CVP = cleanup verification package	RDR/RAWP = remedial design report/remedial action work plan
32 D = diluted	RESRAD = RESidual RADioactivity (dose model)
33 GEA = gamma energy analysis	RPD = relative percent difference
34 GW = groundwater	SAP = sampling and analysis plan
35 J = estimate	TDL = target detection limit
36 MDA = minimum detectable activity	U = undetected
37 MTCA = Model Toxics Control Act	UCL = upper confidence limit
38	WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm
Project Field Remediation
Subject 118-F-2 Cleanup Verification 95% UCL Calculations

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Job No. 14655

Calc. No. 0100F-CA-V0285
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Rev. No. 0
Date 8/16/07
Sheet No. 5 of 13

1 Sampling Data - Shallow Zone Excavation

Sample Location	Sample Number	Sample Date	Cesium-137			Cobalt-60			Europium-152			Europium-154			Nickel-63			Plutonium-238			Plutonium-239/240		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A3	J152N4	07/31/07	0.036		0.025	0.028	U	0.028	0.069	U	0.069	0.093	U	0.093	-0.84	U	3.46	0.110	U	0.407	0	U	0.282
Duplicate of J152N4	J152N5	07/31/07	0.028		0.026	0.027	U	0.027	0.055	U	0.055	0.081	U	0.081	-0.894	U	3.51	0.054	U	0.299	0	U	0.207
A1	J152N2	07/31/07	0.024	U	0.024	0.022	U	0.022	0.062	U	0.062	0.073	U	0.073	-1.25	U	3.37	0.060	U	0.460	0	U	0.460
A2	J152N3	07/31/07	0.039	U	0.039	0.037	U	0.037	0.096	U	0.096	0.139	U	0.139	-2.12	U	3.38	0.057	U	0.218	0.314		0.218
A4	J152N6	07/31/07	0.093		0.025	0.023	U	0.023	0.081	U	0.081	0.071	U	0.071	-2.23	U	3.50	-0.030	U	0.283	0	U	0.226

10 Statistical Computation Input Data

Sample Location	Sample Number	Sample Date	Cesium-137 pCi/g			Cobalt-60 pCi/g			Europium-152 pCi/g			Europium-154 pCi/g			Nickel-63 pCi/g			Plutonium-238 pCi/g			Plutonium-239/240 pCi/g		
A3	J152N4/ J152N5	7/31/07	0.032			0.014			0.031			0.044			-0.868			0.082			0		
A1	J152N2	7/31/07	0.012			0.011			0.031			0.037			-1.25			0.060			0		
A2	J152N3	7/31/07	0.020			0.019			0.048			0.070			-2.12			0.057			0.314		
A4	J152N6	7/31/07	0.093			0.012			0.041			0.036			-2.23			-0.030			0		

18 Statistical Computations

95% UCL value based on	Cesium-137			Cobalt-60			Europium-152			Europium-154			Nickel-63			Plutonium-238			Plutonium-239/240		
	Radionuclide data set. Use nonparametric z- statistic.			Radionuclide data set. Use nonparametric z- statistic.			Radionuclide data set. Use nonparametric z- statistic.			Radionuclide data set. Use nonparametric z- statistic.			Radionuclide data set. Use nonparametric z- statistic.			Radionuclide data set. Use nonparametric z- statistic.			Radionuclide data set. Use nonparametric z- statistic.		
N	4			4			4			4			4			4			4		
% < Detection limit	50%			100%			100%			100%			100%			100%			75%		
Mean	0.039			0.014			0.038			0.046			-1.6170			0.042			0.083		
Standard deviation	0.037			0.0034			0.0082			0.0159			0.664			0.049			0.154		
95% UCL on mean	0.069			0.017			0.044			0.059			-1.071			0.083			0.210		
Maximum value	0.093			0.037	U		0.096	U		0.139	U		-0.842	U		0.110	U		0.314		
Background	NA			NA			NA			NA			NA			NA			NA		
Statistical value above background	0.069			0.017	U		0.044	U		0.059	U		-1.071	U		0.083	U		0.210		

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm
Project Field Remediation
Subject 118-F-2 Cleanup Verification 95% UCL Calculations

Date 08/15/07
Job No. 14655

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Rev. No. 0
Date 8/15/07
Sheet No. 6 of 13

1 Sampling Data - Shallow Zone Excavation (continued)

Sample Location	Sample Number	Sample Date	Strontium-90			Uranium-233/234			Uranium-238			Chromium			Lead			Mercury		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A3	J152N4	07/31/07	0.110	U	0.306	0.681		0.237	0.495		0.237	3.9		0.29	2.6		0.95	0.01	U	0.01
Duplicate of J152N4	J152N5	07/31/07	0.079	U	0.287	0.397		0.190	0.397		0.190	5.5		0.29	3.6		0.94	0.01	U	0.01
A1	J152N2	07/31/07	0.132	U	0.314	0.575		0.183	0.839		0.183	4.6		0.29	2.9		0.97	0.01	U	0.01
A2	J152N3	07/31/07	0.029	U	0.400	0.381		0.194	0.406		0.194	13.0		0.29	6.8		0.95	0.01	U	0.01
A4	J152N6	07/31/07	-0.067	U	0.382	0.598		0.254	0.365		0.254	6.4		0.29	4.0		0.95	0.02	U	0.02

10 Statistical Computation Input Data

Sample Location	Sample Number	Sample Date	Strontium-90 pCi/g			Uranium-233/234 pCi/g			Uranium-238 pCi/g			Chromium mg/kg			Lead mg/kg			Mercury mg/kg		
A3	J152N4/J152N5	7/31/07	0.095			0.539			0.446			4.7			3.1			0.005		
A1	J152N2	7/31/07	0.132			0.575			0.839			4.6			2.9			0.005		
A2	J152N3	7/31/07	0.029			0.381			0.406			13.0			6.8			0.005		
A4	J152N6	7/31/07	-0.067			0.598			0.365			6.4			4.0			0.01		

18 Statistical Computations

			Strontium-90			Uranium-233/234			Uranium-238			Chromium			Lead			Mercury		
95% UCL value based on			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Small data set (n < 10). Use nonparametric z-statistic.			Small data set (n < 10). Use nonparametric z-statistic.			Greater than 50% of the data are below detection. Default to maximum value.		
N			4			4			4			4			4			4		
% < Detection limit			100%			0%			0%			0%			0%			100%		
Mean			0.047			0.523			0.514			7.2			4.2			0.006		
Standard deviation			0.087			0.098			0.219			4.0			1.8			0.003		
95% UCL on mean			0.119			0.604			0.694			10.4			5.7			0.008		
Maximum value			0.132	U		0.681			0.839			13.0			6.8			0.02	U	
Background*			NA			1.1			1.1			18.5			10.2			0.33		
Statistical value above background*			0.12	U		0 (< BG)			0 (< BG)			10.4			5.7			0.02	U	
Most Stringent Cleanup Limit for nonradionuclide and RAG type												BG/GW & River Protection			BG/GW & River Protection			BG/GW & River Protection		
WAC 173-340 3-PART TEST												18.5			10.2			0.33		
95% UCL > Cleanup Limit?												NA			NA			NA		
> 10% above Cleanup Limit?												NA			NA			NA		
Any sample > 2X Cleanup Limit?												NA			NA			NA		
WAC 173-340 Compliance?			YES									Because all values are below background (18.5 mg/kg), the WAC 173-340 3-part test is not required.			Because all values are below background (10.2 mg/kg), the WAC 173-340 3-part test is not required.			Because mercury was not detected in any sample, the WAC 173-340 3-part test is not required.		

* Background is not subtracted for nonradionuclides; consideration of background is provided for comparison purposes.

CALCULATION SHEET

Washington Closure HanfordOriginator K. A. AnselmProject Field RemediationSubject 118-F-2 Cleanup Verification 95% UCL CalculationsDate 08/15/07
Job No. 14655Calc. No. 0100F-CA-V0285Checked J. M. CapronRev. No. 0
Date 8/16/07
Sheet No. 17 of 13

1 Sampling Data - Overburden/BCL Stockpile

Sample Location	Sample Number	Sample Date	Cesium-137			Cobalt-60			Europium-152			Europium-154			Nickel-63			Plutonium-238			Plutonium-239/240		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A4	J152N0	05/17/07	0.060	U	0.060	0.026	U	0.026	0.062	U	0.062	0.087	U	0.087	-0.713	U	3.4	0.125	U	0.16	0	U	0.16
Duplicate of J152N0	J152N1	05/17/07	0.054	U	0.054	0.026	U	0.026	0.073	U	0.073	0.093	U	0.093	-2.09	U	3.4	-0.0380	U	0.18	-0.0190	U	0.15
A1	J152J7	06/06/07	0.025	U	0.025	0.025	U	0.025	0.060	U	0.060	0.080	U	0.080	0.639	U	3.11	0.021	U	0.197	0	U	0.157
A2	J152J8	05/17/07	0.046	U	0.046	0.025	U	0.025	0.069	U	0.069	0.087	U	0.087	0.514	U	3.3	0	U	0.18	0	U	0.18
A3	J152J9	05/17/07	0.108		0.024	0.034	U	0.034	0.083	U	0.083	0.12	U	0.12	-1.24	U	3.2	0.0314	U	0.24	-0.0314	U	0.24

10 Statistical Computation Input Data

Sample Location	Sample Number	Sample Date	Cesium-137 pCi/g			Cobalt-60 pCi/g			Europium-152 pCi/g			Europium-154 pCi/g			Nickel-63 pCi/g			Plutonium-238 pCi/g			Plutonium-239/240 pCi/g		
A4	J152N0/J152N1	5/17/07	0.029			0.013			0.034			0.045			-1.40			0.044			-0.010		
A1	J152J7	6/6/07	0.013			0.013			0.030			0.040			0.639			0.021			0		
A2	J152J8	5/17/07	0.023			0.013			0.035			0.044			0.514			0			0		
A3	J152J9	5/17/07	0.108			0.017			0.042			0.060			-1.24			0.0314			-0.0314		

18 Statistical Computations

	Cesium-137			Cobalt-60			Europium-152			Europium-154			Nickel-63			Plutonium-238			Plutonium-239/240		
95% UCL value based on	Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.		
N	4			4			4			4			4			4			4		
% < Detection limit	75%			100%			100%			100%			100%			100%			100%		
Mean	0.043			0.014			0.035			0.047			-0.37			0.024			-0.010		
Standard deviation	0.044			0.0022			0.0048			0.0088			1.10			0.018			0.015		
95% UCL on mean	0.079			0.016			0.039			0.054			0.53			0.039			0.0020		
Maximum value	0.108			0.034	U		0.083	U		0.12	U		0.639	U		0.125	U		0	U	
Background	1.1			0.008			NA			0.033			NA			0.004			0.025		
Statistical value above background	0 (< BG)			0.008	U		0.039	U		0.021	U		0.53	U		0.035	U		0 (< BG)	U	

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron
Project Field Remediation
Subject 118-F-2 Cleanup Verification 95% UCL Calculations

Date 09/15/07
Job No. 14655

Calc. No. 0100F-CA-V0285
Checked T. M. Blakley

Rev. No. 1
Date
Sheet No. 8 of 13

1 Sampling Data - Overburden/BCL Stockpile (continued)

Sample Location	Sample Number	Sample Date	Strontium-90			Uranium-233/234			Uranium-238			Chromium			Lead			Mercury			Selenium		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A4	J152N0	05/17/07	0.0820	U	0.22	0.591		0.16	0.428		0.16	5.2	C	0.23	3.3		0.82	0.02	U	0.02	1.4		1.1
Duplicate of J152N0	J152N1	05/17/07	0.0040	U	0.25	0.400		0.13	0.250		0.13	6.8	C	0.23	3.4		0.82	0.01	U	0.01	1.1	U	1.1
A1	J152J7	06/06/07	0.267	U	0.317	0.405		0.041	0.458		0.026	5.3		0.30	3.7		1.0	0.01	U	0.01	1.3	U	1.3
A2	J152J8	05/17/07	-0.0154	U	0.27	0.538		0.14	0.341		0.14	7.0	C	0.23	4.2		0.81	0.01	U	0.01	1.1	U	1.1
A3	J152J9	05/17/07	-0.0580	U	0.22	0.379		0.19	0.404		0.19	9.4	C	0.23	4.8		0.81	0.01	U	0.01	1.1	U	1.1

10 Statistical Computation Input Data

Sample Location	Sample Number	Sample Date	Strontium-90			Uranium-233/234			Uranium-238			Chromium			Lead			Mercury			Selenium		
			pCi/g			pCi/g			pCi/g			mg/kg			mg/kg			mg/kg			mg/kg		
A4	J152N0/ J152N1	5/17/07	0.043			0.496			0.339			6.0			3.4			0.008			0.98		
A1	J152J7	6/6/07	0.267			0.405			0.458			5.3			3.7			0.005			0.65		
A2	J152J8	5/17/07	-0.0154			0.538			0.341			7.0			4.2			0.005			0.55		
A3	J152J9	5/17/07	-0.0580			0.379			0.404			9.4			4.8			0.005			0.55		

18 Statistical Computations

			Strontium-90			Uranium-233/234			Uranium-238			Chromium			Lead			Mercury			Selenium		
95% UCL value based on			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Small data set (n < 10). Use nonparametric z-statistic.			Small data set (n < 10). Use nonparametric z-statistic.			Greater than 50% below detection. Default to maximum value.			Greater than 50% of the data are below detection. Default to maximum value.		
N			4			4			4			4			4			4			4		
% < Detection limit			100%			0%			0%			0%			0%			100%			75%		
Mean			0.059			0.454			0.386			6.9			4.0			0.006			0.68		
Standard deviation			0.145			0.075			0.057			1.8			0.63			0.001			0.20		
95% UCL on mean			0.178			0.516			0.432			8.4			4.5			0.007			0.85		
Maximum value			0.267			0.591			0.458			9.4			4.8			0.02			1.4		
Background*			0.18			1.1			1.1			18.5			10.2			0.33			0.78		
Statistical value above background*			0 (< BG)			0 (< BG)			0 (< BG)			8.4			4.5			0.02			1.4		
Most Stringent Cleanup Limit for nonradionuclide and RAG type												BG/GW & River Protection			BG/GW & River Protection			BG/GW & River Protection			1 River Protection		
WAC 173-340 3-PART TEST												18.5			10.2			0.33					
95% UCL > Cleanup Limit?												NA			NA			NA			YES		
> 10% above Cleanup Limit?												NA			NA			NA			YES		
Any sample > 2X Cleanup Limit?												NA			NA			NA			NO		
WAC 173-340 Compliance?			Further Assessment Required									Because all values are below background (18.5 mg/kg), the WAC 173-340 3-part test is not required.			Because all values are below background (10.2 mg/kg), the WAC 173-340 3-part test is not required.			Because mercury was not detected in any sample, the WAC 173-340 3-part test is not required.			Because of the yes answers to the WAC 173-340 3-part test, a detailed assessment will be performed using RESRAD.		

* Background is not subtracted for nonradionuclides; consideration of background is provided for comparison purposes.

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm
Project Field Remediation
Subject I18-F-2 Cleanup Verification 95% UCL Calculations

Date 08/15/07
Job No. 14655

Calc. No. 0100F-CA-V0285
Checked J. M. Capron

Rev. No. 0
Date 8/16/07
Sheet No. 9 of 13

1 Sampling Data - Staging Pile (ACL) Footprint

Sample Location	Sample Number	Sample Date	Cesium-137			Cobalt-60			Europium-152			Europium-154			Nickel-63			Plutonium-238			Plutonium-239/240		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J152N7	07/17/07	0.073		0.030	0.026	U	0.026	0.070	U	0.070	0.092	U	0.092	1.32	U	3.12	1.00		0.192	0	U	0.192
Duplicate of J152N7	J152N8	07/17/07	0.103		0.029	0.022	U	0.022	0.056	U	0.056	0.075	U	0.075	-1.66	U	3.21	-0.028	U	0.217	0	U	0.217
A2	J152N9	07/17/07	0.038		0.033	0.037	U	0.037	0.079	U	0.079	0.122	U	0.122	0.439	U	3.11	0.093	U	0.238	0	U	0.238
A3	J152P0	07/17/07	0.060		0.028	0.025	U	0.025	0.065	U	0.065	0.086	U	0.086	0.188	U	3.20	-0.019	U	0.209	0.038	U	0.145
A4	J152P1	07/17/07	0.623		0.030	0.040	U	0.040	0.066	U	0.066	0.077	U	0.077	-0.280	U	2.98	0	U	0.223	0.081	U	0.154

9

10 Statistical Computation Input Data

Sample Location	Sample Number	Sample Date	Cesium-137			Cobalt-60			Europium-152			Europium-154			Nickel-63			Plutonium-238			Plutonium-239/240		
			pCi/g			pCi/g			pCi/g			pCi/g			pCi/g			pCi/g			pCi/g		
A1	J152N7/ J152N8	7/17/07	0.088			0.012			0.032			0.042			-0.170			0.486			0		
A2	J152N9	7/17/07	0.038			0.019			0.040			0.0610			0.439			0.093			0		
A3	J152P0	7/17/07	0.060			0.013			0.033			0.043			0.188			-0.019			0.038		
A4	J152P1	7/17/07	0.623			0.020			0.033			0.039			-0.280			0			0.081		

17

18 Statistical Computations

			Cesium-137			Cobalt-60			Europium-152			Europium-154			Nickel-63			Plutonium-238			Plutonium-239/240		
95% UCL value based on			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.		
N			4			4			4			4			4			4			4		
% < Detection limit			0%			100%			100%			100%			100%			75%			100%		
Mean			0.202			0.016			0.034			0.046			0.0443			0.14			0.030		
Standard deviation			0.281			0.0041			0.0036			0.0101			0.330			0.24			0.039		
95% UCL on mean			0.434			0.019			0.037			0.054			0.316			0.33			0.061		
Maximum value			0.623			0.040	U		0.079	U		0.122	U		1.32	U		1.00			0.081	U	
Background			NA			NA			NA			NA			NA			NA			NA		
Statistical value above background			0.434			0.019	U		0.037	U		0.054	U		0.316	U		0.33			0.061	U	

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron
Project Field Remediation
Subject 118-F-2 Cleanup Verification 95% UCL Calculations

Date 09/15/07
Job No. 14655

Calc. No. 0100F-CA-V0285
Checked T. M. Blakley

Rev. No. 1
Date 9/17/07
Sheet No. 10 of 13

1 Sampling Data - Staging Pile (ACL) Footprint (continued)

Sample Location	Sample Number	Sample Date	Strontium-90			Uranium-233/234			Uranium-238			Chromium			Lead			Mercury			Selenium		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1	J152N7	07/17/07	0.095	U	0.306	0.518		0.165	0.367		0.165	8.4		0.30	4.7		0.98	0.01	U	0.01	1.3	U	1.3
Duplicate of J152N7	J152N8	07/17/07	0.216	U	0.240	0.742		0.167	0.480		0.167	7.5		0.29	3.9		0.96	0.02	U	0.02	1.3	U	1.3
A2	J152N9	07/17/07	-0.021	U	0.247	0.613		0.162	0.423		0.162	7.7		0.29	4.7		0.95	0.02	U	0.02	1.4		1.2
A3	J152P0	07/17/07	0.019	U	0.261	0.418		0.160	0.523		0.160	5.5		0.29	3.8		0.96	0.01	U	0.01	1.3	U	1.3
A4	J152P1	07/17/07	0.336	U	0.339	0.441		0.169	0.441		0.169	5.4		0.29	3.4		0.96	0.01	U	0.01	1.2	U	1.2

10 Statistical Computation Input Data

Sample Location	Sample Number	Sample Date	Strontium-90			Uranium-233/234			Uranium-238			Chromium			Lead			Mercury			Selenium		
			pCi/g			pCi/g			pCi/g			mg/kg			mg/kg			mg/kg			mg/kg		
A1	J152N7/ J152N8	7/17/07	0.16			0.630			0.424			8.0			4.3			0.008			0.65		
A2	J152N9	7/17/07	-0.021			0.613			0.423			7.7			4.7			0.010			1.4		
A3	J152P0	7/17/07	0.019			0.418			0.523			5.5			3.8			0.005			0.65		
A4	J152P1	7/17/07	0.336			0.441			0.441			5.4			3.4			0.005			0.60		

18 Statistical Computations

			Strontium-90			Uranium-233/234			Uranium-238			Chromium			Lead			Mercury			Selenium		
95% UCL value based on			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Radionuclide data set. Use nonparametric z-statistic.			Small data set (n < 10). Use nonparametric z-statistic.			Small data set (n < 10). Use nonparametric z-statistic.			Greater than 50% below detection. Default to maximum value.			Greater than 50% of the data are below detection. Default to maximum value.		
N			4			4			4			4			4			4			4		
% < Detection limit			100%			0%			0%			0%			0%			100%			75%		
Mean			0.12			0.526			0.453			6.6			4.1			0.007			0.83		
Standard deviation			0.16			0.111			0.048			1.4			0.57			0.002			0.38		
95% UCL on mean			0.25			0.617			0.492			7.8			4.5			0.009			1.1		
Maximum value			0.336	U		0.742			0.523			8.4			4.7			0.02	U		1.4		
Background*			NA			1.1			1.1			18.5			10.2			0.33			0.78		
Statistical value above background*			0.25	U		0 (< BG)			0 (< BG)			7.8			4.5			0.02	U		1.4		
Most Stringent Cleanup Limit for nonradionuclide and RAG type												BG/GW & River Protection			BG/GW & River Protection			BG/GW & River Protection			1 River Protection		
WAC 173-340 3-PART TEST												18.5			10.2			0.33			1		
95% UCL > Cleanup Limit?												NA			NA			NA			YES		
> 10% above Cleanup Limit?												NA			NA			NA			YES		
Any sample > 2X Cleanup Limit?												NA			NA			NA			NO		
WAC 173-340 Compliance?			Further Assessment Required									Because all values are below background (18.5 mg/kg), the WAC 173-340 3-part test is not required.			Because all values are below background (10.2 mg/kg), the WAC 173-340 3-part test is not required.			Because mercury was not detected in any sample, the WAC 173-340 3-part test is not required.			Because of the yes answers to the WAC 173-340 3-part test, a detailed assessment will be performed using RESRAD.		

35 * Background is not subtracted for nonradionuclides; consideration of background is provided for comparison purposes.

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron

Project Field Remediation

Subject 118-F-2 Cleanup Verification 95% UCL Calculations

Date 09/15/07

Job No. 14655

Calc. No. 0100F-CA-V0285

Checked T. M. Blakley

Rev. No. 1

Date 9/17/07

Sheet No. 11 of 13

1 Split/Duplicate Analysis - Shallow Zone Excavation

Sample Area	Sample Number	Sample Date	Cesium-137			Potassium-40			Radium-226			Radium-228			Thorium-228 GEA			Thorium-232 GEA			Total beta radiostrontium			Uranium-233/234			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A3	J152N4	7/31/07	0.036		0.025	11.2		0.308	0.347		0.046	0.526		0.109	0.482		0.032	0.526		0.109	0.110	U	0.306	0.681		0.237	0.495		0.237
Duplicate of J152N4	J152N5	7/31/07	0.028		0.026	11.7		0.194	0.350		0.043	0.556		0.086	0.494		0.027	0.556		0.086	0.079	U	0.287	0.397		0.190	0.397		0.190
Split of J152N4	J152P4	7/31/07	0.0329		0.0127	Not evaluated			Not evaluated			Not evaluated			Not evaluated			Not evaluated			0.308		0.133	0.136		0.0471	0.104		0.0556

7 Analysis:

Duplicate Analysis	TDL		0.1		0.5		0.1		0.2		1		1		1		1		5	
	Both > MDA?	Yes (continue)	Both > 5xTDL?	No - evaluate difference	Yes (continue)	Yes (calc RPD)	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference
Duplicate Analysis	RPD				4.4%															
	Difference > 2xTDL?	No - acceptable			Not applicable															
	Both > MDA?	Yes (continue)																		
Split Analysis	Both > 5xTDL?	No - evaluate difference			Not evaluated															
	RPD																			
	Difference > 2xTDL?	No - acceptable																		

17 Split/Duplicate Analysis - Shallow Zone Excavation (continued)

Sample Area	Sample Number	Sample Date	Aluminum			Arsenic			Barium			Beryllium			Boron			Calcium			Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A3	J152N4	7/31/07	3600		4.8	1.2		1.2	58.1		0.06	0.19		0.03	1	U	1.0	3340		2.0	3.9		0.29	5.5		0.23	9.8		0.26	15300		6.9
Duplicate of J152N4	J152N5	7/31/07	4180		4.8	1.9		1.2	61.0		0.06	0.22		0.03	1	U	1.0	3880		2.0	5.5		0.29	5.9		0.23	12.4		0.26	15100		6.8
Split of J152N4	J152P4	7/31/07	5690		5.1	1.5		0.24	70.5		0.23	0.18	B	0.070	8.9	BC	3.0	4750		151	12.0		0.23	10.7		0.23	10.8		0.40	18500		7.5

23 Analysis:

Duplicate Analysis	TDL		10		10		20		0.5		100		100		1		2		1		5	
	Both > PQL/MDA?	Yes (continue)	Both > 5xTDL?	No - evaluate difference	Yes (continue)	Yes (calc RPD)	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference
Duplicate Analysis	RPD				15%																	
	Difference > 2xTDL?	Not applicable			No - acceptable																	
	Both > PQL/MDA?	Yes (continue)			No - evaluate difference																	
Split Analysis	Both > 5xTDL?	Yes (calc RPD)			No - evaluate difference																	
	RPD				45%																	
	Difference > 2xTDL?	Not applicable			No - acceptable																	

34 Split/Duplicate Analysis - Shallow Zone Excavation (continued)

Sample Area	Sample Number	Sample Date	Lead			Magnesium			Manganese			Nickel			Potassium			Silicon			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A3	J152N4	7/31/07	2.6		0.95	3020		2.3	226		0.20	7.3		0.77	612		9.2	1520		2.5	149		2.0	38.9		0.23	32.1		0.11
Duplicate of J152N4	J152N5	7/31/07	3.6		0.94	3430		2.3	246		0.20	8.6		0.77	844		9.2	1990		2.5	145		2.0	32.7		0.23	35.6		0.11
Split of J152N4	J152P4	7/31/07	2.6	B	1.5	4550		45.0	266		2.0	11.6		1.1	1900		301	811		45.2	182	B	24.1	58.9		0.54	40.1		7.5

41 Analysis:

Duplicate Analysis	TDL		1		75		5		4		400		2		50		2.5		1	
	Both > PQL/MDA?	Yes (continue)	Both > 5xTDL?	No - evaluate difference	Yes (continue)	Yes (calc RPD)	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference
Duplicate Analysis	RPD				13%															
	Difference > 2xTDL?	No - acceptable			Not applicable															
	Both > PQL/MDA?	Yes (continue)			No - evaluate difference															
Split Analysis	Both > 5xTDL?	Yes (calc RPD)			No - evaluate difference															
	RPD				40%															
	Difference > 2xTDL?	No - acceptable			Not applicable															

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm

Project Field Remediation

Subject J18-F-2 Cleanup Verification 95% UCL Calculations

Date 08/15/07

Job No. 14655

Calc. No. 0100F-CA-V0285

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Rev. No. 0

Date 8/16/07

Sheet No. 42 of 43

1 Split/Duplicate Analysis - Overburden/BCL Stockpile

Sample Area	Sample Number	Sample Date	Potassium-40			Radium-226			Radium-228			Thorium-228 GEA			Thorium-232 GEA			Uranium-233/234			Uranium-238			Aluminum			Antimony			Arsenic		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A4	J152N0	5/17/07	11.8		0.25	0.370		0.052	0.547		0.099	0.586		0.031	0.547		0.099	0.591		0.16	0.428		0.16	4260		4.3	0.93	U	0.93	1.2		1.2
Duplicate of J152N0	J152N1	5/17/07	11.7		0.26	0.356		0.041	0.603		0.11	0.636		0.050	0.603		0.11	0.400		0.13	0.250		0.13	5150		4.3	0.93	U	0.93	1.2		1.2
Split of J152N0	J152P3	5/17/07	Not evaluated			Not evaluated			Not evaluated			Not evaluated			Not evaluated			0.171		0.0520	0.209		0.0491	6540	N	0.52	1.8	N	0.52	1.7		0.24

7 Analysis:

TDL		0.5	0.1	0.2	1	1	1	1	5	0.6	10
Duplicate Analysis	Both > MDA?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No - evaluate difference
	Both >5xTDL?	Yes (calc RPD)	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	Yes (calc RPD)	No - evaluate difference
	RPD	1%								19%	
	Difference >2xTDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Not applicable	No - acceptable
Split Analysis	Both > MDA?	Not evaluated	Not evaluated	Not evaluated	Not evaluated	Not evaluated	Not evaluated	Not evaluated	Not evaluated	Not evaluated	Not evaluated
	Both >5xTDL?										
	RPD										
	Difference >2xTDL?										

17 Split/Duplicate Analysis - Overburden/BCL Stockpile (continued)

Sample Area	Sample Number	Sample Date	Barium			Beryllium			Boron			Calcium			Chromium			Cobalt			Copper			Iron			Lead			Magnesium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A4	J152N0	5/17/07	68.2	C	0.06	0.36		0.03	1.1	U	1.1	3820	C	2.2	5.2	C	0.23	6.3		0.26	10.3		0.35	16700	C	8.6	3.3		0.82	3350	C	2.1
Duplicate of J152N0	J152N1	5/17/07	67.1	C	0.06	0.41		0.03	1.4		1.1	3970	C	2.2	6.8	C	0.23	7.0		0.26	11.1		0.35	19800	C	8.6	3.4		0.82	4120	C	2.1
Split of J152N0	J152P3	5/17/07	102	N	0.23	0.2	B	0.071	3.8	BC	1.5	4380	N	8.7	7.5		0.23	11.7		0.24	10.6		0.16	21100	N	3.8	3.6		0.099	4530		9.1

23 Analysis:

TDL		20	0.5	2	100	1	2	1	5	1	75
Duplicate Analysis	Both > PQL/MDA?	Yes (continue)	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No - evaluate difference	No - evaluate difference		Yes (calc RPD)	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
	RPD				4%	27%		7%	17%		21%
	Difference >2xTDL?	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable	Not applicable	No - acceptable	Not applicable
Split Analysis	Both > PQL/MDA?	Yes (continue)	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No - evaluate difference	No - evaluate difference		Yes (calc RPD)	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)
	RPD				14%	36%		3%	23%		30%
	Difference >2xTDL?	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	Yes - assess further	Not applicable	Not applicable	No - acceptable	Not applicable

34 Split/Duplicate Analysis - Overburden/BCL Stockpile (continued)

Sample Area	Sample Number	Sample Date	Manganese			Molybdenum			Nickel			Potassium			Selenium			Silicon			Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A4	J152N0	5/17/07	275	C	0.06	0.41	C	0.38	8.4		0.55	1020		14.2	1.4		1.1	1450	C	1.2	0.26	U	0.26	95.9	C	1.3	38.1		0.29	36.8	C	0.09
Duplicate of J152N0	J152N1	5/17/07	294	C	0.06	0.45	C	0.38	10.3		0.55	1090		14.2	1.1	U	1.1	894	C	1.2	0.29		0.26	112	C	1.3	48.3		0.29	41.0	C	0.09
Split of J152N0	J152P3	5/17/07	388	N	0.22	0.91	U	0.91	10.1		1.2	1340		93.3	0.45	U	0.45	1040	CN	4.1	0.37	U	0.37	250		5.9	60.9		0.55	39.4	C	1.4

40 Analysis:

TDL		5	2	4	400	10	2	0.2	50	2.5	1
Duplicate Analysis	Both > PQL/MDA?	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	No - evaluate difference	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)	No - evaluate difference	No - evaluate difference	No - evaluate difference		Yes (calc RPD)		No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)
	RPD	7%					47%			24%	11%
	Difference >2xTDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Not applicable	No - acceptable	No - acceptable	Not applicable	Not applicable
Split Analysis	Both > PQL/MDA?	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	No - evaluate difference	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	Yes (calc RPD)		No - evaluate difference	No - evaluate difference		Yes (calc RPD)		No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)
	RPD	34%					33%			46%	7%
	Difference >2xTDL?	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Not applicable	No - acceptable	Yes - assess further	Not applicable	Not applicable

CALCULATION SHEET

Washington Closure Hanford

Originator K. A. Anselm

Project Field Remediation

Subject 118-F-2 Cleanup Verification 95% UCL Calculations

Date 08/15/07

Job No. 14655

Calc. No. 0100F-CA-V0285

Checked J. M. Capron

Rev. No. 0

Date

Sheet No. 13 of 13

1 Split/Duplicate Analysis - Staging Pile (ACL) Footprint

Sample Area	Sample Number	Sample Date	Cesium-137			Plutonium-238			Potassium-40			Radium-226			Radium-228			Thorium-228 GEA			Thorium-232 GEA			Uranium-233/234			Uranium-238			Aluminum		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	mg/kg	Q	PQL
A1	J152N7	7/17/07	0.073		0.030	1.00		0.192	10.5		0.255	0.438		0.043	0.629		0.105	0.632		0.032	0.629		0.105	0.518		0.165	0.367		0.165	5580		4.9
Duplicate of J152N7	J152N8	7/17/07	0.103		0.029	-0.028	U	0.217	12.8		0.215	0.472		0.044	0.757		0.115	0.692		0.031	0.757		0.115	0.742		0.167	0.480		0.167	5160		4.9
Split of J152N7	J152P2	7/17/07	0.0701		0.0175	-0.00181	U	0.0433	Not evaluated			Not evaluated			Not evaluated			Not evaluated			Not evaluated			0.710		0.0436	0.843		0.0514	8250	N	0.52

7 Analysis:

TDL		0.1	1	0.5	0.1	0.2	1	1	1	1	5	
Duplicate Analysis	Both > MDA?	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	
	Both >5xTDL?	No - evaluate difference		Yes (calc RPD	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	No - evaluate difference	Yes (calc RPD	
	RPD			20%							8%	
	Difference >2xTDL?	No - acceptable	No - acceptable	Not applicable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	No - acceptable	Not applicable	
Split Analysis	Both > MDA?	Yes (continue)	No - evaluate difference	Not evaluated	Not evaluated	Not evaluated	Not evaluated	Not evaluated	Not evaluated	Yes (continue)	Yes (continue)	Yes (continue)
	Both >5xTDL?	No - evaluate difference								No - evaluate difference	No - evaluate difference	Yes (calc RPD
	RPD											39%
	Difference >2xTDL?	No - acceptable	No - acceptable								No - acceptable	No - acceptable

17 Split/Duplicate Analysis - Staging Pile (ACL) Footprint (continued)

Sample Area	Sample Number	Sample Date	Antimony			Arsenic			Barium			Beryllium			Boron			Calcium			Chromium			Cobalt			Copper			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1	J152N7	7/17/07	0.65	U	0.65	2.7		1.2	79.3	C	0.06	0.40		0.03	1.4		1.1	4060	C	2.1	8.4		0.30	7.0		0.24	12.6	C	0.27	17100	C	7.1
Duplicate of J152N7	J152N8	7/17/07	0.64	U	0.64	1.7		1.2	71.6	C	0.06	0.35		0.03	1.1	U	1.1	3940	C	2.1	7.5		0.29	6.1		0.23	12.5	C	0.26	16600	C	7.0
Split of J152N7	J152P2	7/17/07	3.9	BN	2.6	3.6	B	1.2	88.6		1.2	0.36	U	0.36	7.6	U	7.6	5000		153	12.1		1.2	12.5	B	1.2	12.1	B	2.0	23900	N	19.1

23 Analysis:

Duplicate Analysis	TDL		0.6		10		20		0.5		2		100		1		2		1		5	
	Both > PQL/MDA?	No - evaluate difference	Yes (continue)		Yes (continue)		Yes (continue)		Yes (continue)		No - evaluate difference		Yes (continue)		Yes (continue)		Yes (continue)		Yes (continue)		Yes (continue)	
Duplicate Analysis	Both >5xTDL?	No - evaluate difference			No - evaluate difference		No - evaluate difference		No - evaluate difference				Yes (calc RPD)		Yes (calc RPD)		No - evaluate difference		Yes (calc RPD)		Yes (calc RPD)	
	RPD												3%		11%				1%		3%	
	Difference >2xTDL?	No - acceptable	No - acceptable		No - acceptable		No - acceptable		No - acceptable		No - acceptable		Not applicable		Not applicable		No - acceptable		Not applicable		Not applicable	
Split Analysis	Both > PQL/MDA?	No - evaluate difference	Yes (continue)		Yes (continue)		No - evaluate difference		No - evaluate difference		No - evaluate difference		Yes (continue)		Yes (continue)		Yes (continue)		Yes (continue)		Yes (continue)	
	Both >5xTDL?	No - evaluate difference			No - evaluate difference		No - evaluate difference						Yes (calc RPD)		Yes (calc RPD)		No - evaluate difference		Yes (calc RPD)		Yes (calc RPD)	
	RPD												21%		36%				4%		33%	
Difference >2xTDL?		Yes - assess further	No - acceptable		No - acceptable		No - acceptable		No - acceptable		Yes - assess further		Not applicable		Not applicable		Yes - assess further		Not applicable		Not applicable	

34 Split/Duplicate Analysis - Staging Pile (ACL) Footprint (continued)

Sample Area	Sample Number	Sample Date	Lead			Magnesium			Manganese			Molybdenum			Nickel			Potassium			Silicon			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1	J152N7	7/17/07	4.7		0.98	3960	C	2.4	337		0.21	0.90		0.47	10.6		0.80	1230	C	9.5	1530		2.5	262	C	4.8	38.7		0.24	40.1	C	0.12
Duplicate of J152N7	J152N8	7/17/07	3.9		0.96	3630	C	2.4	296		0.20	0.47	U	0.47	10.6		0.79	1130	C	9.4	1440		2.5	230	C	4.8	37.5		0.23	35.8	C	0.12
Split of J152N7	J152P2	7/17/07	6.5		1.5	5470		45.7	369	N	2.0	4.5	U	4.5	12.8	B	5.8	1730		153	338	N	45.9	309		12.2	60.8		2.7	52.2	C	7.6

40 Analysis:

41	TDL		1	75	5	2	4	400	2	50	2.5	1
42	Duplicate Analysis	Both > PQL/MDA?	Yes (continue)	Yes (continue)	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
43		Both >5xTDL?	No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)		No - evaluate difference	No - evaluate difference	Yes (calc RPD)	No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)
44		RPD		9%	13%				6%		3%	11%
45		Difference >2xTDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	No - acceptable	Not applicable	Not applicable
46	Split Analysis	Both > PQL/MDA?	Yes (continue)	Yes (continue)	Yes (continue)	No - evaluate difference	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)	Yes (continue)
47		Both >5xTDL?	No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)		No - evaluate difference	No - evaluate difference	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)	Yes (calc RPD)
48		RPD		32%	9%				128%	16%	44%	26%
49		Difference >2xTDL?	No - acceptable	Not applicable	Not applicable	No - acceptable	No - acceptable	No - acceptable	Not applicable	Not applicable	Not applicable	Not applicable

Attachment 1. 118-F-2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Americium-241 GEA			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Shallow Zone Excavation																	
A3	J152N4	7/31/07	0.034	U	0.034	0.036		0.025	0.028	U	0.028	0.069	U	0.069	0.093	U	0.093
Duplicate of J152N4	J152N5	7/31/07	0.038	U	0.038	0.028		0.026	0.027	U	0.027	0.055	U	0.055	0.081	U	0.081
A1	J152N2	7/31/07	0.139	U	0.139	0.024	U	0.024	0.022	U	0.022	0.062	U	0.062	0.073	U	0.073
A2	J152N3	7/31/07	0.309	U	0.309	0.039	U	0.039	0.037	U	0.037	0.096	U	0.096	0.139	U	0.139
A4	J152N6	7/31/07	0.135	U	0.135	0.093		0.025	0.023	U	0.023	0.081	U	0.081	0.071	U	0.071
Split of J152N4	J152P4	7/31/07				0.0329		0.0127	0.00726	U	0.0146	0.0158	U	0.0306	0.000709	U	0.0447
Overburden/BCL Stockpile																	
A4	J152N0	5/17/07	0.029	U	0.029	0.060	U	0.060	0.026	U	0.026	0.062	U	0.062	0.087	U	0.087
Duplicate of J152N0	J152N1	5/17/07	0.088	U	0.088	0.054	U	0.054	0.026	U	0.026	0.073	U	0.073	0.093	U	0.093
A1	J152J7	6/6/07	0.028	U	0.028	0.025	U	0.025	0.025	U	0.025	0.060	U	0.060	0.080	U	0.080
A2	J152J8	5/17/07	0.083	U	0.083	0.046	U	0.046	0.025	U	0.025	0.069	U	0.069	0.087	U	0.087
A3	J152J9	5/17/07	0.26	U	0.26	0.108		0.024	0.034	U	0.034	0.083	U	0.083	0.12	U	0.12
Split of J152N0	J152P3	5/17/07				0.0117	U	0.0183	-0.00505	U	0.0181	-0.0378	U	0.0353	-0.0117	U	0.0609
Staging Pile (ACL) Footprint																	
A1	J152N7	7/17/07	0.036	U	0.036	0.073		0.030	0.026	U	0.026	0.070	U	0.070	0.092	U	0.092
Duplicate of J152N7	J152N8	7/17/07	0.042	U	0.042	0.103		0.029	0.022	U	0.022	0.056	U	0.056	0.075	U	0.075
A2	J152N9	7/17/07	0.267	U	0.267	0.038		0.033	0.037	U	0.037	0.079	U	0.079	0.122	U	0.122
A3	J152P0	7/17/07	0.033	U	0.033	0.060		0.028	0.025	U	0.025	0.065	U	0.065	0.086	U	0.086
A4	J152P1	7/17/07	0.043	U	0.043	0.623		0.030	0.040	U	0.040	0.066	U	0.066	0.077	U	0.077
Split of J152N7	J152P2	7/17/07				0.0701		0.0175	0.00250	U	0.012	-0.0262	U	0.0380	-0.0535	U	0.0547

Note: The following abbreviations apply to all Attachment 1 tables. Data qualified with B, C, D, J, and/or N are considered acceptable values.

ACL = above cleanup level

B = result is less than reporting limit

BCL = below cleanup level

C = method blank contamination

D = diluted

GEA = gamma energy analysis

J = estimated

MDA = minimum detectable activity

N = spike sample recovery is outside control limits

PQL = practical quantitation limit

Q = qualifier

U = undetected

Attachment	1	Sheet No.	1 of 10
Originator	J. M. Capron <i>JMC</i>	Date	09/15/07
Checked	T. M. Blakley <i>TMB</i>	Date	9/17/07
Calc. No.	0100F-CA-V0285	Rev. No.	1

Attachment 1. 118-F-2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Europium-155			Nickel-63			Plutonium-238			Plutonium-239/240			Potassium-40		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Shallow Zone Excavation																	
A3	J152N4	7/31/07	0.063	U	0.063	-0.842	U	3.46	0.110	U	0.407	0.037	U	0.282	11.2		0.308
Duplicate of J152N4	J152N5	7/31/07	0.059	U	0.059	-0.894	U	3.51	0.054	U	0.299	0	U	0.207	11.7		0.194
A1	J152N2	7/31/07	0.077	U	0.077	-1.25	U	3.37	0.060	U	0.460	0	U	0.460	12.3		0.237
A2	J152N3	7/31/07	0.116	U	0.116	-2.12	U	3.38	0.057	U	0.218	0.314		0.218	15.8		0.368
A4	J152N6	7/31/07	0.079	U	0.079	-2.23	U	3.50	-0.030	U	0.283	0	U	0.226	11.7		0.200
Split of J152N4	J152P4	7/31/07	0.0211	U	0.0329	2.76	U	5.35	0	U	0.0457	-0.00382	U	0.0539			
Overburden/BCL Stockpile																	
A4	J152N0	5/17/07	0.056	U	0.056	-0.713	U	3.4	0.125	U	0.16	0	U	0.16	11.8		0.25
Duplicate of J152N0	J152N1	5/17/07	0.075	U	0.075	-2.09	U	3.4	-0.0380	U	0.18	-0.0190	U	0.15	11.7		0.26
A1	J152J7	6/6/07	0.055	U	0.055	0.639	U	3.11	0.021	U	0.197	0	U	0.157	12.3		0.216
A2	J152J8	5/17/07	0.073	U	0.073	0.514	U	3.3	0	U	0.18	0	U	0.18	11.2		0.26
A3	J152J9	5/17/07	0.10	U	0.10	-1.24	U	3.2	0.0314	U	0.24	-0.0314	U	0.24	11.5		0.31
Split of J152N0	J152P3	5/17/07	0.0146	U	0.0403	0.153	U	6.12	-0.0108	U	0.152	-0.00538	U	0.129			
Staging Pile (ACL) Footprint																	
A1	J152N7	7/17/07	0.098	U	0.098	1.32	U	3.12	1.00		0.192	0	U	0.192	10.5		0.255
Duplicate of J152N7	J152N8	7/17/07	0.063	U	0.063	-1.66	U	3.21	-0.028	U	0.217	0	U	0.217	12.8		0.215
A2	J152N9	7/17/07	0.104	U	0.104	0.439	U	3.11	0.093	U	0.238	0	U	0.238	12.3		0.364
A3	J152P0	7/17/07	0.060	U	0.060	0.188	U	3.20	-0.019	U	0.209	0.038	U	0.145	11.4		0.232
A4	J152P1	7/17/07	0.065	U	0.065	-0.280	U	2.98	0	U	0.223	0.081	U	0.154	13.6		0.240
Split of J152N7	J152P2	7/17/07	0.0490	U	0.0423	3.33	U	5.36	-0.00181	U	0.0433	0.00361	U	0.0571			

Attachment	1	Sheet No.	2 of 10
Originator	J. M. Capron	Date	09/15/07
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0285	Rev. No.	1

Attachment 1. 118-F-2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Radium-226			Radium-228			Silver-108m			Thorium-228 GEA			Thorium-232 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Shallow Zone Excavation																	
A3	J152N4	7/31/07	0.347		0.046	0.526		0.109	0.020	U	0.020	0.482		0.032	0.526		0.109
Duplicate of J152N4	J152N5	7/31/07	0.350		0.043	0.556		0.086	0.016	U	0.016	0.494		0.027	0.556		0.086
A1	J152N2	7/31/07	0.427		0.044	0.630		0.083	0.017	U	0.017	0.527		0.028	0.630		0.083
A2	J152N3	7/31/07	0.575		0.076	1.04		0.150	0.029	U	0.029	0.894		0.046	1.04		0.150
A4	J152N6	7/31/07	0.370		0.040	0.581		0.092	0.015	U	0.015	0.517		0.030	0.581		0.092
Split of J152N4	J152P4	7/31/07							0.000790	U	0.00924						
Overburden/BCL Stockpile																	
A4	J152N0	5/17/07	0.370		0.052	0.547		0.099	0.018	U	0.018	0.586		0.031	0.547		0.099
Duplicate of J152N0	J152N1	5/17/07	0.356		0.041	0.603		0.11	0.018	U	0.018	0.636		0.050	0.603		0.11
A1	J152J7	6/6/07	0.371		0.046	0.590		0.101	0.016	U	0.016	0.566		0.030	0.590		0.101
A2	J152J8	5/17/07	0.355		0.045	0.526		0.12	0.018	U	0.018	0.676		0.046	0.526		0.12
A3	J152J9	5/17/07	0.414		0.065	0.660		0.15	0.024	U	0.024	0.766		0.066	0.660		0.15
Split of J152N0	J152P3	5/17/07							-0.00115	U	0.012						
Staging Pile (ACL) Footprint																	
A1	J152N7	7/17/07	0.438		0.043	0.629		0.105	0.019	U	0.019	0.632		0.032	0.629		0.105
Duplicate of J152N7	J152N8	7/17/07	0.472		0.044	0.757		0.115	0.016	U	0.016	0.692		0.031	0.757		0.115
A2	J152N9	7/17/07	0.506		0.069	0.796		0.137	0.023	U	0.023	0.696		0.044	0.796		0.137
A3	J152P0	7/17/07	0.425		0.045	0.708		0.088	0.018	U	0.018	0.629		0.031	0.708		0.088
A4	J152P1	7/17/07	0.440		0.041	0.655		0.103	0.018	U	0.018	0.684		0.030	0.655		0.103
Split of J152N7	J152P2	7/17/07							-0.00161	U	0.0128						

Attachment	1	Sheet No.	3 of 10
Originator	J. M. Capron	Date	09/15/07
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0285	Rev. No.	1

Attachment 1. 118-F-2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Total beta radiostrontium			Uranium-233/234			Uranium-235			Uranium-235 GEA			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Shallow Zone Excavation																	
A3	J152N4	7/31/07	0.110	U	0.306	0.681		0.237	0.075	U	0.287	0.105	U	0.105	0.495		0.237
Duplicate of J152N4	J152N5	7/31/07	0.079	U	0.287	0.397		0.190	0.060	U	0.230	0.097	U	0.097	0.397		0.190
A1	J152N2	7/31/07	0.132	U	0.314	0.575		0.183	0	U	0.222	0.105	U	0.105	0.839		0.183
A2	J152N3	7/31/07	0.029	U	0.400	0.381		0.194	0	U	0.235	0.171	U	0.171	0.406		0.194
A4	J152N6	7/31/07	-0.067	U	0.382	0.598		0.254	0	U	0.308	0.107	U	0.107	0.365		0.254
Split of J152N4	J152P4	7/31/07	0.308		0.133	0.136		0.0471	-0.00197	U	0.0471				0.104		0.0556
Overburden/BCL Stockpile																	
A4	J152N0	5/17/07	0.0820	U	0.22	0.591		0.16	0.0494	U	0.19	0.098	U	0.098	0.428		0.16
Duplicate of J152N0	J152N1	5/17/07	0.0040	U	0.25	0.400		0.13	0	U	0.15	0.12	U	0.12	0.250		0.13
A1	J152J7	6/6/07	0.267	U	0.317	0.405		0.041	0.020	U	0.031	0.099	U	0.099	0.458		0.026
A2	J152J8	5/17/07	-0.0154	U	0.27	0.538		0.14	0.0434	U	0.17	0.11	U	0.11	0.341		0.14
A3	J152J9	5/17/07	-0.0580	U	0.22	0.379		0.19	0.0306	U	0.23	0.15	U	0.15	0.404		0.19
Split of J152N0	J152P3	5/17/07	0.0495	U	0.143	0.171		0.0520	-0.000737	U	0.0370				0.209		0.0491
Staging Pile (ACL) Footprint																	
A1	J152N7	7/17/07	0.095	U	0.306	0.518		0.165	0.052	U	0.200	0.108	U	0.108	0.367		0.165
Duplicate of J152N7	J152N8	7/17/07	0.216	U	0.240	0.742		0.167	0.026	U	0.202	0.103	U	0.103	0.480		0.167
A2	J152N9	7/17/07	-0.021	U	0.247	0.613		0.162	0.026	U	0.196	0.152	U	0.152	0.423		0.162
A3	J152P0	7/17/07	0.019	U	0.261	0.418		0.160	0	U	0.194	0.101	U	0.101	0.523		0.160
A4	J152P1	7/17/07	0.336	U	0.339	0.441		0.169	0.027	U	0.204	0.109	U	0.109	0.441		0.169
Split of J152N7	J152P2	7/17/07	0.0857	U	0.149	0.710		0.0436	0.00728	U	0.0436				0.843		0.0514

Attachment	1	Sheet No.	4 of 10
Originator	J. M. Capron	Date	09/15/07
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0285	Rev. No.	1

Attachment 1. 118-F-2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Uranium-238 GEA			Barium-133		
			pCi/g	Q	MDA	pCi/g	Q	MDA
Shallow Zone Excavation								
A3	J152N4	7/31/07	3.18	U	3.18	0.028	U	0.028
Duplicate of J152N4	J152N5	7/31/07	2.90	U	2.90	0.026	U	0.026
A1	J152N2	7/31/07	2.47	U	2.47	0.028	U	0.028
A2	J152N3	7/31/07	4.71	U	4.71	0.035	U	0.035
A4	J152N6	7/31/07	2.65	U	2.65	0.027	U	0.027
Split of J152N4	J152P4	7/31/07				0.000636	U	0.0124
Overburden/BCL Stockpile								
A4	J152N0	5/17/07	3.0	U	3.0			
Duplicate of J152N0	J152N1	5/17/07	3.1	U	3.1			
A1	J152J7	6/6/07	2.38	U	2.38			
A2	J152J8	5/17/07	3.0	U	3.0			
A3	J152J9	5/17/07	4.2	U	4.2			
Staging Pile (ACL) Footprint								
A1	J152N7	7/17/07	4.45	U	4.45			
Duplicate of J152N7	J152N8	7/17/07	2.95	U	2.95			
A2	J152N9	7/17/07	4.35	U	4.35			
A3	J152P0	7/17/07	2.79	U	2.79			
A4	J152P1	7/17/07	2.85	U	2.85			

Attachment	1	Sheet No.	5 of 10
Originator	J. M. Capron	Date	09/15/07
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0285	Rev. No.	1

CVP-2007-00002
Rev. 0

Attachment 1. 118-F-2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Shallow Zone Excavation																	
A3	J152N4	7/31/07	3600		4.8	0.63	UJ	0.63	1.2		1.2	58.1		0.06	0.19		0.03
Duplicate of J152N4	J152N5	7/31/07	4180		4.8	0.63	UJ	0.63	1.9		1.2	61.0		0.06	0.22		0.03
A1	J152N2	7/31/07	3580		4.9	0.65	UJ	0.65	1.2	U	1.2	55.3		0.06	0.22		0.03
A2	J152N3	7/31/07	7510		4.8	0.63	UJ	0.63	2.9		1.2	93.0		0.09	0.37		0.03
A4	J152N6	7/31/07	4550		4.8	0.63	UJ	0.63	1.8		1.2	63.4		0.06	0.25		0.03
Split of J152N4	J152P4	7/31/07	5690		5.1	2.6	U	2.6	1.5		0.24	70.5		0.23	0.18	B	0.070
Overburden/BCL Stockpile																	
A4	J152N0	5/17/07	4260		4.3	0.93	U	0.93	1.2		1.2	68.2	C	0.06	0.36		0.03
Duplicate of J152N0	J152N1	5/17/07	5150		4.3	0.93	U	0.93	1.2		1.2	67.1	C	0.06	0.41		0.03
A1	J152J7	6/6/07	4000	C	5.0	0.67	U	0.67	2.1		1.2	58.4	C	0.06	0.03	U	0.03
A2	J152J8	5/17/07	5420		4.2	0.93	U	0.93	1.2		1.2	78.8	C	0.06	0.48		0.03
A3	J152J9	5/17/07	6800		4.2	0.93	U	0.93	2.6		1.2	86.8	C	0.06	0.52		0.03
Split of J152N0	J152P3	5/17/07	6540	N	5.2	1.8	N	0.52	1.7		0.24	102	N	0.23	0.20	B	0.071
Staging Pile (ACL) Footprint																	
A1	J152N7	7/17/07	5580		4.9	0.65	U	0.65	2.7		1.2	79.3	C	0.06	0.40		0.03
Duplicate of J152N7	J152N8	7/17/07	5160		4.9	0.64	U	0.64	1.7		1.2	71.6	C	0.06	0.35		0.03
A2	J152N9	7/17/07	5830		4.8	0.64	U	0.64	1.7		1.2	77.0	C	0.06	0.38		0.03
A3	J152P0	7/17/07	4220		4.8	0.64	U	0.64	1.4		1.2	65.7	C	0.06	0.30		0.03
A4	J152P1	7/17/07	4260		4.8	0.64	U	0.64	1.7		1.2	55.7	C	0.06	0.30		0.03
Split of J152N7	J152P2	7/17/07	8250	N	5.2	3.9	BN	2.6	3.6	B	1.2	88.6		1.2	0.36	U	0.36

Attachment	1	Sheet No.	6 of 10
Originator	J. M. Capron	Date	09/15/07
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0285	Rev. No.	1

Attachment 1. 118-F-2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Shallow Zone Excavation																	
A3	J152N4	7/31/07	1.0	U	1.0	0.14	U	0.14	3340		2.0	3.9		0.29	5.5		0.23
Duplicate of J152N4	J152N5	7/31/07	1.0	U	1.0	0.14	U	0.14	3880		2.0	5.5		0.29	5.9		0.23
A1	J152N2	7/31/07	1.1	U	1.1	0.15	U	0.15	3340		2.1	4.6		0.29	4.7		0.23
A2	J152N3	7/31/07	1.0	U	1.0	0.16		0.14	5060		2.0	13.0		0.29	8.1		0.23
A4	J152N6	7/31/07	1.0	U	1.0	0.14	U	0.14	3650		2.0	6.4		0.29	6.4		0.23
Split of J152N4	J152P4	7/31/07	8.9	BC	3.0	0.31	U	0.31	4750		151	12.0		0.23	10.7		0.23
Overburden/BCL Stockpile																	
A4	J152N0	5/17/07	1.1	U	1.1	0.09	U	0.09	3820	C	2.2	5.2	C	0.23	6.3		0.26
Duplicate of J152N0	J152N1	5/17/07	1.4		1.1	0.09	U	0.09	3970	C	2.2	6.8	C	0.23	7.0		0.26
A1	J152J7	6/6/07	1.1	U	1.1	0.23		0.15	4330		2.2	5.3		0.30	6.4		0.24
A2	J152J8	5/17/07	1.4		1.1	0.09	U	0.09	4310	C	2.2	7.0	C	0.23	8.2		0.26
A3	J152J9	5/17/07	1.4		1.1	0.09		0.09	4550	C	2.2	9.4	C	0.23	8.9		0.26
Split of J152N0	J152P3	5/17/07	3.8	BC	1.5	0.062	U	0.062	4380	N	8.7	7.5		0.23	11.7		0.24
Staging Pile (ACL) Footprint																	
A1	J152N7	7/17/07	1.4		1.1	0.15	U	0.15	4060	C	2.1	8.4		0.30	7		0.24
Duplicate of J152N7	J152N8	7/17/07	1.1	U	1.1	0.15	U	0.15	3940	C	2.1	7.5		0.29	6.1		0.23
A2	J152N9	7/17/07	1.3		1.0	0.14	U	0.14	3850	C	2.1	7.7		0.29	6.6		0.23
A3	J152P0	7/17/07	1	U	1.0	0.15	U	0.15	3620	C	2.1	5.5		0.29	5.4		0.23
A4	J152P1	7/17/07	1.3		1.0	0.14	U	0.14	3600	C	2.1	5.4		0.29	5.1		0.23
Split of J152N7	J152P2	7/17/07	7.6	U	7.6	0.31	U	0.31	5000		153	12.1		1.2	12.5	B	1.2

Attachment	1	Sheet No.	7 of 10
Originator	J. M. Capron	Date	09/15/07
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0285	Rev. No.	1

Attachment 1. 118-F-2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Shallow Zone Excavation																	
A3	J152N4	7/31/07	9.8		0.26	15300		6.9	2.6		0.95	3020		2.3	226		0.20
Duplicate of J152N4	J152N5	7/31/07	12.4		0.26	15100		6.8	3.6		0.94	3430		2.3	246		0.20
A1	J152N2	7/31/07	9.7		0.26	12300		7.0	2.9		0.97	2740		2.4	216		0.21
A2	J152N3	7/31/07	17.0		0.26	19800		6.9	6.8		0.95	5460		2.3	347		0.20
A4	J152N6	7/31/07	11.5		0.26	16700		6.9	4.0		0.95	3670		2.3	245		0.20
Split of J152N4	J152P4	7/31/07	10.8		0.40	18500		7.5	2.6	B	1.5	4550		45.0	266		2.0
Overburden/BCL Stockpile																	
A4	J152N0	5/17/07	10.3		0.35	16700	C	8.6	3.3		0.82	3350	C	2.1	275	C	0.06
Duplicate of J152N0	J152N1	5/17/07	11.1		0.35	19800	C	8.6	3.4		0.82	4120	C	2.1	294	C	0.06
A1	J152J7	6/6/07	9.6		0.27	16700		7.3	3.7		1.0	3360	C	2.5	267		0.21
A2	J152J8	5/17/07	11.9		0.35	22500	C	8.6	4.2		0.81	4570	C	2.1	375	C	0.06
A3	J152J9	5/17/07	12.8		0.35	25100	C	8.6	4.8		0.81	4910	C	2.1	395	C	0.06
Split of J152N0	J152P3	5/17/07	10.6		0.16	21100	N	3.8	3.6		0.099	4530		9.1	388	N	0.22
Staging Pile (ACL) Footprint																	
A1	J152N7	7/17/07	12.6	C	0.27	17100	C	7.1	4.7		0.98	3960	C	2.4	337		0.21
Duplicate of J152N7	J152N8	7/17/07	12.5	C	0.26	16600	C	7.0	3.9		0.96	3630	C	2.4	296		0.20
A2	J152N9	7/17/07	11.0	C	0.26	17900	C	6.9	4.7		0.95	3810	C	2.3	298		0.20
A3	J152P0	7/17/07	11.2	C	0.26	13300	C	7.0	3.8		0.96	3200	C	2.4	237		0.20
A4	J152P1	7/17/07	11.2	C	0.26	12500	C	6.9	3.4		0.96	2860	C	2.3	223		0.20
Split of J152N7	J152P2	7/17/07	12.1	B	2.0	23900	N	19.1	6.5		1.5	5470		45.7	369	N	2.0

Attachment	1	Sheet No.	8 of 10
Originator	J. M. Capron	Date	09/15/07
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0285	Rev. No.	1

Attachment 1. 118-F-2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Shallow Zone Excavation																	
A3	J152N4	7/31/07	0.01	U	0.01	0.46	U	0.46	7.3		0.77	612		9.2	1.2	U	1.2
Duplicate of J152N4	J152N5	7/31/07	0.01	U	0.01	0.46	U	0.46	8.6		0.77	844		9.2	1.2	U	1.2
A1	J152N2	7/31/07	0.01	U	0.01	0.47	U	0.47	12.0		0.79	821		9.4	1.3	U	1.3
A2	J152N3	7/31/07	0.01	U	0.01	0.46	U	0.46	15.1		0.78	1390		9.2	1.2	U	1.2
A4	J152N6	7/31/07	0.02	U	0.02	0.46	U	0.46	9.2		0.77	898		9.2	1.2	U	1.2
Split of J152N4	J152P4	7/31/07	0.0067	U	0.0067	0.90	U	0.90	11.6		1.1	1900		301	2.2	U	2.2
Overburden/BCL Stockpile																	
A4	J152N0	5/17/07	0.02	U	0.02	0.41	C	0.38	8.4		0.55	1020		14.2	1.4		1.1
Duplicate of J152N0	J152N1	5/17/07	0.01	U	0.01	0.45	C	0.38	10.3		0.55	1090		14.2	1.1	U	1.1
A1	J152J7	6/6/07	0.01	U	0.01	0.49	U	0.49	8.2		0.82	947		9.7	1.3	U	1.3
A2	J152J8	5/17/07	0.01	U	0.01	0.38	U	0.38	12.7		0.55	1200		14.1	1.1	U	1.1
A3	J152J9	5/17/07	0.01	U	0.01	0.44	C	0.38	13.3		0.55	1500		14.1	1.1	U	1.1
Split of J152N0	J152P3	5/17/07	0.0068	U	0.0068	0.91	U	0.91	10.1		1.2	1340		93.3	0.45	U	0.45
Staging Pile (ACL) Footprint																	
A1	J152N7	7/17/07	0.01	U	0.01	0.90		0.47	10.6		0.80	1230	C	9.5	1.3	U	1.3
Duplicate of J152N7	J152N8	7/17/07	0.02	U	0.02	0.47	U	0.47	10.6		0.79	1130	C	9.4	1.3	U	1.3
A2	J152N9	7/17/07	0.02	U	0.02	0.46	U	0.46	8.9		0.78	1420	C	9.3	1.4		1.2
A3	J152P0	7/17/07	0.01	U	0.01	0.47	U	0.47	8.4		0.79	901	C	9.3	1.3	U	1.3
A4	J152P1	7/17/07	0.01	U	0.01	0.46	U	0.46	6.9		0.78	904	C	9.3	1.2	U	1.2
Split of J152N7	J152P2	7/17/07	0.0068	U	0.0068	4.5	U	4.5	12.8	B	5.8	1730		153	2.2	U	2.2

Attachment	1	Sheet No.	9 of 10
Originator	<u>J. M. Capron</u>	Date	<u>09/15/07</u>
Checked	<u>T. M. Blakley</u>	Date	
Calc. No.	<u>0100F-CA-V0285</u>	Rev. No.	<u>1</u>

CVP-2007-00002
Rev. 0

Attachment 1. 118-F-2 Verification Sampling Results.

Sample Location	Sample Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Shallow Zone Excavation																	
A3	J152N4	7/31/07	1520		2.5	0.26	U	0.26	149		2.0	38.9		0.23	32.1		0.11
Duplicate of J152N4	J152N5	7/31/07	1990		2.5	0.26	U	0.26	145		2.0	32.7		0.23	35.6		0.11
A1	J152N2	7/31/07	1540		2.5	0.26	U	0.26	188		2.1	30.4		0.23	28.5		0.12
A2	J152N3	7/31/07	2890		2.5	0.26	U	0.26	220		2.0	41.3		0.23	47.4		0.12
A4	J152N6	7/31/07	2380		2.5	0.26	U	0.26	136		2.0	38.4		0.23	39.5		0.11
Split of J152N4	J152P4	7/31/07	811		45.2	0.37	U	0.37	182	B	24.1	58.9		0.54	40.1		7.5
Overburden/BCL Stockpile																	
A4	J152N0	5/17/07	1450	C	1.2	0.26	U	0.26	95.9	C	1.3	38.1		0.29	36.8	C	0.09
Duplicate of J152N0	J152N1	5/17/07	894	C	1.2	0.29		0.26	112	C	1.3	48.3		0.29	41.0	C	0.09
A1	J152J7	6/6/07	1050		2.6	0.27	U	0.27	146	C	2.1	38.5		0.24	36.3	C	0.12
A2	J152J8	5/17/07	1160	C	1.2	0.26	U	0.26	112	C	1.3	54.9		0.29	48.3	C	0.09
A3	J152J9	5/17/07	1250	C	1.2	0.26	U	0.26	128	C	1.3	63.0		0.29	52.1	C	0.09
Split of J152N0	J152P3	5/17/07	1040	CN	4.1	0.37	U	0.37	250		5.9	60.9		0.55	39.4	C	1.4
Staging Pile (ACL) Footprint																	
A1	J152N7	7/17/07	1530		2.5	0.27	U	0.27	262	C	4.8	38.7		0.24	40.1	C	0.12
Duplicate of J152N7	J152N8	7/17/07	1440		2.5	0.26	U	0.26	230	C	4.8	37.5		0.23	35.8	C	0.12
A2	J152N9	7/17/07	1300		2.5	0.26	U	0.26	148	C	4.7	42.0		0.23	40.3	C	0.12
A3	J152P0	7/17/07	1630		2.5	0.26	U	0.26	207	C	4.8	30.1		0.23	31.1	C	0.12
A4	J152P1	7/17/07	1390		2.5	0.26	U	0.26	167	C	4.7	26.0		0.23	30.4	C	0.12
Split of J152N7	J152P2	7/17/07	338	N	45.9	1.9	U	1.9	309		12.2	60.8		2.7	52.2	C	7.6

Attachment	1	Sheet No.	10 of 10
Originator	J. M. Capron	Date	09/15/07
Checked	T. M. Blakley	Date	
Calc. No.	0100F-CA-V0285	Rev. No.	1

CALCULATION COVER SHEET

Project Title: 100-F Field Remediation Job No. **14655**

Area: 100-F

Discipline: Environmental *Calculation No: 0100F-CA-V0295

Subject: 118-F-2 Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2003

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

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Total = 4	J. M. Capron	T. M. Blakley	N/A	S. W. Callison	
		<i>J. M. Capron</i>	<i>T. M. Blakley</i>		<i>SW Callison</i>	<i>9-18-07</i>

SUMMARY OF REVISION

Washington Closure Hanford		CALCULATION SHEET					
Originator:	J. M. Capron <i>JMC</i>	Date:	09/17/07	Calc. No.:	0100F-CA-V0295	Rev.:	0
Project:	100-F Field Remediation	Job No:	14655	Checked:	T. M. Blakley <i>TMB</i>	Date:	9/17/07
Subject:	118-F-2 Hazard Quotient and Carcinogenic Risk Calculations					Sheet No.	1 of 3

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and excess carcinogenic risk values for the 118-F-2 waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (DOE-RL 2005), the following criteria must be met:

- 1) An HQ of ≤ 1.0 for all individual noncarcinogens
- 2) A cumulative HQ of ≤ 1.0 for noncarcinogens
- 3) An excess carcinogenic risk of $\leq 1 \times 10^{-6}$ for individual carcinogens
- 4) A cumulative excess carcinogenic risk of $\leq 1 \times 10^{-5}$ for carcinogens.

GIVEN/REFERENCES:

- 1) DOE-RL, 2005, *Remedial Design Report/Remedial Action Work Plan for the 100 Areas*, DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- 2) WAC 173-340, 1996, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*.
- 3) WCH, 2007, Waste Site Reclassification Form 2007-021, and Attachment *Cleanup Verification Package for the 118-F-2 Burial Ground*, Washington Closure Hanford, Richland, Washington.

SOLUTION:

- 1) Calculate an HQ for each noncarcinogenic constituent detected above background and compare to the individual HQ of ≤ 1.0 (DOE-RL 2005).
- 2) Sum the HQs and compare to the cumulative HQ criterion of ≤ 1.0 .
- 3) Calculate an excess carcinogenic risk value for each carcinogenic constituent detected above background and compare to the individual excess carcinogenic risk criterion of $\leq 1 \times 10^{-6}$ (DOE-RL 2005).
- 4) Sum the excess carcinogenic risk values and compare to the cumulative excess carcinogenic risk criterion of $\leq 1 \times 10^{-5}$.

METHODOLOGY:

Hazard quotient and carcinogenic risk calculations for the 118-F-2 waste site were conservatively calculated for the entire waste site using the highest of the focused and statistically calculated results for each analyte from WCH (2007). Of the contaminants of potential concern for this site, selenium is included because it was detected at a concentration above its Washington State background value.

Washington Closure Hanford		CALCULATION SHEET					
Originator:	J. M. Capron <i>JMC</i>	Date:	09/17/07	Calc. No.:	0100F-CA-V0295	Rev.:	0
Project:	100-F Field Remediation	Job No:	14655	Checked:	T. M. Blakley <i>TMB</i>	Date:	9/17/07
Subject:	118-F-2 Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 3	

Boron and molybdenum require the HQ calculations because these analytes were detected and a Washington State or Hanford Site background value is not available. Several semivolatile analytes (as shown in Table 1 below) are included because they were detected in verification samples and cannot be attributed to natural occurrence. All other nonradionuclide contaminants of potential concern for this site were either not detected or were quantified below background levels and are not included. An example of the HQ and carcinogenic risk calculations in Table 1 is presented below:

- 1) For example, the maximum detected value for boron is 1.2 mg/kg, divided by the noncarcinogenic RAG value of 16,000 mg/kg (calculated in accordance with the noncarcinogenic toxics effects formula in WAC 173-340-740[3]), is 7.5×10^{-5} . Comparing this value, and all other individual values, to the requirement of ≤ 1.0 , this criterion is met.
- 2) After the HQ calculations are completed for the appropriate analytes, the cumulative HQ is obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation.) The sum of the HQ values is 6.1×10^{-3} . Comparing this value to the requirement of ≤ 1.0 , this criterion is met.
- 3) To calculate the excess carcinogenic risk, the maximum detected value for each carcinogenic analyte is divided by the carcinogenic RAG value, then multiplied by 1×10^{-6} . For example, the maximum detected value for indeno(1,2,3-cd)pyrene is 0.022 mg/kg, divided by 1.37 mg/kg, and multiplied as indicated is 1.6×10^{-8} . Comparing this value, and all other individual values, to the requirement of $\leq 1 \times 10^{-6}$, this criterion is met.
- 4) After these calculations are completed for the carcinogenic analytes, the cumulative excess carcinogenic risk is obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual values prior to rounding are used for this calculation.) The sum of the excess carcinogenic risk values is 1.6×10^{-6} . Comparing this value to the requirement of $\leq 1 \times 10^{-5}$, this criterion is met.

RESULTS:

Table 1 shows the results of the HQ and excess carcinogenic risk calculations for this site.

CONCLUSION:

These calculations demonstrate that the 118-F-2 waste site meets the requirements for hazard quotient and excess carcinogenic risk as identified in the remedial design report/remedial action work plan (DOE-RL 2005).

Washington Closure Hanford

CALCULATION SHEET

Originator:	J. M. Capron <i>JMC</i>	Date:	09/17/07	Calc. No.:	0100F-CA-V0295	Rev.:	0
Project:	100-F Field Remediation	Job No:	14655	Checked:	T. M. Blakley <i>TMB</i>	Date:	9/17/07
Subject:	118-F-2 Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 3	

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 100-B-18 Waste Site.

Contaminants of Potential Concern ^a	Maximum Value ^a (mg/kg)	Noncarcinogen RAG ^b (mg/kg)	Hazard Quotient	Carcinogen RAG ^b (mg/kg)	Carcinogen Risk
Metals					
Boron	1.2	16,000	7.5E-05	--	--
Molybdenum	0.48	400	1.2E-03	--	--
Selenium	1.4	400	3.5E-03	--	--
Semivolatiles					
Benzo(a)anthracene	0.039	--	--	0.33 ^d	1.2E-07
Benzo(a)pyrene	0.029	--	--	0.33 ^d	8.8E-08
Benzo(b)fluoranthene	0.037	--	--	0.33 ^d	1.1E-07
Benzo(k)fluoranthene	0.049	--	--	0.33 ^d	1.5E-07
Benzo(g,h,i)perylene	0.027	2,400	1.1E-05	--	--
bis(2-Ethylhexyl)phthalate	0.090	71.4	1.3E-03	--	--
Butylbenzylphthalate	0.023	16,000	1.4E-06	--	--
Chrysene	0.061	--	--	0.33 ^d	1.8E-07
Di-n-butylphthalate	0.044	8000	5.5E-06	--	--
Fluorene	0.079	3,200	2.5E-05	--	--
Indeno(1,2,3-cd) pyrene	0.022	--	--	1.37	1.6E-08
Pyrene	0.073	2,400	3.0E-05	--	--
Totals					
Cumulative Hazard Quotient:			6.1E-03		
Cumulative Excess Cancer Risk:					1.6E-06

^a = From WCH (2007).

^b = Value obtained from *Washington Administrative Code* (WAC) 173-340-740(3), Method B, 1996, unless otherwise noted.

^d = Total carcinogenic risk calculated using the cleanup level instead of the required detection limit. Individual carcinogenic risk calculated using the required detection limit.

-- = not applicable

RAG = remedial action goal

CALCULATION COVER SHEET

Project Title: 118-F-2 Burial Ground Cleanup Verification **Job No:** 14655

Area: 100-F Area

Discipline: Environmental ***Calculation No:** 0100F-CA-V0286

Subject: 118-F-2 Burial Ground Cleanup Verification RESRAD Calculation Brief

Computer Program: RESRAD **Program No:** Version 6.3

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

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

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover - 1 pg Summary - 5 pg Attm. 1 - 1 pg Attm. 2 - 22 pg Attm. 3 - 31 pg Attm. 4 - 10 pg Attm. 5 - 20 pg Attm. 6 - 30 pg Attm. 7 - 10 pg Total - 130 pages	S. W. Clark <i>S.W. Clark</i> 8/16/07	M. W. Perrott <i>M. Perrott</i> 8/16/07	H. M. Sulloway <i>H.M. Sulloway</i> 8/16/07	S. W. Callison <i>SW Callison</i> 8-16-07	8-16-07
SUMMARY OF REVISION						

WCH-DE-018 (05/08/2007)

*Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford

CALCULATION SHEET

Originator:	S. W. Clark <i>SWC</i>	Date:	8/6/07	Calc. No.:	0100F-CA-V0286	Rev.:	0
Project:	118-F-2 Burial Ground Cleanup	Job No.:	14655	Checked:	M. W. Perrott <i>mlp</i>	Date:	8/14/07
Subject:	118-F-2 Burial Ground Cleanup Verification RESRAD Calculation Brief						Sheet No. 1 of 5

PURPOSE:

Calculate the soil and groundwater concentrations, dose, and risk contributions from remaining radionuclide contaminants in remediated 118-F-2 Burial Ground areas, in overburden/below cleanup level soil, and in staging pile (stockpile) areas over a period of 1,000 years.

GIVEN/REFERENCES:

- 1) Cleanup verification data from *118-F-2 Burial Ground 95% UCL Calculation*, Calculation No. 0100F-CA-V0285, Rev. 0, Washington Closure Hanford, Richland, Washington.
- 2) *Remedial Design Report/Remedial Action Work Plan for the 100 Area (RDR/RAWP)*, DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
- 3) Radioactive and nonradioactive contaminants of concern from the *100 Area Burial Grounds Remedial Action Sampling and Analysis Plan*, DOE/RL-2001-35, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. For the purpose of these RESRAD calculations, the radioactive contaminants of concern (COCs) are cesium-137, cobalt-60, europium-152, europium-154, nickel-63, plutonium-238, plutonium-239/240, strontium-90, and uranium-238. The nonradionuclide contaminants of concern are chromium, lead, and mercury. Attainment of remedial action goals (RAGs) by residual concentrations of nonradionuclides is discussed in the *118-F-2 Burial Ground 95% UCL Calculation*. All nonradionuclide direct exposure RAGs are met and protection of groundwater and the river can be demonstrated by the results of vertical migration modeling in the *100 Area Analogous Sites RESRAD Calculations*, 0100X-CA-V0050, Rev. 0, Bechtel Hanford, Inc., Richland, Washington, which predicts that none of the nonradionuclides will migrate to groundwater (and thus the Columbia River) within 1,000 years.
- 4) RESidual RADioactivity (RESRAD) computer code, version 6.3, to calculate compliance with residual radioactivity guidelines, developed for the U.S. Department of Energy by the Environmental Assessment Division of Argonne National Laboratory, Argonne, Illinois.
- 5) Sample design data from the *118-F-2 Burial Ground Sampling Plan*, Calculation No. 0100F-CA-V0288, Rev. 0, Washington Closure Hanford, Richland, Washington.
- 6) Groundwater elevation from *Hanford Groundwater Monitoring for Fiscal Year 2006* PNNL-16346, Pacific Northwest National Laboratory, Richland, Washington.

SOLUTION:

- 1) Separate RESRAD runs were performed for the 118-F-2 Burial Ground Excavation Shallow Zone, Overburden/Below Cleanup Level Stockpile (OB/BCL) soils, and the Staging Pile (ACL) Footprint. Table 1 shows the elevations (NAVD88) and thickness of each soil horizon. Attachment 1 shows representative dimensions of soil horizons and contaminant pathways considered for dose, risk, and groundwater protection. Input factors for each run are shown in the "Summary" section of the RESRAD "Mixture Sums and Single Radionuclide Guidelines" printouts in the Attachments to this Calculation Summary.

Washington Closure Hanford

CALCULATION SHEET

Originator:	S. W. Clark <i>SWC</i>	Date:	8/16/07	Calc. No.:	0100F-CA-V0286	Rev.:	0
Project:	118-F-2 Burial Ground Cleanup	Job No.:	14655	Checked:	M. W. Perrott <i>MWP</i>	Date:	8/16/07
Subject:	118-F-2 Burial Ground Cleanup Verification RESRAD Calculation Brief					Sheet No.	2 of 5

Table 1. Waste Site Dimensions for RESRAD Modeling

Parameter	Units	Excavation Shallow Zone	OB/BCL	Staging Pile ACL Footprint
<i>Contaminated Zone Dimensions</i>				
Cover Depth	m	0	0	0
Area of Contaminated Zone (CZ)	m ²	5,462	4,143	4,592
Length Parallel to Aquifer Flow	m	75	65	69
<i>Elevations of Vadose Zone Horizons</i>				
Elevation: Surface	m	122.0	122.0	122.0
Elevation: Groundwater	m	114.5	114.5	114.5
Thickness: Contaminated Zone	m	7.5	7.5	7.5
Thickness: Unsaturated Zone	m	0	0	0
OB/BCL = Overburden/Below Cleanup Levels Stockpile ACL = Above Cleanup Levels				

- 2) The year where the peak dose (or concentration) occurs from each individual radionuclide 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 pathway (i.e. soil ingestion and inhalation and external radiation), the peak year occurred at year zero (year 2007) for all COCs. For the water pathways (i.e. drinking water and food ingestion) the peak year was year 43 for cesium-137. The 43-year time period was added to all RESRAD runs.

To be conservative, shallow zone evaluations for radionuclides were performed for the 118-F-2 Burial Ground areas assuming that the residual contamination levels from the shallow zone sample data sets extend uniformly from the surface to groundwater (Attachment 1).

METHODOLOGY:

- 1) Runs of RESRAD version 6.3 were completed for the 118-F-2 Burial Ground Excavation Shallow Zone, Overburden/Below Cleanup Level Stockpile (OB/BCL) soils, and the Staging Pile (ACL) Footprint using the radionuclide concentrations shown in Table 2. RESRAD numerical output reports for dose, risk, and concentration for the Excavation Shallow Zone, OB/BCL soils, and the Staging Pile area are presented in the Attachments to this calculation summary.

Washington Closure Hanford**CALCULATION SHEET**

Originator:	S. W. Clark	Date:	8/16/07	Calc. No.:	0100F-CA-V0286	Rev.:	0
Project:	118-F-2 Burial Ground Cleanup	Job No.:	14655	Checked:	M. W. Perrott	Date:	8/16/07
Subject:	118-F-2 Burial Ground Cleanup Verification RESRAD Calculation Brief					Sheet No.	3 of 5

Table 2. Cleanup Verification Data Set ^a

COCs	Excavation Shallow Zone	OB/BCL	Staging Pipe ACL Footprint
<i>Radionuclide Activity (pCi/g)</i>			
Cesium-137	0.069	0(<BG)	0.434
Cobalt-60	0.017 U	0.008 U	0.019 U
Europium-152	0.044 U	0.039 U	0.037 U
Europium-154	0.059 U	0.021 U	0.054 U
Nickel-63	-1.071 U	0.53 U	0.316 U
Plutonium-238	0.083 U	0.035 U	0.33
Plutonium-239	0.169	0(<BG)	0.049 U
Plutonium-240	0.041	0(<BG)	0.012 U
Strontium-90	0.12 U	0(<BG)	0.25 U
Uranium-233/234	0(<BG)	0(<BG)	0(<BG)
Uranium-238	0(<BG)	0(<BG)	0(<BG)

U = Undetected. Not evaluated in RESRAD modeling.

OB/BCL = Overburden/Below Cleanup Levels Stockpile

^a Soil concentration values are from 118-F-2 Burial Ground 95% UCL Calculation, Calculation No. 0100F-CA-V0285, Rev. 0, Washington Closure Hanford, Richland, Washington. Refer to the 95% UCL for nonradionuclide concentrations. Nonradionuclides are not evaluated in this RESRAD calculation.

RESULTS:**1) Radionuclide "All Pathways" Dose Rate**

The "all pathways" (maximum) dose rates are shown in Table 3. The maximum all pathways dose rate from the 118-F-2 Burial Ground is 1.13 mrem/yr at year zero (2007) from the Staging Pile (ACL) Footprint. The maximum all-pathways dose rates from the Excavation Shallow Zone is 0.25 mrem/yr at year zero (2007). The contaminants in the Overburden/Below Cleanup Level Stockpile (OB/BCL) soil were all undetected so this soil recorded no dose.

Table 3. All Pathways 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	11	43	135	300	1000
Excavation	Shallow Zone	2.50E-01	2.47E-01	2.39E-01	2.26E-01	2.14E-01	1.48E-01	9.54E-02	8.73E-02	8.26E-02
Staging Pile	Shallow Zone	1.13E+00	1.11E+00	1.06E+00	9.73E-01	8.93E-01	4.61E-01	8.74E-02	1.27E-02	1.05E-04
OB/BCL	Shallow Zone	0	0	0	0	0	0	0	0	0

OB/BCL = Overburden/Below Cleanup Levels Stockpile Material

2) Radionuclide Excess Lifetime Cancer Risk

The radionuclide excess lifetime cancer risk (ELCR) results are shown in Table 4. The maximum ELCR for the 118-F-2 Burial Ground is 1.64×10^{-5} at year zero (2007) for the Staging Pile (ACL) Footprint. The maximum ELCR result for the Excavation Shallow Zone is 2.77×10^{-6} . The contaminants in the Overburden/Below Cleanup Level Stockpile (OB/BCL) soil were all undetected so this soil recorded no risk.

Washington Closure Hanford

CALCULATION SHEET

Originator:	S. W. Clark	Date:	8/15/07	Calc. No.:	0100F-CA-V0286	Rev.:	0
Project:	118-F-2 Burial Ground Cleanup	Job No.:	14655	Checked:	M. W. Perrott	Date:	8/16/07
Subject:	118-F-2 Burial Ground Cleanup Verification RESRAD Calculation Brief					Sheet No.	4 of 5

Table 4. Radionuclide Excess Lifetime Cancer Risk

RESRAD Run	Vadose Zone Horizons	Excess Cancer Risk at Each Time Slice (yr)								
		0	1	3	7	11	43	135	300	1000
Excavation	Shallow Zone	2.77E-06	2.71E-06	2.60E-06	2.38E-06	2.19E-06	1.13E-06	2.85E-07	1.71E-07	1.60E-07
Staging Pile	Shallow Zone	1.64E-05	1.61E-05	1.53E-05	1.40E-05	1.28E-05	6.15E-06	7.91E-07	3.76E-08	6.04E-10
OB/BCL	Shallow Zone	0	0	0	0	0	0	0	0	0

OB/BCL = Overburden/Below Cleanup Levels Stockpile

3) Radionuclide Groundwater Protection

The radionuclide concentrations in groundwater calculated by the RESRAD model are summarized in Table 5. Among the radionuclide contaminants of concern only cesium-137 is calculated to reach groundwater in the 1,000 years of the RESRAD model evaluation. The organ specific dose via the groundwater (and river) pathway is presented in a separate calculation brief [118-F-2 Burial Ground Comparison To Drinking Water Standards (MCL) Calculation, Calculation No. 0100F-CA-V0287, Rev. 0, Washington Closure Hanford, Richland, Washington]. Only concentrations are presented here.

Table 5. Predicted Groundwater (Well Water/Drinking Water) Concentrations (2 Pages)

Radio-nuclides	RESRAD Run	Groundwater Concentrations in pCi/L at Each Time Slice (yr)									RAGs, pCi/L
		0	1	3	7	11	43	135	300	1000	
Cs-137	Excavation	0	1.74E-04	4.97E-04	1.06E-03	1.52E-03	2.82E-03	1.05E-03	5.13E-05	1.56E-11	60
	Staging Pile	0	1.09E-03	3.13E-03	6.65E-03	9.53E-03	1.78E-02	6.62E-03	3.23E-04	9.82E-11	
	OB/BCL	0	0	0	0	0	0	0	0	0	

RAGs = Remedial action goals from the 100 Area RDR/RAWP

OB/BCL = Overburden/Below Cleanup Levels Stockpile

CONCLUSIONS:

- The "all pathways" (maximum) dose rates are shown in Table 3. The maximum all pathways dose rate from the 118-F-2 Burial Ground is 1.13 mrem/yr at year zero (2007) from the Staging Pile (ACL) Footprint.
- The radionuclide excess lifetime cancer risk (ELCR) results are shown in Table 4. The maximum ELCR for the 118-F-2 Burial Ground is 1.64×10^{-5} at year zero (2007) for the Staging Pile (ACL) Footprint.
- The dominant pathway for the dose rate for the Excavation Shallow Zone and the Staging Pile (ACL) Footprint RESRAD evaluations is direct external exposure due to cesium-137.
- None of the site COCs are projected to exceed remedial action goals (RAGs).

Washington Closure Hanford

CALCULATION SHEET

Originator:	S. W. Clark <i>SWC</i>	Date:	8/6/87	Calc. No.:	0100F-CA-V0286	Rev.:	0
Project:	118-F-2 Burial Ground Cleanup	Job No.:	14655	Checked:	M. W. Perrott <i>MWP</i>	Date:	9/16/87
Subject:	118-F-2 Burial Ground Cleanup Verification RESRAD Calculation Brief					Sheet No.	5 of 5

- Among the radionuclide contaminants of concern, cesium-137 is calculated to reach groundwater in the 1,000 years of the RESRAD model run. Cesium-137 is predicted to reach groundwater at concentrations significantly below the RAGs.

ATTACHMENTS:

1. Graphic showing 118-F-2 Cleanup Verification Model (1 page)
2. RESRAD Output: 118-F-2 Excavation Shallow Zone Radionuclides – Mixture Sums and Single Radionuclide Guidelines (22 pages)
3. RESRAD Output: 118-F-2 Excavation Shallow Zone Radionuclides – Intake Quantities and Health Risk Factors (31 pages)
4. RESRAD Output: 118-F-2 Excavation Shallow Zone Radionuclides – Concentration of Radionuclides, (10 pages)
5. RESRAD Output: 118-F-2 Staging Pile (ACL) Footprint Radionuclides – Mixture Sums and Single Radionuclide Guidelines (20 pages)
6. RESRAD Output: 118-F-2 Staging Pile (ACL) Footprint Radionuclides - Intake Quantities and Health Risk Factors (30 pages)
7. RESRAD Output: 118-F-2 Staging Pile (ACL) Footprint Radionuclides - Concentration of Radionuclides (10 pages)

118-F-2 Burial Ground Cleanup Verification Model

ATTACHMENT 1

Vadose Zone Contribution to Groundwater Contamination

E0211029.1

CVP-2007-00002
Rev. 0

ATTACHMENT 2

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1RESRAD, Version 6.3      T« Limit = 180 days      08/15/2007 18:05 Page 1
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File    : 118-F-2 Excavation SZ:RAD
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Table of Contents
 AAAAAAAAAAAAAAAAAAAAAA

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary ...	2
Site-Specific Parameter Summary	4
Summary of Pathway Selections	9
Contaminated Zone and Total Dose Summary	10
Total Dose Components	
Time = 0.000E+00	11
Time = 1.000E+00	12
Time = 3.000E+00	13
Time = 7.000E+00	14
Time = 1.100E+01	15
Time = 4.300E+01	16
Time = 1.350E+02	17
Time = 3.000E+02	18
Time = 1.000E+03	19
Dose/Source Ratios Summed Over All Pathways	20
Single Radionuclide Soil Guidelines	20
Dose Per Nuclide Summed Over All Pathways	21
Soil Concentration Per Nuclide	22

Attachment 2 Sheet No. 1 of 22
 Originator: S. W. Clark Date 8/6/07
 Chk'd By M. W. Perrott Date 8/6/07
 Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 2
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

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

Menu	Parameter	Current Value	Base Case*	Parameter Name
Dose conversion factors for inhalation, mrem/pCi:				
B-1	Ac-227+D	6.724E+00	6.700E+00	DCF2(1)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(2)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(3)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(4)
B-1	Pu-240	4.290E-01	4.290E-01	DCF2(5)
B-1	Ra-228+D	5.078E-03	4.770E-03	DCF2(7)
B-1	Th-228+D	3.454E-01	3.420E-01	DCF2(8)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(9)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(10)
B-1	U-236	1.250E-01	1.250E-01	DCF2(11)
Dose conversion factors for ingestion, mrem/pCi:				
D-1	Ac-227+D	1.480E-02	1.410E-02	DCF3(1)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(2)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(3)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(4)
D-1	Pu-240	3.540E-03	3.540E-03	DCF3(5)
D-1	Ra-228+D	1.442E-03	1.440E-03	DCF3(7)
D-1	Th-228+D	8.086E-04	3.960E-04	DCF3(8)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(9)
D-1	U-235+D	2.673E-04	2.660E-04	DCF3(10)
D-1	U-236	2.690E-04	2.690E-04	DCF3(11)
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	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(2,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(2,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(2,3)
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(3,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(3,3)
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(4,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(4,3)
D-34	Pu-240 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Pu-240 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Pu-240 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(5,3)
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(7,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(7,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(7,3)

Attachment 2 Sheet No. 2 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 3
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)

File: HEAST 2001 MORBIDITY

Menu	Parameter	Current Value	Base Case*	Parameter Name
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(9,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(9,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(9,3)
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(10,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(10,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(10,3)
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(11,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(11,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(11,3)
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	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(2,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(3,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(3,2)
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(4,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(4,2)
D-5	Pu-240 , fish	3.000E+01	3.000E+01	BIOFAC(5,1)
D-5	Pu-240 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(5,2)
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(7,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(7,2)
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(8,2)
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(9,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(9,2)
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10,2)
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(11,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11,2)

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

Attachment 2 Sheet No. 3 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3   T« Limit = 180 days   08/15/2007 18:05 Page 4
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Site-Specific Parameter Summary					Used by RESRAD		Parameter	
Menu	Parameter	User	Default	(If different from user input)			Name	
0	AAAAA						AAAAA	
R011	Area of contaminated zone (m**2)	5.462E+03	1.000E+04	---			AREA	
R011	Thickness of contaminated zone (m)	7.500E+00	2.000E+00	---			THICKO	
R011	Length parallel to aquifer flow (m)	7.500E+01	1.000E+02	---			LCZPAQ	
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---			BRDL	
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---			TI	
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---			T(2)	
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---			T(3)	
R011	Times for calculations (yr)	7.000E+00	1.000E+01	---			T(4)	
R011	Times for calculations (yr)	1.100E+01	3.000E+01	---			T(5)	
R011	Times for calculations (yr)	4.300E+01	1.000E+02	---			T(6)	
R011	Times for calculations (yr)	1.350E+02	3.000E+02	---			T(7)	
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---			T(8)	
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---			T(9)	
R011	Times for calculations (yr)	not used	0.000E+00	---			T(10)	
R012	Initial principal radionuclide (pCi/g): Cs-137	6.900E-02	0.000E+00	---			S1(2)	
R012	Initial principal radionuclide (pCi/g): Pu-239	1.690E-01	0.000E+00	---			S1(4)	
R012	Initial principal radionuclide (pCi/g): Pu-240	4.100E-02	0.000E+00	---			S1(5)	
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---			W1(2)	
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---			W1(4)	
R012	Concentration in groundwater (pCi/L): Pu-240	not used	0.000E+00	---			W1(5)	
R013	Cover depth (m)	0.000E+00	0.000E+00	---			COVERO	
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---			DENSCV	
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---			VCV	
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	---			DENSCZ	
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---			VCZ	
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---			TPCZ	
R013	Contaminated zone field capacity	1.500E-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)	1.600E+00	1.500E+00	---			DENSAQ	
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---			TPSZ	
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---			EPSZ	
R014	Saturated zone field capacity	1.500E-01	2.000E-01	---			FCSZ	
R014	Saturated zone hydraulic conductivity (m/yr)	5.530E+03	1.000E+02	---			HCSZ	
R014	Saturated zone hydraulic gradient	1.250E-03	2.000E-02	---			HGWT	
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---			BSZ	
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---			VWT	
R014	Well pump intake depth (m below water table)	4.600E+00	1.000E+01	---			DWIBWT	

Attachment 2 Sheet No. 4 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 5
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Site-Specific Parameter Summary (continued)					
Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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	0	1	---	NS
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	5.000E+01	4.600E+03	---	DCNUCC(2)
R016	Saturated zone (cm**3/g)	5.000E+01	4.600E+03	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.329E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(4)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.328E-05	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Pu-240				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(5)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.328E-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	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.310E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(3)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.329E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(7)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.498E-05	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(8)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.110E-07	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)

Attachment 2 Sheet No. 5 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

File : 118-F-2 Excavation SZ,RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User	Default	Used by RESRAD	Parameter
		Input	(If different from user input)		Name
R016	Distribution coefficients for daughter Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(9)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.110E-07	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter U-235				
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	1.329E-04	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for daughter U-236				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(11)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.329E-04	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
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)

Attachment 2 Sheet No. 6 of 22
 Originator: S. W. Clark Date _____
 Chk'd By M. W. Perrott Date _____
 Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3   T« Limit = 180 days   08/15/2007 18:05 Page 7
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Site-Specific Parameter Summary (continued)					
Menu	Parameter	User	Input	Default	Used by RESRAD
(If different from user input)					
Parameter Name					
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.100E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	2.700E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	1.000E+02	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	3.600E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	1.970E+01	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	7.300E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIW
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	0.273E+00	FMEAT
R018	Contamination fraction of milk	-1	-1	0.273E+00	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LF15
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LF16
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LW15
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LW16
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R198	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R198	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R198	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R198	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R198	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R198	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)

Attachment 2 Sheet No. 7 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 8
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Site-Specific Parameter Summary (continued)					
Menu	Parameter	User	Default	Used by RESRAD	Parameter Name
		Input	(If different from user input)		
AAAAA	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	---	C12C2
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	0.000E+00	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
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	---	PH20CV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH20FL
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	---	HMX
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)

Attachment 2 Sheet No. 8 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 9
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Site-Specific Parameter Summary (continued)

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

Summary of Pathway Selections

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

Attachment 2 Sheet No. 9 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 10
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
AAAAAAAAAAAAAAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAAAAAAAAAAAAAA	
Area:	5462.00 square meters	Cs-137	6.900E-02
Thickness:	7.50 meters	Pu-239	1.690E-01
Cover Depth:	0.00 meters	Pu-240	4.100E-02

0

Total Dose TD0SE(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)
AAAAAAAAAAAAAAAAAAAAAAAAAAAA

t (years):	0.000E+00	1.000E+00	3.000E+00	7.000E+00	1.100E+01	4.300E+01	1.350E+02	3.000E+02	1.000E+03
TD0SE(t):	2.502E-01	2.465E-01	2.394E-01	2.261E-01	2.139E-01	1.484E-01	9.536E-02	8.733E-02	8.263E-02
M(t):	1.668E-02	1.643E-02	1.596E-02	1.507E-02	1.426E-02	9.894E-03	6.358E-03	5.822E-03	5.509E-03

Maximum TD0SE(t): 2.502E-01 mrem/yr at t = 0.000E+00 years

Attachment 2 Sheet No. 10 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 11
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.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)

0	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
0	Radio- mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
0	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Nuclide	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	1.477E-01 0.5903	8.347E-08 0.0000	0.000E+00 0.0000	7.776E-03 0.0311	3.277E-03 0.0131	2.035E-03 0.0081	2.015E-04 0.0008
Pu-239	3.199E-05 0.0001	2.750E-03 0.0110	0.000E+00 0.0000	3.374E-02 0.1348	3.342E-04 0.0013	9.071E-06 0.0000	3.494E-02 0.1397
Pu-240	3.999E-06 0.0000	6.670E-04 0.0027	0.000E+00 0.0000	8.184E-03 0.0327	8.108E-05 0.0003	2.201E-06 0.0000	8.476E-03 0.0339
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
Total	1.477E-01 0.5904	3.417E-03 0.0137	0.000E+00 0.0000	4.970E-02 0.1986	3.692E-03 0.0148	2.047E-03 0.0082	4.362E-02 0.1743

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

0	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*
0	Radio- mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
0	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Nuclide	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
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	1.610E-01 0.6434
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	7.180E-02 0.2870
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	1.741E-02 0.0696
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
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	2.502E-01 1.0000

0*Sum of all water independent and dependent pathways.

Attachment 2 Sheet No. 11 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 12
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_S2.RAD

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

	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
Radio-	AAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAA
Nuclide	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.443E-01 0.5854	8.156E-08 0.0000	0.000E+00 0.0000	7.598E-03 0.0308	3.202E-03 0.0130	1.989E-03 0.0081	1.969E-04 0.0008
Pu-239	3.199E-05 0.0001	2.749E-03 0.0112	0.000E+00 0.0000	3.373E-02 0.1369	3.342E-04 0.0014	9.070E-06 0.0000	3.494E-02 0.1417
Pu-240	3.999E-06 0.0000	6.669E-04 0.0027	0.000E+00 0.0000	8.183E-03 0.0332	8.107E-05 0.0003	2.200E-06 0.0000	8.475E-03 0.0344
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
Total	1.443E-01 0.5855	3.416E-03 0.0139	0.000E+00 0.0000	4.951E-02 0.2009	3.617E-03 0.0147	2.000E-03 0.0081	4.361E-02 0.1769

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

	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*
Radio-	AAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAA
Nuclide	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	6.289E-06 0.0000	4.710E-06 0.0000	0.000E+00 0.0000	6.375E-07 0.0000	7.279E-07 0.0000	7.704E-07 0.0000	1.573E-01 0.6381
Pu-239	2.962E-14 0.0000	2.585E-16 0.0000	0.000E+00 0.0000	2.562E-15 0.0000	3.876E-17 0.0000	1.504E-16 0.0000	7.179E-02 0.2913
Pu-240	1.504E-13 0.0000	6.857E-16 0.0000	0.000E+00 0.0000	1.371E-14 0.0000	1.127E-16 0.0000	1.094E-15 0.0000	1.741E-02 0.0706
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
Total	6.289E-06 0.0000	4.710E-06 0.0000	0.000E+00 0.0000	6.375E-07 0.0000	7.279E-07 0.0000	7.704E-07 0.0000	2.465E-01 1.0000

0*Sum of all water independent and dependent pathways.

Attachment 2 Sheet No. 12 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 13
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

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

Radio- Nuclide	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr
fract.	fract.	fract.	fract.	fract.	fract.	fract.	fract.
Cs-137	1.377E-01 0.5754	7.785E-08 0.0000	0.000E+00 0.0000	7.253E-03 0.0303	3.056E-03 0.0128	1.898E-03 0.0079	1.879E-04 0.0008
Pu-239	3.198E-05 0.0001	2.749E-03 0.0115	0.000E+00 0.0000	3.373E-02 0.1409	3.342E-04 0.0014	9.069E-06 0.0000	3.493E-02 0.1459
Pu-240	3.998E-06 0.0000	6.668E-04 0.0028	0.000E+00 0.0000	8.181E-03 0.0342	8.105E-05 0.0003	2.200E-06 0.0000	8.473E-03 0.0354
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.378E-01 0.5756	3.416E-03 0.0143	0.000E+00 0.0000	4.916E-02 0.2054	3.471E-03 0.0145	1.910E-03 0.0080	4.359E-02 0.1821

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

Radio- Nuclide	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*
mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr
fract.	fract.	fract.	fract.	fract.	fract.	fract.	fract.
Cs-137	1.810E-05 0.0001	1.398E-05 0.0001	0.000E+00 0.0000	1.961E-06 0.0000	3.233E-06 0.0000	2.689E-06 0.0000	1.502E-01 0.6274
Pu-239	1.985E-13 0.0000	1.154E-15 0.0000	0.000E+00 0.0000	2.104E-14 0.0000	4.626E-16 0.0000	1.919E-15 0.0000	7.179E-02 0.2999
Pu-240	1.373E-12 0.0000	6.634E-15 0.0000	0.000E+00 0.0000	1.423E-13 0.0000	2.355E-15 0.0000	1.408E-14 0.0000	1.741E-02 0.0727
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.810E-05 0.0001	1.398E-05 0.0001	0.000E+00 0.0000	1.961E-06 0.0000	3.233E-06 0.0000	2.689E-06 0.0000	2.394E-01 1.0000

0*Sum of all water independent and dependent pathways.

Attachment 2 Sheet No. 13 of 22
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 14
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.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 = 7.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

0	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
0	Radio- AAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA
	Nuclide mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
	AAAAAAAA AAAAAAAAAA	AAAAAAAA AAAAAA	AAAAAAAA AAAAAA	AAAAAAAA AAAAAA	AAAAAAAA AAAAAA	AAAAAAAA AAAAAA	AAAAAAAA AAAAAA
Cs-137	1.255E-01 0.5552	7.094E-08 0.0000	0.000E+00 0.0000	6.609E-03 0.0292	2.785E-03 0.0123	1.730E-03 0.0077	1.712E-04 0.0008
Pu-239	3.198E-05 0.0001	2.748E-03 0.0122	0.000E+00 0.0000	3.372E-02 0.1492	3.341E-04 0.0015	9.067E-06 0.0000	3.492E-02 0.1545
Pu-240	3.996E-06 0.0000	6.664E-04 0.0029	0.000E+00 0.0000	8.176E-03 0.0362	8.101E-05 0.0004	2.199E-06 0.0000	8.468E-03 0.0375
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.255E-01 0.5554	3.415E-03 0.0151	0.000E+00 0.0000	4.851E-02 0.2146	3.200E-03 0.0142	1.741E-03 0.0077	4.356E-02 0.1927

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 7.000E+00 years
Water Dependent Pathways

0	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*
0	Radio- AAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA
	Nuclide mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
	AAAAAAAA AAAAAA	AAAAAAAA AAAAAA	AAAAAAAA AAAAAA	AAAAAAAA AAAAAA	AAAAAAAA AAAAAA	AAAAAAAA AAAAAA	AAAAAAAA AAAAAA
Cs-137	3.855E-05 0.0002	3.003E-05 0.0001	0.000E+00 0.0000	4.254E-06 0.0000	7.574E-06 0.0000	6.013E-06 0.0000	1.369E-01 0.6056
Pu-239	1.061E-12 0.0000	5.785E-15 0.0000	0.000E+00 0.0000	1.141E-13 0.0000	2.630E-15 0.0000	1.151E-14 0.0000	7.177E-02 0.3175
Pu-240	7.481E-12 0.0000	3.678E-14 0.0000	0.000E+00 0.0000	8.047E-13 0.0000	1.555E-14 0.0000	8.437E-14 0.0000	1.740E-02 0.0770
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	3.855E-05 0.0002	3.003E-05 0.0001	0.000E+00 0.0000	4.254E-06 0.0000	7.574E-06 0.0000	6.013E-06 0.0000	2.261E-01 1.0000

0*Sum of all water independent and dependent pathways.

Attachment 2 Sheet No. 14 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 15
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.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 = 1.100E+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.
Cs-137	1.144E-01 0.5346	6.465E-08 0.0000	0.000E+00 0.0000	6.022E-03 0.0282	2.538E-03 0.0119	1.576E-03 0.0074	1.560E-04 0.0007
Pu-239	3.197E-05 0.0001	2.748E-03 0.0128	0.000E+00 0.0000	3.371E-02 0.1576	3.340E-04 0.0016	9.065E-06 0.0000	3.491E-02 0.1632
Pu-240	3.993E-06 0.0000	6.660E-04 0.0031	0.000E+00 0.0000	8.172E-03 0.0382	8.096E-05 0.0004	2.197E-06 0.0000	8.463E-03 0.0396
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.144E-01 0.5348	3.414E-03 0.0160	0.000E+00 0.0000	4.791E-02 0.2239	2.953E-03 0.0138	1.587E-03 0.0074	4.353E-02 0.2035

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.100E+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.
Cs-137	5.525E-05 0.0003	4.313E-05 0.0002	0.000E+00 0.0000	6.125E-06 0.0000	1.112E-05 0.0001	8.727E-06 0.0000	1.248E-01 0.5833
Pu-239	2.603E-12 0.0000	1.409E-14 0.0000	0.000E+00 0.0000	2.841E-13 0.0000	6.307E-15 0.0000	2.916E-14 0.0000	7.175E-02 0.3354
Pu-240	1.847E-11 0.0000	9.125E-14 0.0000	0.000E+00 0.0000	2.006E-12 0.0000	4.034E-14 0.0000	2.138E-13 0.0000	1.739E-02 0.0813
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	5.525E-05 0.0003	4.313E-05 0.0002	0.000E+00 0.0000	6.125E-06 0.0000	1.112E-05 0.0001	8.727E-06 0.0000	2.139E-01 1.0000

0*Sum of all water independent and dependent pathways.

Attachment 2 Sheet No. 15 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 16
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.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 = 4.300E+01 years									
Water Independent Pathways (Inhalation excludes radon)									
0	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil		
0	Radio- Nuclide	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
	Cs-137	5.437E-02 0.3663	3.073E-08 0.0000	0.000E+00 0.0000	2.863E-03 0.0193	1.206E-03 0.0081	7.493E-04 0.0050	7.418E-05 0.0005	
	Pu-239	3.191E-05 0.0002	2.742E-03 0.0185	0.000E+00 0.0000	3.365E-02 0.2267	3.333E-04 0.0022	9.047E-06 0.0001	3.485E-02 0.2348	
	Pu-240	3.976E-06 0.0000	6.631E-04 0.0045	0.000E+00 0.0000	8.136E-03 0.0548	8.060E-05 0.0005	2.188E-06 0.0000	8.426E-03 0.0568	
	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
	Total	5.441E-02 0.3666	3.405E-03 0.0229	0.000E+00 0.0000	4.464E-02 0.3008	1.620E-03 0.0109	7.606E-04 0.0051	4.334E-02 0.2921	

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)									
As mrem/yr and Fraction of Total Dose At t = 4.300E+01 years									
Water Dependent Pathways									
0	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*		
0	Radio- Nuclide	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
	Cs-137	1.030E-04 0.0007	8.064E-05 0.0005	0.000E+00 0.0000	1.149E-05 0.0001	2.139E-05 0.0001	1.654E-05 0.0001	5.950E-02 0.4009	
	Pu-239	4.352E-11 0.0000	2.929E-13 0.0000	0.000E+00 0.0000	4.808E-12 0.0000	1.287E-13 0.0000	4.612E-13 0.0000	7.161E-02 0.4825	
	Pu-240	2.817E-10 0.0000	1.400E-12 0.0000	0.000E+00 0.0000	3.101E-11 0.0000	6.552E-13 0.0000	3.371E-12 0.0000	1.731E-02 0.1166	
	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
	Total	1.030E-04 0.0007	8.064E-05 0.0005	0.000E+00 0.0000	1.149E-05 0.0001	2.139E-05 0.0001	1.654E-05 0.0001	1.484E-01 1.0000	

0*Sum of all water independent and dependent pathways.

Attachment 2 Sheet No. 16 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 17
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.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 = 1.350E+02 years
Water Independent Pathways (Inhalation excludes radon)

0	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
0	Radio- AAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA
	Nuclide mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
	Cs-137 6.411E-03 0.0672	3.623E-09 0.0000	0.000E+00 0.0000	3.376E-04 0.0035	1.422E-04 0.0015	8.835E-05 0.0009	8.746E-06 0.0001
	Pu-239 3.173E-05 0.0003	2.727E-03 0.0286	0.000E+00 0.0000	3.345E-02 0.3508	3.314E-04 0.0035	8.995E-06 0.0001	3.465E-02 0.3633
	Pu-240 3.925E-06 0.0000	6.546E-04 0.0069	0.000E+00 0.0000	8.032E-03 0.0842	7.957E-05 0.0008	2.160E-06 0.0000	8.318E-03 0.0872
	iiiiiii iiiiiiiiii iiiiii	iiiiiiiiiii iiiiii	iiiiiiiiiii iiiiii	iiiiiiiiiii iiiiii	iiiiiiiiiii iiiiii	iiiiiiiiiii iiiiii	iiiiiiiiiii iiiiii
Total	6.446E-03 0.0676	3.381E-03 0.0355	0.000E+00 0.0000	4.182E-02 0.4386	5.533E-04 0.0058	9.950E-05 0.0010	4.297E-02 0.4506

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.350E+02 years
Water Dependent Pathways

0	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*
0	Radio- AAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA	AAAAAAAAAAAAAAAAAAAA
	Nuclide mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
	Cs-137 3.842E-05 0.0004	3.010E-05 0.0003	0.000E+00 0.0000	4.293E-06 0.0000	8.035E-06 0.0001	6.194E-06 0.0001	7.074E-03 0.0742
	Pu-239 6.021E-10 0.0000	6.616E-12 0.0000	0.000E+00 0.0000	6.669E-11 0.0000	2.148E-12 0.0000	4.619E-12 0.0000	7.120E-02 0.7466
	Pu-240 2.761E-09 0.0000	1.374E-11 0.0000	0.000E+00 0.0000	3.048E-10 0.0000	6.513E-12 0.0000	3.329E-11 0.0000	1.709E-02 0.1792
	iiiiiii iiiiiiiiii iiiiii	iiiiiiiiiii iiiiii	iiiiiiiiiii iiiiii	iiiiiiiiiii iiiiii	iiiiiiiiiii iiiiii	iiiiiiiiiii iiiiii	iiiiiiiiiii iiiiii
Total	3.843E-05 0.0004	3.010E-05 0.0003	0.000E+00 0.0000	4.294E-06 0.0000	8.035E-06 0.0001	6.194E-06 0.0001	9.536E-02 1.0000

0*Sum of all water independent and dependent pathways.

Attachment 2 Sheet No. 17 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 18
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.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	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
0	Radio- Nuclide	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
	Cs-137	1.386E-04 0.0016	7.833E-11 0.0000	0.000E+00 0.0000	7.297E-06 0.0001	3.075E-06 0.0000	1.910E-06 0.0000
	Pu-239	3.142E-05 0.0004	2.699E-03 0.0309	0.000E+00 0.0000	3.311E-02 0.3792	3.281E-04 0.0038	8.904E-06 0.0001
	Pu-240	3.836E-06 0.0000	6.397E-04 0.0073	0.000E+00 0.0000	7.849E-03 0.0899	7.777E-05 0.0009	2.112E-06 0.0000
	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
	Total	1.738E-04 0.0020	3.339E-03 0.0382	0.000E+00 0.0000	4.097E-02 0.4691	4.089E-04 0.0047	1.293E-05 0.0001

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

0	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*
0	Radio- Nuclide	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.
	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
	Cs-137	1.871E-06 0.0000	1.466E-06 0.0000	0.000E+00 0.0000	2.092E-07 0.0000	3.920E-07 0.0000	3.020E-07 0.0000
	Pu-239	4.192E-09 0.0000	5.793E-11 0.0000	0.000E+00 0.0000	4.631E-10 0.0000	1.813E-11 0.0000	2.313E-11 0.0000
	Pu-240	1.349E-08 0.0000	6.718E-11 0.0000	0.000E+00 0.0000	1.491E-09 0.0000	3.195E-11 0.0000	1.630E-10 0.0000
	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
	Total	1.889E-06 0.0000	1.467E-06 0.0000	0.000E+00 0.0000	2.111E-07 0.0000	3.921E-07 0.0000	3.021E-07 0.0000

0*Sum of all water independent and dependent pathways.

Attachment 2 Sheet No. 18 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 19
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.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)														
	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.195E-11	0.0000	6.753E-18	0.0000	0.000E+00	0.0000	6.291E-13	0.0000	2.651E-13	0.0000	1.647E-13	0.0000	1.630E-14	0.0000
Pu-239	3.014E-05	0.0004	2.584E-03	0.0313	0.000E+00	0.0000	3.170E-02	0.3837	3.141E-04	0.0038	8.525E-06	0.0001	3.284E-02	0.3974
Pu-240	3.480E-06	0.0000	5.803E-04	0.0070	0.000E+00	0.0000	7.120E-03	0.0862	7.054E-05	0.0009	1.917E-06	0.0000	7.374E-03	0.0892
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	3.362E-05	0.0004	3.164E-03	0.0383	0.000E+00	0.0000	3.883E-02	0.4699	3.846E-04	0.0047	1.044E-05	0.0001	4.021E-02	0.4866

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															
0	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*		
0	Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	
	Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
	Cs-137	5.701E-13	0.0000	4.467E-13	0.0000	0.000E+00	0.0000	6.374E-14	0.0000	1.195E-13	0.0000	9.203E-14	0.0000	1.431E-11	0.0000
	Pu-239	8.956E-08	0.0000	1.508E-09	0.0000	0.000E+00	0.0000	9.899E-09	0.0000	5.349E-10	0.0000	2.634E-10	0.0000	6.748E-02	0.8166
	Pu-240	1.434E-07	0.0000	7.141E-10	0.0000	0.000E+00	0.0000	1.585E-08	0.0000	3.403E-10	0.0000	1.734E-09	0.0000	1.515E-02	0.1834
	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
	Total	2.329E-07	0.0000	2.223E-09	0.0000	0.000E+00	0.0000	2.575E-08	0.0000	8.753E-10	0.0000	1.998E-09	0.0000	8.263E-02	1.0000
	0*Sum of all water independent and dependent pathways.														

0*Sum of all water independent and dependent pathways.

Attachment 2 Sheet No. 19 of 22
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3   T_{1/2} Limit = 180 days   08/15/2007 18:05 Page 20
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

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

0 Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g)									
AAAAA	AAAAA	AAAAA	0.000E+00	1.000E+00	3.000E+00	7.000E+00	1.100E+01	4.300E+01	1.350E+02	3.000E+02	1.000E+03	
Cs-137+D	Cs-137+D	1.000E+00	2.333E+00	2.279E+00	2.176E+00	1.984E+00	1.808E+00	8.623E-01	1.025E-01	2.251E-03	2.075E-10	
OPu-239	Pu-239	1.000E+00	4.248E-01	4.248E-01	4.248E-01	4.247E-01	4.246E-01	4.237E-01	4.213E-01	4.170E-01	3.993E-01	
Pu-239	U-235+D	1.000E+00	0.000E+00	5.373E-10	1.614E-09	3.770E-09	5.929E-09	2.330E-08	7.421E-08	1.691E-07	6.206E-07	
Pu-239	Pa-231	1.000E+00	0.000E+00	7.952E-14	7.056E-13	3.811E-12	9.452E-12	1.493E-10	1.622E-09	9.314E-09	1.619E-07	
Pu-239	Ac-227+D	1.000E+00	0.000E+00	5.228E-14	6.927E-14	3.759E-13	1.005E-12	5.544E-11	1.811E-09	1.645E-08	4.153E-07	
Pu-239	DSR(j)		4.248E-01	4.248E-01	4.248E-01	4.247E-01	4.246E-01	4.237E-01	4.213E-01	4.170E-01	3.993E-01	
OPu-240	Pu-240	4.950E-08	2.103E-08	2.102E-08	2.102E-08	2.100E-08	2.099E-08	2.090E-08	2.063E-08	2.016E-08	1.829E-08	
OPu-240	Pu-240	1.000E+00	4.248E-01	4.247E-01	4.246E-01	4.243E-01	4.241E-01	4.222E-01	4.168E-01	4.074E-01	3.695E-01	
Pu-240	U-236	1.000E+00	0.000E+00	1.809E-09	5.506E-09	1.299E-08	2.061E-08	8.608E-08	3.190E-07	8.996E-07	5.551E-06	
Pu-240	Th-232	1.000E+00	0.000E+00	2.884E-19	2.526E-18	1.362E-17	3.353E-17	5.085E-16	4.968E-15	2.417E-14	2.522E-13	
Pu-240	Ra-228+D	1.000E+00	0.000E+00	2.116E-19	7.599E-18	7.009E-17	2.316E-16	6.720E-15	8.473E-14	4.421E-13	4.852E-12	
Pu-240	Th-228+D	1.000E+00	0.000E+00	1.650E-20	1.094E-18	2.312E-17	1.052E-16	5.256E-15	7.341E-14	3.914E-13	4.301E-12	
Pu-240	DSR(j)		4.248E-01	4.247E-01	4.246E-01	4.243E-01	4.241E-01	4.222E-01	4.168E-01	4.074E-01	3.695E-01	

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

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

0 Nuclide (i)	t = 0.000E+00	1.000E+00	3.000E+00	7.000E+00	1.100E+01	4.300E+01	1.350E+02	3.000E+02	1.000E+03
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	6.430E+00	6.580E+00	6.892E+00	7.561E+00	8.294E+00	1.740E+01	1.463E+02	6.665E+03	7.230E+10
Pu-239	3.531E+01	3.531E+01	3.531E+01	3.532E+01	3.533E+01	3.540E+01	3.560E+01	3.597E+01	3.757E+01
Pu-240	3.531E+01	3.532E+01	3.533E+01	3.535E+01	3.537E+01	3.553E+01	3.599E+01	3.682E+01	4.059E+01

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)	DSR(i,tmax)	G(i,tmax)
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	6.900E-02	0.000E+00	2.333E+00	6.430E+00	2.333E+00	6.430E+00
Pu-239	1.690E-01	0.000E+00	4.248E-01	3.531E+01	4.248E-01	3.531E+01
Pu-240	4.100E-02	0.000E+00	4.248E-01	3.531E+01	4.248E-01	3.531E+01

Attachment 2 Sheet No. 20 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 21
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated
DOSE(j,t), mrem/yr

ONuclide	Parent	THF(i)	t=	0.000E+00	1.000E+00	3.000E+00	7.000E+00	1.100E+01	4.300E+01	1.350E+02	3.000E+02	1.000E+03
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	Cs-137	1.000E+00		1.610E-01	1.573E-01	1.502E-01	1.369E-01	1.248E-01	5.950E-02	7.074E-03	1.553E-04	1.431E-11
OPu-239	Pu-239	1.000E+00		7.180E-02	7.179E-02	7.179E-02	7.177E-02	7.175E-02	7.161E-02	7.120E-02	7.047E-02	6.748E-02
OU-235	Pu-239	1.000E+00		0.000E+00	9.080E-11	2.728E-10	6.371E-10	1.002E-09	3.937E-09	1.254E-08	2.858E-08	1.049E-07
OPa-231	Pu-239	1.000E+00		0.000E+00	1.344E-14	1.192E-13	6.440E-13	1.597E-12	2.523E-11	2.742E-10	1.574E-09	2.737E-08
OAc-227	Pu-239	1.000E+00		0.000E+00	8.835E-15	1.171E-14	6.352E-14	1.699E-13	9.370E-12	3.061E-10	2.781E-09	7.018E-08
OPu-240	Pu-240	4.950E-08		8.620E-10	8.619E-10	8.617E-10	8.612E-10	8.607E-10	8.569E-10	8.460E-10	8.268E-10	7.499E-10
Pu-240	Pu-240	1.000E+00		1.741E-02	1.741E-02	1.741E-02	1.740E-02	1.739E-02	1.731E-02	1.709E-02	1.670E-02	1.515E-02
Pu-240	adose(j)			1.741E-02	1.741E-02	1.741E-02	1.740E-02	1.739E-02	1.731E-02	1.709E-02	1.670E-02	1.515E-02
OU-236	Pu-240	1.000E+00		0.000E+00	7.416E-11	2.257E-10	5.328E-10	8.450E-10	3.529E-09	1.308E-08	3.688E-08	2.276E-07
OTH-232	Pu-240	1.000E+00		0.000E+00	1.182E-20	1.036E-19	5.584E-19	1.375E-18	2.085E-17	2.037E-16	9.908E-16	1.034E-14
ORa-228	Pu-240	1.000E+00		0.000E+00	8.674E-21	3.116E-19	2.874E-18	9.494E-18	2.755E-16	3.474E-15	1.813E-14	1.989E-13
OTH-228	Pu-240	1.000E+00		0.000E+00	6.767E-22	4.486E-20	9.481E-19	4.314E-18	2.155E-16	3.010E-15	1.605E-14	1.764E-13
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii

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

Attachment 2 Sheet No. 21 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 2

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 22
Summary : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

ONuclide	Parent	THF(i)	t=	0.000E+00	1.000E+00	3.000E+00	7.000E+00	1.100E+01	4.300E+01	1.350E+02	3.000E+02	1.000E+03
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	Cs-137	1.000E+00	6.900E-02	6.742E-02	6.435E-02	5.864E-02	5.344E-02	2.540E-02	2.995E-03	6.475E-05	5.582E-12	
OPu-239	Pu-239	1.000E+00	1.690E-01	1.690E-01	1.690E-01	1.689E-01	1.689E-01	1.685E-01	1.676E-01	1.659E-01	1.588E-01	
OU-235	Pu-239	1.000E+00	0.000E+00	1.664E-10	4.992E-10	1.164E-09	1.829E-09	7.127E-09	2.218E-08	4.849E-08	1.510E-07	
OPa-231	Pu-239	1.000E+00	0.000E+00	1.761E-15	1.584E-14	8.621E-14	2.128E-13	3.240E-12	3.159E-11	1.530E-10	1.568E-09	
OAc-227	Pu-239	1.000E+00	0.000E+00	1.853E-17	4.924E-16	6.060E-15	2.279E-14	1.082E-12	2.018E-11	1.237E-10	1.463E-09	
OPu-240	Pu-240	4.950E-08	2.029E-09	2.029E-09	2.029E-09	2.028E-09	2.026E-09	2.017E-09	1.992E-09	1.946E-09	1.766E-09	
Pu-240	Pu-240	1.000E+00	4.100E-02	4.099E-02	4.098E-02	4.096E-02	4.094E-02	4.076E-02	4.024E-02	3.932E-02	3.567E-02	
Pu-240	as(j):		4.100E-02	4.099E-02	4.098E-02	4.096E-02	4.094E-02	4.076E-02	4.024E-02	3.932E-02	3.567E-02	
OU-236	Pu-240	1.000E+00	0.000E+00	1.214E-09	3.640E-09	8.488E-09	1.333E-08	5.188E-08	1.609E-07	3.495E-07	1.059E-06	
OTH-232	Pu-240	1.000E+00	0.000E+00	2.994E-20	2.694E-19	1.466E-18	3.619E-18	5.514E-17	5.390E-16	2.622E-15	2.735E-14	
ORa-228	Pu-240	1.000E+00	0.000E+00	1.168E-21	2.974E-20	3.382E-19	1.184E-18	3.795E-17	4.768E-16	2.481E-15	2.690E-14	
OTH-228	Pu-240	1.000E+00	0.000E+00	9.909E-23	6.699E-21	1.430E-19	6.524E-19	3.268E-17	4.567E-16	2.435E-15	2.676E-14	
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii

THF(i) is the thread fraction of the parent nuclide.
ORESCALC.EXE execution time = 9.73 seconds

Attachment 2 Sheet No. 22 of 22
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

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1RESRAD, Version 6.3      T« Limit = 180 days      08/15/2007  18:05  Page   1
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File    : 118-F-2_Excavation_SZ.RAD
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Table of Contents

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Part III: Intake Quantities and Health Risk Factors

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Cancer Risk Slope Factors	2
Risk Slope and ETFG for the Ground Pathway	4
Amount of Intake quantities and Excess Cancer Risks	
Time= 0.000E+00	5
Time= 1.000E+00	8
Time= 3.000E+00	11
Time= 7.000E+00	14
Time= 1.100E+01	17
Time= 4.300E+01	20
Time= 1.350E+02	23
Time= 3.000E+02	26
Time= 1.000E+03	29

Attachment 3 Sheet No. 1 of 31
 Originator: S. W. Clark *swc* Date 8/16/87
 Chk'd By M. W. Perrott *mwp* Date 8/16/87
 Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 2
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Cancer Risk Slope Factors Summary Table
Risk Library: HEAST 2001 Morbidity

0	Menu	Parameter	Current Value	Base Case*	Parameter Name
		AAAAA			AAAAA
	Sf-1	Ground external radiation slope factors, 1/yr per (pCi/g):			
	Sf-1	Ac-227+D	1.47E-06	3.48E-10	SLPF(1,1)
	Sf-1	Cs-137+D	2.55E-06	5.32E-10	SLPF(2,1)
	Sf-1	Pa-231	1.39E-07	1.39E-07	SLPF(3,1)
	Sf-1	Pu-239	2.00E-10	2.00E-10	SLPF(4,1)
	Sf-1	Pu-240	6.98E-11	6.98E-11	SLPF(5,1)
	Sf-1	Ra-228+D	4.53E-06	0.00E+00	SLPF(7,1)
	Sf-1	Th-228+D	7.76E-06	5.59E-09	SLPF(8,1)
	Sf-1	Th-232	3.42E-10	3.42E-10	SLPF(9,1)
	Sf-1	U-235+D	5.43E-07	5.18E-07	SLPF(10,1)
	Sf-1	U-236	1.25E-10	1.25E-10	SLPF(11,1)
	Sf-2	Inhalation, slope factors, 1/(pCi):			
	Sf-2	Ac-227+D	2.09E-07	1.49E-07	SLPF(1,2)
	Sf-2	Cs-137+D	1.19E-11	1.19E-11	SLPF(2,2)
	Sf-2	Pa-231	4.55E-08	4.55E-08	SLPF(3,2)
	Sf-2	Pu-239	3.33E-08	3.33E-08	SLPF(4,2)
	Sf-2	Pu-240	3.33E-08	3.33E-08	SLPF(5,2)
	Sf-2	Ra-228+D	5.23E-09	5.18E-09	SLPF(7,2)
	Sf-2	Th-228+D	1.43E-07	1.32E-07	SLPF(8,2)
	Sf-2	Th-232	4.33E-08	4.33E-08	SLPF(9,2)
	Sf-2	U-235+D	1.01E-08	1.01E-08	SLPF(10,2)
	Sf-2	U-236	1.05E-08	1.05E-08	SLPF(11,2)
	Sf-3	Food ingestion, slope factors, 1/(pCi):			
	Sf-3	Ac-227+D	6.53E-10	2.45E-10	SLPF(1,3)
	Sf-3	Cs-137+D	3.74E-11	3.74E-11	SLPF(2,3)
	Sf-3	Pa-231	2.26E-10	2.26E-10	SLPF(3,3)
	Sf-3	Pu-239	1.74E-10	1.74E-10	SLPF(4,3)
	Sf-3	Pu-240	1.74E-10	1.74E-10	SLPF(5,3)
	Sf-3	Ra-228+D	1.43E-09	1.43E-09	SLPF(7,3)
	Sf-3	Th-228+D	4.22E-10	1.48E-10	SLPF(8,3)
	Sf-3	Th-232	1.33E-10	1.33E-10	SLPF(9,3)
	Sf-3	U-235+D	9.76E-11	9.44E-11	SLPF(10,3)
	Sf-3	U-236	9.03E-11	9.03E-11	SLPF(11,3)
	Sf-3	Water ingestion, slope factors, 1/(pCi):			
	Sf-3	Ac-227+D	4.86E-10	2.01E-10	SLPF(1,4)
	Sf-3	Cs-137+D	3.04E-11	3.04E-11	SLPF(2,4)
	Sf-3	Pa-231	1.73E-10	1.73E-10	SLPF(3,4)
	Sf-3	Pu-239	1.35E-10	1.35E-10	SLPF(4,4)
	Sf-3	Pu-240	1.35E-10	1.35E-10	SLPF(5,4)
	Sf-3	Ra-228+D	1.04E-09	1.04E-09	SLPF(7,4)
	Sf-3	Th-228+D	3.00E-10	1.07E-10	SLPF(8,4)
	Sf-3	Th-232	1.01E-10	1.01E-10	SLPF(9,4)
	Sf-3	U-235+D	7.18E-11	6.96E-11	SLPF(10,4)
	Sf-3	U-236	6.70E-11	6.70E-11	SLPF(11,4)
	Sf-3	Soil ingestion, slope factors, 1/(pCi):			
	Sf-3	Ac-227+D	1.16E-09	3.81E-10	SLPF(1,5)

Attachment 3 Sheet No. 2 of 31
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 3
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Cancer Risk Slope Factors Summary Table (continued)
Risk Library: HEAST 2001 Morbidity

0	Menu	Parameter	Current Value	Base Case*	Parameter Name
		AAAAAA			AAAAAA
Sf-3	Cs-137+D		4.33E-11	4.33E-11	SLPF(2,5)
Sf-3	Pa-231		3.74E-10	3.74E-10	SLPF(3,5)
Sf-3	Pu-239		2.76E-10	2.76E-10	SLPF(4,5)
Sf-3	Pu-240		2.77E-10	2.77E-10	SLPF(5,5)
Sf-3	Ra-228+D		2.29E-09	2.28E-09	SLPF(7,5)
Sf-3	Th-228+D		8.09E-10	2.89E-10	SLPF(8,5)
Sf-3	Th-232		2.31E-10	2.31E-10	SLPF(9,5)
Sf-3	U-235+D		1.63E-10	1.57E-10	SLPF(10,5)
Sf-3	U-236		1.49E-10	1.49E-10	SLPF(11,5)
Sf-Rn	Radon Inhalation slope factors, 1/(pCi):				
Sf-Rn	Rn-220Inhalation slope factors, 1/(pCi):		1.90E-13	1.90E-13	SLPFRN(2,1)
Sf-Rn	Po-216Inhalation slope factors, 1/(pCi):		3.00E-15	3.00E-15	SLPFRN(2,2)
Sf-Rn	Pb-212Inhalation slope factors, 1/(pCi):		3.90E-11	3.90E-11	SLPFRN(2,3)
Sf-Rn	Bi-212Inhalation slope factors, 1/(pCi):		3.70E-11	3.70E-11	SLPFRN(2,4)
Sf-Rn	Radon K factors, (mrem/WLM):				
Sf-Rn	Rn-220 Indoor		1.50E+02	1.50E+02	KFACTR(2,1)
Sf-Rn	Rn-220 Outdoor		2.50E+02	2.50E+02	KFACTR(2,2)

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

Attachment 3 Sheet No. 3 of 31
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 4
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

ONuclide	Slope(i)*	Risk Slope and Environmental Transport Factors for the Ground Pathway									
		ETFG(i,t) At Time in Years (dimensionless)									
(i)	t=	0.000E+00	1.000E+00	3.000E+00	7.000E+00	1.100E+01	4.300E+01	1.350E+02	3.000E+02	1.000E+03	
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	
Ac-227	3.480E-10	6.433E-01	6.433E-01	6.433E-01	6.433E-01	6.433E-01	6.433E-01	6.433E-01	6.433E-01	6.433E-01	
Ac-228	4.530E-06	6.319E-01	6.319E-01	6.319E-01	6.319E-01	6.319E-01	6.319E-01	6.319E-01	6.319E-01	6.319E-01	
Ba-137m	2.690E-06	6.274E-01	6.274E-01	6.274E-01	6.274E-01	6.274E-01	6.274E-01	6.274E-01	6.274E-01	6.274E-01	
Bi-211	1.880E-07	6.349E-01	6.349E-01	6.349E-01	6.349E-01	6.349E-01	6.349E-01	6.349E-01	6.349E-01	6.349E-01	
Bi-212	8.870E-07	6.290E-01	6.290E-01	6.290E-01	6.290E-01	6.290E-01	6.290E-01	6.290E-01	6.290E-01	6.290E-01	
Cs-137	5.320E-10	6.386E-01	6.386E-01	6.386E-01	6.386E-01	6.386E-01	6.386E-01	6.386E-01	6.386E-01	6.386E-01	
Fr-223	1.400E-07	6.381E-01	6.381E-01	6.381E-01	6.381E-01	6.381E-01	6.381E-01	6.381E-01	6.381E-01	6.381E-01	
Pa-231	1.390E-07	6.351E-01	6.351E-01	6.351E-01	6.351E-01	6.351E-01	6.351E-01	6.351E-01	6.351E-01	6.351E-01	
Pb-211	2.290E-07	6.308E-01	6.308E-01	6.308E-01	6.308E-01	6.308E-01	6.308E-01	6.308E-01	6.308E-01	6.308E-01	
Pb-212	5.090E-07	6.396E-01	6.396E-01	6.396E-01	6.396E-01	6.396E-01	6.396E-01	6.396E-01	6.396E-01	6.396E-01	
Po-211	3.580E-08	6.274E-01	6.274E-01	6.274E-01	6.274E-01	6.274E-01	6.274E-01	6.274E-01	6.274E-01	6.274E-01	
Po-212	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	
Po-215	7.480E-10	6.308E-01	6.308E-01	6.308E-01	6.308E-01	6.308E-01	6.308E-01	6.308E-01	6.308E-01	6.308E-01	
Po-216	7.870E-11	6.306E-01	6.306E-01	6.306E-01	6.306E-01	6.306E-01	6.306E-01	6.306E-01	6.306E-01	6.306E-01	
Pu-239	2.000E-10	6.413E-01	6.413E-01	6.413E-01	6.413E-01	6.413E-01	6.413E-01	6.413E-01	6.413E-01	6.413E-01	
Pu-240	6.980E-11	6.652E-01	6.652E-01	6.652E-01	6.652E-01	6.652E-01	6.652E-01	6.652E-01	6.652E-01	6.652E-01	
Ra-223	4.340E-07	6.379E-01	6.379E-01	6.379E-01	6.379E-01	6.379E-01	6.379E-01	6.379E-01	6.379E-01	6.379E-01	
Ra-224	3.720E-08	6.388E-01	6.388E-01	6.388E-01	6.388E-01	6.388E-01	6.388E-01	6.388E-01	6.388E-01	6.388E-01	
Ra-228	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	
Rn-219	2.250E-07	6.349E-01	6.349E-01	6.349E-01	6.349E-01	6.349E-01	6.349E-01	6.349E-01	6.349E-01	6.349E-01	
Rn-220	1.700E-09	6.281E-01	6.281E-01	6.281E-01	6.281E-01	6.281E-01	6.281E-01	6.281E-01	6.281E-01	6.281E-01	
Th-227	3.780E-07	6.392E-01	6.392E-01	6.392E-01	6.392E-01	6.392E-01	6.392E-01	6.392E-01	6.392E-01	6.392E-01	
Th-228	5.590E-09	6.420E-01	6.420E-01	6.420E-01	6.420E-01	6.420E-01	6.420E-01	6.420E-01	6.420E-01	6.420E-01	
Th-231	2.450E-08	6.451E-01	6.451E-01	6.451E-01	6.451E-01	6.451E-01	6.451E-01	6.451E-01	6.451E-01	6.451E-01	
Th-232	3.420E-10	6.476E-01	6.476E-01	6.476E-01	6.476E-01	6.476E-01	6.476E-01	6.476E-01	6.476E-01	6.476E-01	
Tl-207	1.520E-08	6.307E-01	6.307E-01	6.307E-01	6.307E-01	6.307E-01	6.307E-01	6.307E-01	6.307E-01	6.307E-01	
Tl-208	1.760E-05	6.338E-01	6.338E-01	6.338E-01	6.338E-01	6.338E-01	6.338E-01	6.338E-01	6.338E-01	6.338E-01	
U-235	5.180E-07	6.401E-01	6.401E-01	6.401E-01	6.401E-01	6.401E-01	6.401E-01	6.401E-01	6.401E-01	6.401E-01	
U-236	1.250E-10	6.552E-01	6.552E-01	6.552E-01	6.552E-01	6.552E-01	6.552E-01	6.552E-01	6.552E-01	6.552E-01	
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	

* - Units are 1/yr per (pCi/g) at infinite depth and area. Multiplication by ETFG(i,t) converts to site conditions.

Attachment 3 Sheet No. 4 of 31
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 5
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 0.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	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	0.000E+00
Cs-137	2.617E-03	1.555E+02	6.554E+01	4.071E+01	4.030E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.658E+02
Pa-231	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	0.000E+00
Pu-239	6.409E-03	9.530E+00	9.441E-02	2.562E-03	9.870E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.950E+01
Pu-240	1.555E-03	2.312E+00	2.291E-02	6.216E-04	2.394E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.730E+00
Ra-228	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	0.000E+00
Th-228	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	0.000E+00
Th-232	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	0.000E+00
U-235	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	0.000E+00
U-236	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	0.000E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

0

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 0.000E+00 years

0

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Attachment 3 Sheet No. 5 of 31
Originator: S.W. Clark Date
Chk'd By M.W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 6
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p) and Fraction of Total Risk at t= 0.000E+00 years												
Water Independent Pathways (Inhalation excludes radon)												
	Ground		Inhalation		Plant		Meat		Milk		Soil	
Radio- Nuclide	AAAAAA risk	AAAAAA fract.	AAAAAA risk	AAAAAA fract.	AAAAAA risk	AAAAAA fract.	AAAAAA risk	AAAAAA fract.	AAAAAA risk	AAAAAA fract.	AAAAAA risk	AAAAAA fract.
Ac-227	2.939E-18	0.0000	2.491E-20	0.0000	2.949E-19	0.0000	1.304E-21	0.0000	7.249E-22	0.0000	2.135E-19	0.0000
Cs-137	2.380E-06	0.8590	6.727E-13	0.0000	1.257E-07	0.0453	5.295E-08	0.0191	3.289E-08	0.0119	3.769E-09	0.0014
Pa-231	1.395E-18	0.0000	2.727E-20	0.0000	2.007E-18	0.0000	2.051E-19	0.0000	5.199E-22	0.0000	3.452E-19	0.0000
Pu-239	6.497E-10	0.0002	6.397E-09	0.0023	4.970E-08	0.0179	4.924E-10	0.0002	1.336E-11	0.0000	8.164E-08	0.0295
Pu-240	5.699E-11	0.0000	1.550E-09	0.0006	1.204E-08	0.0043	1.193E-10	0.0000	3.238E-12	0.0000	1.986E-08	0.0072
Ra-228	3.890E-22	0.0000	2.695E-26	0.0000	4.350E-22	0.0000	5.940E-24	0.0000	1.402E-23	0.0000	1.814E-23	0.0000
Th-228	4.944E-22	0.0000	5.436E-25	0.0000	4.083E-24	0.0000	6.381E-26	0.0000	8.027E-27	0.0000	4.747E-24	0.0000
Th-232	5.956E-26	0.0000	4.416E-25	0.0000	2.028E-24	0.0000	2.034E-26	0.0000	2.817E-27	0.0000	3.628E-24	0.0000
U-235	2.597E-14	0.0000	2.864E-17	0.0000	1.027E-15	0.0000	1.629E-17	0.0000	7.618E-17	0.0000	7.132E-16	0.0000
U-236	4.461E-17	0.0000	2.169E-16	0.0000	6.921E-15	0.0000	1.098E-16	0.0000	5.134E-16	0.0000	4.740E-15	0.0000
Total	2.381E-06	0.8593	7.947E-09	0.0029	1.874E-07	0.0676	5.356E-08	0.0193	3.290E-08	0.0119	1.053E-07	0.0380

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p) and Fraction of Total Risk at t= 0.000E+00 years												
Water Dependent Pathways												
	Water		Fish		Plant		Meat		Milk		All Pathways**	
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Ac-227	2.411E-19	0.0000	7.821E-21	0.0000	3.686E-20	0.0000	5.339E-23	0.0000	1.234E-22	0.0000	3.760E-18	0.0000
Cs-137	1.131E-09	0.0004	1.088E-09	0.0004	1.547E-10	0.0001	2.833E-10	0.0001	2.212E-10	0.0001	2.598E-06	0.9377
Pa-231	5.500E-20	0.0000	4.123E-22	0.0000	7.608E-21	0.0000	2.283E-21	0.0000	7.001E-24	0.0000	4.046E-18	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	1.389E-07	0.0501
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	3.363E-08	0.0121
Ra-228	2.094E-23	0.0000	6.762E-25	0.0000	3.083E-24	0.0000	1.947E-25	0.0000	5.582E-25	0.0000	8.876E-22	0.0000
Th-228	1.297E-26	0.0000	1.842E-27	0.0000	1.307E-26	0.0000	1.368E-27	0.0000	1.834E-28	0.0000	5.039E-22	0.0000
Th-232	2.466E-27	0.0000	1.517E-28	0.0000	4.719E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.183E-24	0.0000
U-235	5.024E-17	0.0000	3.388E-19	0.0000	7.483E-18	0.0000	1.552E-19	0.0000	8.071E-19	0.0000	2.789E-14	0.0000
U-236	3.418E-16	0.0000	2.285E-18	0.0000	5.047E-17	0.0000	1.046E-18	0.0000	5.441E-18	0.0000	1.295E-14	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.131E-09	0.0004	1.088E-09	0.0004	1.547E-10	0.0001	2.833E-10	0.0001	2.212E-10	0.0001	2.771E-06	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Attachment 3 Sheet No. 6 of 31
Originator: S.W. Clark Date _____
Chk'd By M.W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:05 Page 7
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 0.000E+00 years

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	2.380E-06	0.8590	6.727E-13	0.0000	0.000E+00	0.0000	1.257E-07	0.0453	5.295E-08	0.0191	3.289E-08	0.0119	3.769E-09	0.0014
Pu-239	6.497E-10	0.0002	6.397E-09	0.0023	0.000E+00	0.0000	4.970E-08	0.0179	4.924E-10	0.0002	1.336E-11	0.0000	8.164E-08	0.0295
Pu-240	5.699E-11	0.0000	1.550E-09	0.0006	0.000E+00	0.0000	1.204E-08	0.0043	1.193E-10	0.0000	3.239E-12	0.0000	1.986E-08	0.0072
Total	2.381E-06	0.8593	7.947E-09	0.0029	0.000E+00	0.0000	1.874E-07	0.0676	5.356E-08	0.0193	3.290E-08	0.0119	1.053E-07	0.0380

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	1.131E-09	0.0004	1.088E-09	0.0004	0.000E+00	0.0000	1.547E-10	0.0001	2.833E-10	0.0001	2.212E-10	0.0001	2.598E-06	0.9377
Pu-239	5.054E-17	0.0000	3.470E-19	0.0000	0.000E+00	0.0000	7.527E-18	0.0000	1.575E-19	0.0000	8.072E-19	0.0000	1.389E-07	0.0501
Pu-240	3.418E-16	0.0000	2.285E-18	0.0000	0.000E+00	0.0000	5.047E-17	0.0000	1.046E-18	0.0000	5.441E-18	0.0000	3.363E-08	0.0121
Total	1.131E-09	0.0004	1.088E-09	0.0004	0.000E+00	0.0000	1.547E-10	0.0001	2.833E-10	0.0001	2.212E-10	0.0001	2.771E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 3 Sheet No. 7 of 31
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T* Limit = 180 days 08/15/2007 18:05 Page 8
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	7.029E-19	3.435E-15	1.449E-16	7.613E-18	1.082E-15	5.395E-13	1.075E-14	4.012E-14	3.414E-17	9.380E-17	5.952E-13
Cs-137	2.557E-03	1.520E+02	6.403E+01	3.977E+01	3.937E+00	1.258E-01	9.420E-02	1.275E-02	1.456E-02	1.541E-02	2.600E+02
Pa-231	6.677E-17	9.375E-13	8.193E-14	3.268E-16	1.028E-13	1.051E-13	5.454E-16	9.231E-15	2.167E-15	1.028E-17	1.240E-12
Pu-239	6.409E-03	9.529E+00	9.441E-02	2.562E-03	9.869E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.950E+01
Pu-240	1.555E-03	2.312E+00	2.290E-02	6.216E-04	2.394E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.729E+00
Ra-228	4.428E-23	2.349E-18	2.230E-20	6.282E-20	6.818E-20	4.055E-19	9.040E-21	3.741E-20	1.846E-22	2.400E-21	2.956E-18
Th-228	3.758E-24	3.636E-20	5.540E-22	7.965E-23	5.787E-21	4.094E-22	6.292E-23	4.880E-22	3.657E-24	2.392E-24	4.375E-20
Th-232	1.135E-21	1.871E-18	2.241E-20	4.011E-21	1.748E-18	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.646E-18
U-235	6.311E-12	2.292E-08	3.505E-10	1.707E-09	9.719E-09	7.677E-11	3.501E-13	6.997E-12	5.718E-14	5.568E-13	3.479E-08
U-236	4.602E-11	1.672E-07	2.556E-09	1.244E-08	7.087E-08	5.589E-10	2.549E-12	5.095E-11	4.189E-13	4.065E-12	2.537E-07

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

0

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 1.000E+00 years

0

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent   Water-dep. == Water-dependent

Attachment 3 Sheet No. 8 of 31
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 9
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	3.332E-18	0.0000	2.824E-20	0.0000	3.342E-19	0.0000	1.448E-21	0.0000	8.215E-22	0.0000	2.421E-19	0.0000
Cs-137	2.326E-06	0.8577	6.572E-13	0.0000	1.228E-07	0.0453	5.173E-08	0.0191	3.213E-08	0.0119	3.683E-09	0.0014
Pa-231	1.539E-18	0.0000	3.009E-20	0.0000	2.215E-18	0.0000	2.263E-19	0.0000	5.733E-22	0.0000	3.809E-19	0.0000
Pu-239	6.497E-10	0.0002	6.396E-09	0.0024	4.970E-08	0.0183	4.924E-10	0.0002	1.336E-11	0.0000	8.164E-08	0.0301
Pu-240	5.699E-11	0.0000	1.550E-09	0.0006	1.204E-08	0.0044	1.193E-10	0.0000	3.238E-12	0.0000	1.985E-08	0.0073
Ra-228	4.367E-22	0.0000	3.025E-26	0.0000	4.885E-22	0.0000	6.674E-24	0.0000	1.575E-23	0.0000	2.036E-23	0.0000
Th-228	5.604E-22	0.0000	6.162E-25	0.0000	4.610E-24	0.0000	7.193E-26	0.0000	9.049E-27	0.0000	5.380E-24	0.0000
Th-232	6.571E-26	0.0000	4.872E-25	0.0000	2.237E-24	0.0000	2.243E-26	0.0000	3.102E-27	0.0000	4.002E-24	0.0000
U-235	2.770E-14	0.0000	3.054E-17	0.0000	1.095E-15	0.0000	1.738E-17	0.0000	8.125E-17	0.0000	7.607E-16	0.0000
U-236	4.758E-17	0.0000	2.313E-16	0.0000	7.382E-15	0.0000	1.171E-16	0.0000	5.475E-16	0.0000	5.055E-15	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	2.326E-06	0.8580	7.947E-09	0.0029	1.845E-07	0.0680	5.235E-08	0.0193	3.215E-08	0.0119	1.052E-07	0.0388

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	2.529E-19	0.0000	8.319E-21	0.0000	3.987E-20	0.0000	6.282E-23	0.0000	1.428E-22	0.0000	4.240E-18	0.0000
Cs-137	1.189E-09	0.0004	1.143E-09	0.0004	1.625E-10	0.0001	2.972E-10	0.0001	2.322E-10	0.0001	2.539E-06	0.9364
Pa-231	5.573E-20	0.0000	4.256E-22	0.0000	7.997E-21	0.0000	2.581E-21	0.0000	7.479E-24	0.0000	4.459E-18	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	1.389E-07	0.0512
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	3.362E-08	0.0124
Ra-228	2.187E-23	0.0000	7.173E-25	0.0000	3.320E-24	0.0000	2.105E-25	0.0000	6.026E-25	0.0000	9.948E-22	0.0000
Th-228	1.354E-26	0.0000	1.954E-27	0.0000	1.411E-26	0.0000	1.478E-27	0.0000	1.966E-28	0.0000	5.711E-22	0.0000
Th-232	2.579E-27	0.0000	1.610E-28	0.0000	5.117E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.821E-24	0.0000
U-235	5.543E-17	0.0000	3.739E-19	0.0000	8.258E-18	0.0000	1.714E-19	0.0000	8.912E-19	0.0000	2.975E-14	0.0000
U-236	3.771E-16	0.0000	2.521E-18	0.0000	5.567E-17	0.0000	1.156E-18	0.0000	6.008E-18	0.0000	1.382E-14	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.189E-09	0.0004	1.143E-09	0.0004	1.625E-10	0.0001	2.972E-10	0.0001	2.322E-10	0.0001	2.711E-06	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Attachment 3 Sheet No. 9 of 31
Originator: S. W. Clark Date
Chk'd By: M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 10
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 1.000E+00 years

0 Radonulides
Radon Pathway Rn-222 Po-218 Pb-214 Bi-214 Rn-220 Po-216 Pb-212 Bi-212
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 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 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 0.000E+00 0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

0 Water Independent Pathways (Inhalation excludes radon)
0 Ground Inhalation Radon Plant Meat Milk Soil
Radio- Nuclide risk fract. risk fract. risk fract. risk fract. risk fract. risk fract. risk fract.
Cs-137 2.326E-06 0.8577 6.572E-13 0.0000 0.000E+00 0.0000 1.228E-07 0.0453 5.173E-08 0.0191 3.213E-08 0.0119 3.683E-09 0.0014
Pu-239 6.497E-10 0.0002 6.396E-09 0.0024 0.000E+00 0.0000 4.970E-08 0.0183 4.924E-10 0.0002 1.336E-11 0.0000 8.164E-08 0.0301
Pu-240 5.699E-11 0.0000 1.550E-09 0.0006 0.000E+00 0.0000 1.204E-08 0.0044 1.193E-10 0.0000 3.238E-12 0.0000 1.985E-08 0.0073
Total 2.326E-06 0.8580 7.947E-09 0.0029 0.000E+00 0.0000 1.845E-07 0.0680 5.235E-08 0.0193 3.215E-08 0.0119 1.052E-07 0.0388

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Water Dependent Pathways

Radio- Nuclide Water Fish Radon Plant Meat Milk All pathways
risk fract. risk fract. risk fract. risk fract. risk fract. risk fract. risk fract.
Cs-137 1.189E-09 0.0004 1.143E-09 0.0004 0.000E+00 0.0000 1.625E-10 0.0001 2.972E-10 0.0001 2.322E-10 0.0001 2.539E-06 0.9364
Pu-239 5.574E-17 0.0000 3.826E-19 0.0000 0.000E+00 0.0000 8.306E-18 0.0000 1.741E-19 0.0000 8.914E-19 0.0000 1.389E-07 0.0512
Pu-240 3.771E-16 0.0000 2.521E-18 0.0000 0.000E+00 0.0000 5.567E-17 0.0000 1.156E-18 0.0000 6.008E-18 0.0000 3.362E-08 0.0124
Total 1.189E-09 0.0004 1.143E-09 0.0004 0.000E+00 0.0000 1.625E-10 0.0001 2.972E-10 0.0001 2.322E-10 0.0001 2.711E-06 1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 3 Sheet No. 10 of 31
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 11
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 3.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	1.867E-17	7.718E-14	1.556E-15	1.841E-16	2.876E-14	5.358E-13	1.534E-14	8.100E-14	7.610E-17	1.864E-16	7.401E-13
Cs-137	2.441E-03	1.451E+02	6.112E+01	3.797E+01	3.758E+00	3.620E-01	2.796E-01	3.923E-02	6.466E-02	5.378E-02	2.487E+02
Pa-231	6.008E-16	8.761E-12	8.557E-13	2.496E-15	9.252E-13	3.908E-13	2.362E-15	4.524E-14	1.319E-14	3.608E-17	1.100E-11
Pu-239	6.408E-03	9.528E+00	9.440E-02	2.562E-03	9.868E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.949E+01
Pu-240	1.554E-03	2.311E+00	2.290E-02	6.214E-04	2.393E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.728E+00
Ra-228	1.128E-21	6.440E-17	7.925E-19	1.964E-18	1.737E-18	6.275E-17	1.283E-18	4.816E-18	2.579E-20	3.698E-19	1.381E-16
Th-228	2.541E-22	1.225E-18	2.179E-20	2.786E-21	3.912E-19	1.345E-19	1.182E-20	6.674E-20	5.326E-22	3.713E-22	1.855E-18
Th-232	1.022E-20	1.575E-17	1.687E-19	2.573E-20	1.573E-17	7.293E-20	2.972E-21	6.423E-21	5.312E-24	1.092E-23	3.176E-17
U-235	1.893E-11	6.981E-08	1.096E-09	5.184E-09	2.915E-08	6.974E-10	3.373E-12	7.242E-11	1.203E-12	7.166E-12	1.060E-07
U-236	1.380E-10	5.090E-07	7.992E-09	3.779E-08	2.126E-07	5.104E-09	2.466E-11	5.289E-10	8.755E-12	5.235E-11	7.731E-07

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

0 Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 3.000E+00 years

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Attachment 3 Sheet No. 11 of 31
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 12
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+00 years

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	4.230E-18	0.0000	3.586E-20	0.0000	4.239E-19	0.0000	1.765E-21	0.0000	1.042E-21	0.0000	3.074E-19	0.0000
Cs-137	2.220E-06	0.8550	6.274E-13	0.0000	1.172E-07	0.0451	4.938E-08	0.0190	3.067E-08	0.0118	3.515E-09	0.0014
Pa-231	1.855E-18	0.0000	3.626E-20	0.0000	2.670E-18	0.0000	2.729E-19	0.0000	6.902E-22	0.0000	4.590E-19	0.0000
Pu-239	6.496E-10	0.0003	6.396E-09	0.0025	4.969E-08	0.0191	4.923E-10	0.0002	1.336E-11	0.0000	8.163E-08	0.0314
Pu-240	5.697E-11	0.0000	1.549E-09	0.0006	1.204E-08	0.0046	1.193E-10	0.0000	3.237E-12	0.0000	1.985E-08	0.0076
Ra-228	5.441E-22	0.0000	3.769E-26	0.0000	6.088E-22	0.0000	8.324E-24	0.0000	1.963E-23	0.0000	2.537E-23	0.0000
Th-228	7.105E-22	0.0000	7.812E-25	0.0000	5.804E-24	0.0000	9.027E-26	0.0000	1.136E-26	0.0000	6.821E-24	0.0000
Th-232	7.920E-26	0.0000	5.872E-25	0.0000	2.695E-24	0.0000	2.700E-26	0.0000	3.730E-27	0.0000	4.824E-24	0.0000
U-235	3.115E-14	0.0000	3.436E-17	0.0000	1.232E-15	0.0000	1.955E-17	0.0000	9.141E-17	0.0000	8.556E-16	0.0000
U-236	5.352E-17	0.0000	2.602E-16	0.0000	8.304E-15	0.0000	1.318E-16	0.0000	6.159E-16	0.0000	5.686E-15	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	2.221E-06	0.8553	7.946E-09	0.0031	1.789E-07	0.0689	5.000E-08	0.0193	3.069E-08	0.0118	1.050E-07	0.0404

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	3.339E-19	0.0000	1.111E-20	0.0000	5.370E-20	0.0000	8.277E-23	0.0000	1.877E-22	0.0000	5.399E-18	0.0000
Cs-137	1.294E-09	0.0005	1.244E-09	0.0005	1.770E-10	0.0001	3.248E-10	0.0001	2.533E-10	0.0001	2.424E-06	0.9336
Pa-231	7.652E-20	0.0000	5.840E-22	0.0000	1.097E-20	0.0000	3.136E-21	0.0000	1.005E-23	0.0000	5.385E-18	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	1.389E-07	0.0535
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	3.361E-08	0.0129
Ra-228	2.730E-23	0.0000	8.828E-25	0.0000	4.036E-24	0.0000	2.423E-25	0.0000	7.375E-25	0.0000	1.239E-21	0.0000
Th-228	1.690E-26	0.0000	2.405E-27	0.0000	1.711E-26	0.0000	1.699E-27	0.0000	2.505E-28	0.0000	7.240E-22	0.0000
Th-232	3.222E-27	0.0000	1.975E-28	0.0000	6.194E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.220E-24	0.0000
U-235	6.682E-17	0.0000	4.508E-19	0.0000	9.961E-18	0.0000	2.073E-19	0.0000	1.076E-18	0.0000	3.346E-14	0.0000
U-236	4.545E-16	0.0000	3.039E-18	0.0000	6.715E-17	0.0000	1.397E-18	0.0000	7.254E-18	0.0000	1.558E-14	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.294E-09	0.0005	1.244E-09	0.0005	1.770E-10	0.0001	3.248E-10	0.0001	2.533E-10	0.0001	2.597E-06	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Attachment 3 Sheet No. 12 of 31
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 13
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_S2.RAD

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 3.000E+00 years

Radon	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Pathway	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+00 years

Radionuclide	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
Cs-137	2.220E-06	0.8550	6.274E-13	0.0000	0.000E+00	0.0000	1.172E-07
Pu-239	6.496E-10	0.0003	6.396E-09	0.0025	0.000E+00	0.0000	4.969E-08
Pu-240	5.697E-11	0.0000	1.549E-09	0.0006	0.000E+00	0.0000	1.204E-08
Total	2.221E-06	0.8553	7.946E-09	0.0031	0.000E+00	0.0000	1.789E-07

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+00 years

Radionuclide	Water	Fish	Radon	Plant	Meat	Milk	All pathways
Cs-137	1.294E-09	0.0005	1.244E-09	0.0005	0.000E+00	0.0000	1.770E-10
Pu-239	6.723E-17	0.0000	4.625E-19	0.0000	0.000E+00	0.0000	1.003E-17
Pu-240	4.545E-16	0.0000	3.039E-18	0.0000	0.000E+00	0.0000	6.715E-17
Total	1.294E-09	0.0005	1.244E-09	0.0005	0.000E+00	0.0000	1.770E-10

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 3 Sheet No. 13 of 31
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T_{1/2} Limit = 180 days 08/15/2007 18:05 Page 14
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 7.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	2.298E-16	8.970E-13	9.259E-15	2.183E-15	3.539E-13	2.142E-12	4.773E-14	2.113E-13	3.116E-16	8.425E-16	3.664E-12
Cs-137	2.224E-03	1.322E+02	5.570E+01	3.460E+01	3.425E+00	7.711E-01	6.005E-01	8.508E-02	1.515E-01	1.203E-01	2.276E+02
Pa-231	3.269E-15	4.819E-11	4.852E-12	1.289E-14	5.035E-12	1.092E-12	6.833E-15	1.357E-13	4.772E-14	1.213E-16	5.938E-11
Pu-239	6.406E-03	9.526E+00	9.437E-02	2.561E-03	9.865E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.949E+01
Pu-240	1.553E-03	2.310E+00	2.288E-02	6.210E-04	2.392E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.725E+00
Ra-228	1.283E-20	7.479E-16	9.870E-18	2.366E-17	1.975E-17	2.622E-16	6.338E-18	2.985E-17	1.673E-18	5.577E-18	1.107E-15
Th-228	5.424E-21	1.791E-17	3.055E-19	3.836E-20	8.353E-18	5.650E-19	5.860E-20	4.314E-19	3.974E-20	6.464E-21	2.771E-17
Th-232	5.560E-20	8.399E-17	8.622E-19	1.236E-19	8.562E-17	3.093E-19	1.493E-20	3.998E-20	4.498E-22	8.641E-23	1.710E-16
U-235	4.415E-11	1.635E-07	2.586E-09	1.213E-08	6.800E-08	3.807E-09	1.873E-11	4.098E-10	7.929E-12	4.299E-11	2.505E-07
U-236	3.219E-10	1.192E-06	1.885E-08	8.845E-08	4.957E-07	2.781E-08	1.367E-10	2.991E-09	5.781E-11	3.136E-10	1.827E-06

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

0

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 7.000E+00 years

0

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent   Water-dep. == Water-dependent

Attachment 3 Sheet No. 14 of 31
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 15
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p) and Fraction of Total Risk at t= 7.000E+00 years												
Water Independent Pathways (Inhalation excludes radon)												
0	Ground		Inhalation		Plant		Meat		Milk		Soil	
0	Radio-	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
	Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
	Ac-227	6.527E-18	0.0000	5.533E-20	0.0000	6.531E-19	0.0000	2.531E-21	0.0000	1.607E-21	0.0000	4.743E-19
	Cs-137	2.023E-06	0.8492	5.717E-13	0.0000	1.068E-07	0.0448	4.500E-08	0.0189	2.795E-08	0.0117	3.203E-09
	Pa-231	2.599E-18	0.0000	5.079E-20	0.0000	3.740E-18	0.0000	3.827E-19	0.0000	9.651E-22	0.0000	6.429E-19
	Pu-239	6.494E-10	0.0003	6.394E-09	0.0027	4.968E-08	0.0209	4.922E-10	0.0002	1.336E-11	0.0000	8.161E-08
	Pu-240	5.694E-11	0.0000	1.549E-09	0.0007	1.203E-08	0.0051	1.192E-10	0.0001	3.235E-12	0.0000	1.984E-08
	Ra-228	8.094E-22	0.0000	5.607E-26	0.0000	9.061E-22	0.0000	1.241E-23	0.0000	2.924E-23	0.0000	3.774E-23
	Th-228	1.090E-21	0.0000	1.199E-24	0.0000	8.797E-24	0.0000	1.361E-25	0.0000	1.713E-26	0.0000	1.047E-23
	Th-232	1.109E-25	0.0000	8.224E-25	0.0000	3.773E-24	0.0000	3.774E-26	0.0000	5.204E-27	0.0000	6.756E-24
	U-235	3.806E-14	0.0000	4.198E-17	0.0000	1.506E-15	0.0000	2.391E-17	0.0000	1.117E-16	0.0000	1.045E-15
	U-236	6.538E-17	0.0000	3.179E-16	0.0000	1.015E-14	0.0000	1.611E-16	0.0000	7.526E-16	0.0000	6.946E-15
	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
	Total	2.024E-06	0.8495	7.943E-09	0.0033	1.685E-07	0.0707	4.561E-08	0.0191	2.797E-08	0.0117	1.046E-07

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p) and Fraction of Total Risk at t= 7.000E+00 years												
Water Dependent Pathways												
	Water		Fish		Plant		Meat		Milk		All Pathways**	
	Radio-	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
	Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
	Ac-227	5.864E-19	0.0000	1.891E-20	0.0000	8.862E-20	0.0000	1.364E-22	0.0000	3.027E-22	0.0000	8.408E-18
	Cs-137	1.469E-09	0.0006	1.414E-09	0.0006	2.012E-10	0.0001	3.710E-10	0.0002	2.885E-10	0.0001	2.210E-06
	Pa-231	1.138E-19	0.0000	8.721E-22	0.0000	1.645E-20	0.0000	5.027E-21	0.0000	1.526E-23	0.0000	7.552E-18
	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	1.388E-07
	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	3.360E-08
	Ra-228	3.104E-23	0.0000	1.030E-24	0.0000	4.825E-24	0.0000	2.852E-25	0.0000	8.746E-25	0.0000	1.833E-21
	Th-228	1.919E-26	0.0000	2.804E-27	0.0000	2.054E-26	0.0000	1.999E-27	0.0000	2.966E-28	0.0000	1.111E-21
	Th-232	3.699E-27	0.0000	2.332E-28	0.0000	7.819E-28	0.0000	2.885E-30	0.0000	0.000E+00	0.0000	1.151E-23
	U-235	9.361E-17	0.0000	6.318E-19	0.0000	1.397E-17	0.0000	2.919E-19	0.0000	1.511E-18	0.0000	4.090E-14
	U-236	6.367E-16	0.0000	4.260E-18	0.0000	9.418E-17	0.0000	1.967E-18	0.0000	1.019E-17	0.0000	1.914E-14
	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
	Total	1.469E-09	0.0006	1.414E-09	0.0006	2.012E-10	0.0001	3.710E-10	0.0002	2.885E-10	0.0001	2.382E-06

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Attachment 3 Sheet No. 15 of 31
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 16
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 7.000E+00 years

Radionuclides								
Radon	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Pathway	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 7.000E+00 years

		Water Independent Pathways (Inhalation excludes radon)													
0		Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-															
Nuclide		risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137		2.023E-06	0.8492	5.717E-13	0.0000	0.000E+00	0.0000	1.068E-07	0.0448	4.500E-08	0.0189	2.795E-08	0.0117	3.203E-09	0.0013
Pu-239		6.495E-10	0.0003	6.394E-09	0.0027	0.000E+00	0.0000	4.968E-08	0.0209	4.922E-10	0.0002	1.336E-11	0.0000	8.161E-08	0.0343
Pu-240		5.694E-11	0.0000	1.549E-09	0.0007	0.000E+00	0.0000	1.203E-08	0.0051	1.192E-10	0.0001	3.236E-12	0.0000	1.984E-08	0.0083
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total		2.024E-06	0.8495	7.943E-09	0.0033	0.000E+00	0.0000	1.685E-07	0.0707	4.561E-08	0.0191	2.797E-08	0.0117	1.046E-07	0.0439

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 7.000E+00 years

Water Dependent Pathways														
	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
AAAAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA	AAAAAAA	AAAAA
Cs-137	1.469E-09	0.0006	1.414E-09	0.0006	0.000E+00	0.0000	2.012E-10	0.0001	3.710E-10	0.0002	2.885E-10	0.0001	2.210E-06	0.9276
Pu-239	9.431E-17	0.0000	6.516E-19	0.0000	0.000E+00	0.0000	1.407E-17	0.0000	2.970E-19	0.0000	1.512E-18	0.0000	1.388E-07	0.0583
Pu-240	6.367E-16	0.0000	4.260E-18	0.0000	0.000E+00	0.0000	9.418E-17	0.0000	1.967E-18	0.0000	1.019E-17	0.0000	3.360E-08	0.0141
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.469E-09	0.0006	1.414E-09	0.0006	0.000E+00	0.0000	2.012E-10	0.0001	3.710E-10	0.0002	2.885E-10	0.0001	2.382E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 3 Sheet No. 16 of 31
Originator: S. W. Clark Date
Chk'd By: M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 17
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.100E+01 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	8.645E-16	3.319E-12	2.412E-14	8.119E-15	1.331E-12	3.831E-12	9.987E-14	5.008E-13	6.072E-16	1.575E-15	9.116E-12
Cs-137	2.027E-03	1.204E+02	5.075E+01	3.152E+01	3.121E+00	1.105E+00	8.625E-01	1.225E-01	2.224E-01	1.745E-01	2.083E+02
Pa-231	8.070E-15	1.193E-10	1.211E-11	3.134E-14	1.243E-11	3.016E-12	1.711E-14	3.134E-13	7.519E-14	2.906E-16	1.473E-10
Pu-239	6.405E-03	9.523E+00	9.435E-02	2.561E-03	9.863E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.948E+01
Pu-240	1.552E-03	2.308E+00	2.287E-02	6.207E-04	2.391E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.723E+00
Ra-228	4.490E-20	2.633E-15	3.539E-17	8.413E-17	6.914E-17	5.667E-16	1.402E-17	6.627E-17	3.446E-18	9.903E-18	3.482E-15
Th-228	2.474E-20	7.146E-17	1.174E-18	1.473E-19	3.810E-17	1.223E-18	1.297E-19	9.600E-19	8.178E-20	1.134E-20	1.133E-16
Th-232	1.372E-19	2.061E-16	2.090E-18	2.939E-19	2.113E-16	6.730E-19	3.324E-20	9.071E-20	1.063E-21	1.946E-22	4.207E-16
U-235	6.936E-11	2.572E-07	4.075E-09	1.908E-08	1.068E-07	9.406E-09	4.648E-11	1.022E-09	2.057E-11	1.090E-10	3.978E-07
U-236	5.056E-10	1.875E-06	2.970E-08	1.391E-07	7.785E-07	6.867E-08	3.392E-10	7.459E-09	1.500E-10	7.949E-10	2.899E-06

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

0

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 1.100E+01 years

0

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent   Water-dep. == Water-dependent

Attachment 3 Sheet No. 17 of 31
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:05 Page 18
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p) and Fraction of Total Risk at t= 1.100E+01 years												
Water Independent Pathways (Inhalation excludes radon)												
	Ground		Inhalation		Plant		Meat		Milk		Soil	
Radio- Nuclide	AAAAA risk	AAAAA fract.	AAAAA risk	AAAAA fract.	AAAAA risk	AAAAA fract.	AAAAA risk	AAAAA fract.	AAAAA risk	AAAAA fract.	AAAAA risk	AAAAA fract.
Ac-227	9.581E-18	0.0000	8.122E-20	0.0000	9.575E-19	0.0000	3.476E-21	0.0000	2.357E-21	0.0000	6.962E-19	0.0000
Cs-137	1.843E-06	0.8431	5.210E-13	0.0000	9.731E-08	0.0445	4.101E-08	0.0188	2.547E-08	0.0116	2.919E-09	0.0013
Pa-231	3.490E-18	0.0000	6.821E-20	0.0000	5.024E-18	0.0000	5.145E-19	0.0000	1.294E-21	0.0000	8.633E-19	0.0000
Pu-239	6.493E-10	0.0003	6.392E-09	0.0029	4.967E-08	0.0227	4.920E-10	0.0002	1.335E-11	0.0000	8.159E-08	0.0373
Pu-240	5.691E-11	0.0000	1.548E-09	0.0007	1.202E-08	0.0055	1.191E-10	0.0001	3.233E-12	0.0000	1.983E-08	0.0091
Ra-228	1.147E-21	0.0000	7.946E-26	0.0000	1.285E-21	0.0000	1.761E-23	0.0000	4.148E-23	0.0000	5.348E-23	0.0000
Th-228	1.586E-21	0.0000	1.744E-24	0.0000	1.267E-23	0.0000	1.950E-25	0.0000	2.456E-26	0.0000	1.523E-23	0.0000
Th-232	1.490E-25	0.0000	1.104E-24	0.0000	5.064E-24	0.0000	5.061E-26	0.0000	6.964E-27	0.0000	9.074E-24	0.0000
U-235	4.497E-14	0.0000	4.959E-17	0.0000	1.780E-15	0.0000	2.825E-17	0.0000	1.320E-16	0.0000	1.235E-15	0.0000
U-236	7.723E-17	0.0000	3.755E-16	0.0000	1.199E-14	0.0000	1.903E-16	0.0000	8.891E-16	0.0000	8.205E-15	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.844E-06	0.8434	7.941E-09	0.0036	1.590E-07	0.0727	4.162E-08	0.0190	2.549E-08	0.0117	1.043E-07	0.0477

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p) and Fraction of Total Risk at t= 1.100E+01 years												
Water Dependent Pathways												
	Water		Fish		Plant		Meat		Milk		All Pathways**	
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
AAAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA
Ac-227	9.537E-19	0.0000	3.058E-20	0.0000	1.430E-19	0.0000	2.126E-22	0.0000	5.030E-22	0.0000	1.245E-17	0.0000
Cs-137	1.604E-09	0.0007	1.544E-09	0.0007	2.198E-10	0.0001	4.064E-10	0.0002	3.155E-10	0.0001	2.014E-06	0.9212
Pa-231	1.701E-19	0.0000	1.304E-21	0.0000	2.462E-20	0.0000	7.547E-21	0.0000	2.294E-23	0.0000	1.017E-17	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	1.388E-07	0.0635
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	3.358E-08	0.0154
Ra-228	3.922E-23	0.0000	1.286E-24	0.0000	5.953E-24	0.0000	3.988E-25	0.0000	1.101E-24	0.0000	2.592E-21	0.0000
Th-228	2.424E-26	0.0000	3.500E-27	0.0000	2.529E-26	0.0000	2.803E-27	0.0000	3.755E-28	0.0000	1.616E-21	0.0000
Th-232	4.699E-27	0.0000	2.927E-28	0.0000	9.957E-28	0.0000	3.994E-30	0.0000	0.000E+00	0.0000	1.545E-23	0.0000
U-235	1.257E-16	0.0000	8.491E-19	0.0000	1.878E-17	0.0000	3.937E-19	0.0000	2.035E-18	0.0000	4.834E-14	0.0000
U-236	8.554E-16	0.0000	5.725E-18	0.0000	1.266E-16	0.0000	2.655E-18	0.0000	1.372E-17	0.0000	2.273E-14	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.604E-09	0.0007	1.544E-09	0.0007	2.198E-10	0.0001	4.064E-10	0.0002	3.155E-10	0.0001	2.187E-06	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Attachment 3 Sheet No. 18 of 31
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 19
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 1.100E+01 years

Radionuclides								
Radon	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Pathway	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.100E+01 years

Water Independent Pathways (Inhalation excludes radon)									
Ground		Inhalation		Radon		Plant		Meat	
Radio-	risk	risk	risk	risk	risk	risk	risk	risk	risk
Nuclide	risk	risk	risk	risk	risk	risk	risk	risk	risk
Cs-137	1.843E-06	0.8431	5.210E-13	0.0000	0.000E+00	0.0000	9.731E-08	0.0445	4.101E-08
Pu-239	6.493E-10	0.0003	6.392E-09	0.0029	0.000E+00	0.0000	4.967E-08	0.0227	4.920E-10
Pu-240	5.691E-11	0.0000	1.548E-09	0.0007	0.000E+00	0.0000	1.202E-08	0.0055	1.191E-10
Total	1.844E-06	0.8434	7.941E-09	0.0036	0.000E+00	0.0000	1.590E-07	0.0727	4.162E-08

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.100E+01 years

Water Dependent Pathways									
Water		Fish		Radon		Plant		Meat	
Radio-	risk	risk	risk	risk	risk	risk	risk	risk	risk
Nuclide	risk	risk	risk	risk	risk	risk	risk	risk	risk
Cs-137	1.604E-09	0.0007	1.544E-09	0.0007	0.000E+00	0.0000	2.198E-10	0.0001	4.064E-10
Pu-239	1.269E-16	0.0000	8.810E-19	0.0000	0.000E+00	0.0000	1.895E-17	0.0000	4.015E-19
Pu-240	8.554E-16	0.0000	5.725E-18	0.0000	0.000E+00	0.0000	1.266E-16	0.0000	2.655E-18
Total	1.604E-09	0.0007	1.544E-09	0.0007	0.000E+00	0.0000	2.198E-10	0.0001	4.064E-10

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 3 Sheet No. 19 of 31
Originator: S. W. Clark Date
Chk'd By: M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 20
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 4.300E+01 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	4.105E-14	1.542E-10	4.689E-13	3.798E-13	6.321E-11	2.658E-10	6.424E-12	3.031E-11	4.261E-14	1.036E-13	5.209E-10
Cs-137	9.634E-04	5.726E+01	2.413E+01	1.499E+01	1.484E+00	2.060E+00	1.613E+00	2.298E-01	4.277E-01	3.308E-01	1.025E+02
Pa-231	1.229E-13	1.823E-09	1.870E-10	4.678E-13	1.892E-10	1.114E-10	6.975E-13	1.244E-11	3.653E-12	1.109E-14	2.328E-09
Pu-239	6.392E-03	9.504E+00	9.416E-02	2.556E-03	9.843E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.944E+01
Pu-240	1.546E-03	2.298E+00	2.277E-02	6.179E-04	2.380E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.702E+00
Ra-228	1.439E-18	8.499E-14	1.169E-15	2.749E-15	2.216E-15	4.294E-16	1.188E-17	6.335E-17	7.495E-18	1.569E-17	9.165E-14
Th-228	1.239E-18	2.963E-15	4.505E-17	5.679E-18	1.909E-15	8.846E-19	1.079E-19	9.287E-19	1.797E-19	1.857E-20	4.924E-15
Th-232	2.091E-18	3.117E-15	3.107E-17	4.257E-18	3.220E-15	7.399E-19	3.739E-20	2.961E-19	1.156E-20	2.253E-21	6.374E-15
U-235	2.703E-10	1.004E-06	1.595E-08	7.444E-08	4.162E-07	1.437E-07	7.141E-10	1.581E-08	3.342E-10	1.719E-09	1.673E-06
U-236	1.968E-09	7.308E-06	1.161E-07	5.419E-07	3.030E-06	1.047E-06	5.206E-09	1.153E-07	2.436E-09	1.253E-08	1.218E-05

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

0

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 4.300E+01 years

0

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Attachment 3 Sheet No. 20 of 31
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 21
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p) and Fraction of Total Risk at t= 4.300E+01 years									
Water Independent Pathways (Inhalation excludes radon)									
	Ground	Inhalation	Plant	Meat	Milk	Soil			
Radio- Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
Ac-227	7.058E-17 0.0000	5.983E-19 0.0000	7.017E-18 0.0000	1.839E-20 0.0000	1.730E-20 0.0000	5.129E-18 0.0000			
Cs-137	8.763E-07 0.7741	2.477E-13 0.0000	4.626E-08 0.0409	1.949E-08 0.0172	1.211E-08 0.0107	1.388E-09 0.0012			
Pa-231	1.593E-17 0.0000	3.113E-19 0.0000	2.295E-17 0.0000	2.357E-18 0.0000	5.876E-21 0.0000	3.940E-18 0.0000			
Pu-239	6.480E-10 0.0006	6.380E-09 0.0056	4.957E-08 0.0438	4.911E-10 0.0004	1.333E-11 0.0000	8.143E-08 0.0719			
Pu-240	5.665E-11 0.0001	1.541E-09 0.0014	1.197E-08 0.0106	1.186E-10 0.0001	3.219E-12 0.0000	1.974E-08 0.0174			
Ra-228	6.684E-21 0.0000	4.630E-25 0.0000	7.498E-21 0.0000	1.034E-22 0.0000	2.428E-22 0.0000	3.117E-22 0.0000			
Th-228	1.035E-20 0.0000	1.138E-23 0.0000	7.923E-23 0.0000	1.195E-24 0.0000	1.507E-25 0.0000	9.937E-23 0.0000			
Th-232	6.804E-25 0.0000	5.044E-24 0.0000	2.308E-23 0.0000	2.297E-25 0.0000	3.137E-26 0.0000	4.144E-23 0.0000			
U-235	1.000E-13 0.0000	1.103E-16 0.0000	3.960E-15 0.0000	6.292E-17 0.0000	2.937E-16 0.0000	2.747E-15 0.0000			
U-236	1.716E-16 0.0000	8.342E-16 0.0000	2.665E-14 0.0000	4.234E-16 0.0000	1.976E-15 0.0000	1.823E-14 0.0000			
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	8.771E-07 0.7747	7.921E-09 0.0070	1.078E-07 0.0952	2.010E-08 0.0178	1.212E-08 0.0107	1.026E-07 0.0906			

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p) and Fraction of Total Risk at t= 4.300E+01 years									
Water Dependent Pathways									
	Water	Fish	Plant	Meat	Milk	All Pathways**			
Radio- Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
Ac-227	1.262E-17 0.0000	4.033E-19 0.0000	1.883E-18 0.0000	2.645E-21 0.0000	6.708E-21 0.0000	9.827E-17 0.0000			
Cs-137	1.772E-09 0.0016	1.708E-09 0.0015	2.434E-10 0.0002	4.539E-10 0.0004	3.506E-10 0.0003	9.601E-07 0.8481			
Pa-231	1.476E-18 0.0000	1.133E-20 0.0000	2.137E-19 0.0000	6.693E-20 0.0000	1.940E-22 0.0000	4.726E-17 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	1.385E-07 0.1224			
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	3.343E-08 0.0295			
Ra-228	9.535E-23 0.0000	3.040E-24 0.0000	1.370E-23 0.0000	8.893E-25 0.0000	2.534E-24 0.0000	1.496E-20 0.0000			
Th-228	5.821E-26 0.0000	8.225E-27 0.0000	5.782E-26 0.0000	6.248E-27 0.0000	8.615E-28 0.0000	1.054E-20 0.0000			
Th-232	1.202E-26 0.0000	7.241E-28 0.0000	3.109E-27 0.0000	8.353E-29 0.0000	0.000E+00 0.0000	7.052E-23 0.0000			
U-235	5.751E-16 0.0000	3.890E-18 0.0000	8.618E-17 0.0000	1.830E-18 0.0000	9.387E-18 0.0000	1.079E-13 0.0000			
U-236	3.910E-15 0.0000	2.621E-17 0.0000	5.808E-16 0.0000	1.233E-17 0.0000	6.325E-17 0.0000	5.287E-14 0.0000			
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.772E-09 0.0016	1.708E-09 0.0015	2.434E-10 0.0002	4.539E-10 0.0004	3.506E-10 0.0003	1.132E-06 1.0000			

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Attachment 3 Sheet No. 21 of 31
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

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1RESRAD, Version 6.3      T« Limit = 180 days      08/15/2007 18:05 Page 22
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File    : 118-F-2_Excavation_SZ.RAD
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Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of Radon and its Decay Products at t= 4.300E+01 years

[illegible]

Water-ind. == Water-independent   Water-dep. == Water-dependent

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.300E+01 years

		Water Independent Pathways (Inhalation excludes radon)														
		Ground		Inhalation		Radon		Plant		Meat		Milk		Soil		
Radio-	Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	
Pu-239	6.481E-10	0.0006	2.477E-13	0.0000	0.000E+00	0.0000	4.626E-08	0.0409	1.949E-08	0.0172	1.211E-08	0.0107	1.389E-09	0.0012	8.143E-08	0.0719
Pu-240	5.665E-11	0.0001	1.541E-09	0.0014	0.000E+00	0.0000	1.197E-08	0.0106	1.186E-10	0.0001	3.221E-12	0.0000	1.974E-08	0.0174	1.026E-07	0.0900
total	8.771E-07	0.7747	7.921E-09	0.0070	0.000E+00	0.0000	1.078E-07	0.0952	2.010E-08	0.0178	1.212E-08	0.0107	1.026E-07	0.0900	1.026E-07	0.0900

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.300E+01 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
CS-137	1.772E-09	0.0016	1.708E-09	0.0015	0.000E+00	0.0000	2.434E-10	0.0002	4.539E-10	0.0004	3.506E-10	0.0003	9.601E-07	0.8481
Pu-239	5.892E-16	0.0000	4.304E-18	0.0000	0.000E+00	0.0000	8.828E-17	0.0000	1.899E-18	0.0000	9.394E-18	0.0000	1.385E-07	0.1224
Pu-240	3.910E-15	0.0000	2.621E-17	0.0000	0.000E+00	0.0000	5.808E-16	0.0000	1.233E-17	0.0000	6.325E-17	0.0000	3.343E-08	0.0295
Total	1.772E-09	0.0016	1.708E-09	0.0015	0.000E+00	0.0000	2.434E-10	0.0002	4.539E-10	0.0004	3.506E-10	0.0003	1.132E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 3 Sheet No. 22 of 31
 Originator: S. W. Clark Date _____
 Chk'd By M. W. Perrott Date _____
 Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 23
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.350E+02 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	7.654E-13	2.860E-09	5.852E-12	7.057E-12	1.179E-09	1.280E-08	3.061E-10	1.428E-09	1.972E-12	4.807E-12	1.859E-08
Cs-137	1.136E-04	6.751E+00	2.845E+00	1.767E+00	1.749E-01	7.685E-01	6.021E-01	8.587E-02	1.607E-01	1.239E-01	1.328E+01
Pa-231	1.198E-12	1.780E-08	1.830E-09	4.540E-12	1.845E-09	3.375E-09	1.981E-11	3.734E-10	1.160E-10	3.390E-13	2.536E-08
Pu-239	6.356E-03	9.450E+00	9.363E-02	2.541E-03	9.787E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.933E+01
Pu-240	1.526E-03	2.269E+00	2.248E-02	6.101E-04	2.350E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.642E+00
Ra-228	1.808E-17	1.069E-12	1.478E-14	3.468E-14	2.785E-14	1.133E-14	2.647E-16	1.201E-15	7.628E-17	2.202E-16	1.160E-12
Th-228	1.732E-17	3.984E-14	5.938E-16	7.501E-17	2.667E-14	2.368E-17	2.412E-18	1.718E-17	1.817E-18	2.539E-19	6.723E-14
Th-232	2.044E-17	3.042E-14	3.019E-16	4.110E-17	3.148E-14	1.542E-17	7.063E-19	3.564E-18	1.151E-19	2.263E-20	6.226E-14
U-235	8.410E-10	3.124E-06	4.966E-08	2.317E-07	1.295E-06	1.410E-06	7.017E-09	1.556E-07	3.326E-09	1.700E-08	6.293E-06
U-236	6.101E-09	2.266E-05	3.603E-07	1.681E-06	9.395E-06	1.026E-05	5.109E-08	1.133E-06	2.421E-08	1.237E-07	4.569E-05
Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil and water-dependent water, fish, plant, meat, milk pathways	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii

0
Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 1.350E+02 years

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent   Water-dep. == Water-dependent

Attachment 3 Sheet No. 23 of 31
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:05 Page 24
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p) and Fraction of Total Risk at t= 1.350E+02 years											
Water Independent Pathways (Inhalation excludes radon)											
	Ground		Inhalation		Plant		Meat		Milk		Soil
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
Ac-227	7.288E-16	0.0000	6.179E-18	0.0000	7.223E-17	0.0000	1.445E-19	0.0000	1.782E-19	0.0000	5.296E-17
Cs-137	1.033E-07	0.3628	2.920E-14	0.0000	5.455E-09	0.0192	2.298E-09	0.0081	1.428E-09	0.0050	1.636E-10
Pa-231	1.034E-16	0.0000	2.022E-18	0.0000	1.492E-16	0.0000	1.534E-17	0.0000	3.805E-20	0.0000	2.559E-17
Pu-239	6.443E-10	0.0023	6.343E-09	0.0223	4.928E-08	0.1730	4.883E-10	0.0017	1.325E-11	0.0000	8.096E-08
Pu-240	5.593E-11	0.0002	1.521E-09	0.0053	1.182E-08	0.0415	1.171E-10	0.0004	3.178E-12	0.0000	1.949E-08
Ra-228	5.129E-20	0.0000	3.553E-24	0.0000	5.758E-20	0.0000	7.960E-22	0.0000	1.868E-21	0.0000	2.391E-21
Th-228	8.483E-20	0.0000	9.327E-23	0.0000	6.343E-22	0.0000	9.446E-24	0.0000	1.193E-24	0.0000	8.144E-22
Th-232	4.430E-24	0.0000	3.284E-23	0.0000	1.501E-22	0.0000	1.490E-24	0.0000	2.027E-25	0.0000	2.698E-22
U-235	2.564E-13	0.0000	2.828E-16	0.0000	1.015E-14	0.0000	1.614E-16	0.0000	7.529E-16	0.0000	7.041E-15
U-236	4.383E-16	0.0000	2.131E-15	0.0000	6.808E-14	0.0000	1.082E-15	0.0000	5.048E-15	0.0000	4.656E-14
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.040E-07	0.3652	7.865E-09	0.0276	6.656E-08	0.2337	2.904E-09	0.0102	1.444E-09	0.0051	1.006E-07

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p) and Fraction of Total Risk at t= 1.350E+02 years											
Water Dependent Pathways											
	Water		Fish		Plant		Meat		Milk		All Pathways**
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
Ac-227	2.602E-16	0.0000	8.287E-18	0.0000	3.860E-17	0.0000	5.393E-20	0.0000	1.400E-19	0.0000	1.168E-15
Cs-137	5.549E-10	0.0019	5.349E-10	0.0019	7.629E-11	0.0003	1.428E-10	0.0005	1.101E-10	0.0004	1.141E-07
Pa-231	2.411E-17	0.0000	1.850E-19	0.0000	3.491E-18	0.0000	1.093E-18	0.0000	3.173E-21	0.0000	3.245E-16
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	1.377E-07
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	3.300E-08
Ra-228	4.337E-22	0.0000	1.418E-23	0.0000	6.553E-23	0.0000	4.102E-24	0.0000	1.206E-23	0.0000	1.145E-19
Th-228	2.599E-25	0.0000	3.807E-26	0.0000	2.771E-25	0.0000	2.879E-26	0.0000	4.107E-27	0.0000	8.638E-20
Th-232	5.755E-26	0.0000	3.525E-27	0.0000	1.781E-26	0.0000	5.670E-28	0.0000	8.789E-29	0.0000	4.590E-22
U-235	3.759E-15	0.0000	2.544E-17	0.0000	5.643E-16	0.0000	1.207E-17	0.0000	6.165E-17	0.0000	2.792E-13
U-236	2.552E-14	0.0000	1.713E-16	0.0000	3.798E-15	0.0000	8.123E-17	0.0000	4.149E-16	0.0000	1.533E-13
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	5.549E-10	0.0019	5.349E-10	0.0019	7.629E-11	0.0003	1.428E-10	0.0005	1.101E-10	0.0004	2.848E-07

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Attachment 3 Sheet No. 24 of 31
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:05 Page 25
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 1.350E+02 years

0 Radionuclides
Radon Pathway Rn-222 Po-218 Pb-214 Bi-214 Rn-220 Po-216 Pb-212 Bi-212
AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA
AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA
Water-ind. 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
Water-dep. 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
iiiiii iiii iiii iiii iiii iiii iiii iiii iiii
Total 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

0 Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.350E+02 years

0 Water Independent Pathways (Inhalation excludes radon)
0 Ground Inhalation Radon Plant Meat Milk Soil
Radio- AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA
Nuclide risk fract. risk fract. risk fract. risk fract. risk fract. risk fract. risk fract.
AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA
Cs-137 1.033E-07 0.3628 2.920E-14 0.0000 0.000E+00 0.0000 5.455E-09 0.0192 2.298E-09 0.0081 1.428E-09 0.0050 1.636E-10 0.0006
Pu-239 6.445E-10 0.0023 6.343E-09 0.0223 0.000E+00 0.0000 4.928E-08 0.1730 4.883E-10 0.0017 1.325E-11 0.0000 8.096E-08 0.2843
Pu-240 5.593E-11 0.0002 1.521E-09 0.0053 0.000E+00 0.0000 1.182E-08 0.0415 1.171E-10 0.0004 3.183E-12 0.0000 1.949E-08 0.0684
iiiiii iiii iiii iiii iiii iiii iiii iiii iiii
Total 1.040E-07 0.3652 7.865E-09 0.0276 0.000E+00 0.0000 6.656E-08 0.2337 2.904E-09 0.0102 1.444E-09 0.0051 1.006E-07 0.3532

0 Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.350E+02 years

Water Dependent Pathways
Radio- Water Fish Radon Plant Meat Milk All pathways
Nuclide risk fract. risk fract. risk fract. risk fract. risk fract. risk fract. risk fract.
AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA AAAAA
Cs-137 5.549E-10 0.0019 5.349E-10 0.0019 0.000E+00 0.0000 7.629E-11 0.0003 1.428E-10 0.0005 1.101E-10 0.0004 1.141E-07 0.4006
Pu-239 4.043E-15 0.0000 3.392E-17 0.0000 0.000E+00 0.0000 6.064E-16 0.0000 1.322E-17 0.0000 6.179E-17 0.0000 1.377E-07 0.4836
Pu-240 2.552E-14 0.0000 1.713E-16 0.0000 0.000E+00 0.0000 3.798E-15 0.0000 8.123E-17 0.0000 4.149E-16 0.0000 3.300E-08 0.1159
iiiiii iiii iiii iiii iiii iiii iiii iiii iiii
Total 5.549E-10 0.0019 5.349E-10 0.0019 0.000E+00 0.0000 7.629E-11 0.0003 1.428E-10 0.0005 1.101E-10 0.0004 2.848E-07 1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 3 Sheet No. 25 of 31
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 26
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 3.000E+02 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Ac-227	4.691E-12	1.751E-08	3.178E-11	4.321E-11	7.223E-09	1.324E-07	3.140E-09	1.462E-08	2.062E-11	5.326E-11	1.751E-07
Cs-137	2.456E-06	1.459E-01	6.150E-02	3.820E-02	3.781E-03	3.743E-02	2.933E-02	4.184E-03	7.841E-03	6.039E-03	3.342E-01
Pa-231	5.804E-12	8.623E-08	8.873E-09	2.197E-11	8.938E-09	3.646E-08	2.141E-10	4.038E-09	1.269E-09	3.674E-12	1.461E-07
Pu-239	6.291E-03	9.354E+00	9.267E-02	2.515E-03	9.687E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.914E+01
Pu-240	1.491E-03	2.217E+00	2.197E-02	5.962E-04	2.296E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.536E+00
Ra-228	9.409E-17	5.567E-12	7.702E-14	1.806E-13	1.449E-13	8.724E-14	2.133E-15	9.983E-15	4.974E-16	1.495E-15	6.071E-12
Th-228	9.235E-17	2.107E-13	3.126E-15	3.950E-16	1.422E-13	1.833E-16	1.950E-17	1.438E-16	1.179E-17	1.710E-18	3.568E-13
Th-232	9.944E-17	1.479E-13	1.467E-15	1.993E-16	1.531E-13	1.147E-16	5.521E-18	2.243E-17	5.805E-19	1.135E-19	3.029E-13
U-235	1.839E-09	6.833E-06	1.086E-07	5.067E-07	2.832E-06	6.904E-06	3.438E-08	7.628E-07	1.635E-08	8.341E-08	1.808E-05
U-236	1.326E-08	4.925E-05	7.830E-07	3.652E-06	2.041E-05	5.015E-05	2.497E-07	5.541E-06	1.188E-07	6.059E-07	1.308E-04

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

0 Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 3.000E+02 years

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Attachment 3 Sheet No. 26 of 31
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 27
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p) and Fraction of Total Risk at t= 3.000E+02 years												
Water Independent Pathways (Inhalation excludes radon)												
0	Ground		Inhalation		Plant		Meat		Milk		Soil	
0	Radio-	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
	Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
	Ac-227	3.852E-15	0.0000	3.266E-17	0.0000	3.814E-16	0.0000	6.891E-19	0.0000	9.414E-19	0.0000	2.799E-16
	Cs-137	2.234E-09	0.0131	6.312E-16	0.0000	1.179E-10	0.0007	4.969E-11	0.0003	3.086E-11	0.0002	3.537E-12
	Pa-231	4.464E-16	0.0000	8.725E-18	0.0000	6.439E-16	0.0000	6.626E-17	0.0000	1.640E-19	0.0000	1.104E-16
	Pu-239	6.377E-10	0.0037	6.279E-09	0.0367	4.878E-08	0.2851	4.833E-10	0.0028	1.312E-11	0.0001	8.014E-08
	Pu-240	5.466E-11	0.0003	1.487E-09	0.0087	1.155E-08	0.0675	1.144E-10	0.0007	3.106E-12	0.0000	1.904E-08
	Ra-228	2.354E-19	0.0000	1.631E-23	0.0000	2.644E-19	0.0000	3.658E-21	0.0000	8.579E-21	0.0000	1.098E-20
	Th-228	3.975E-19	0.0000	4.370E-22	0.0000	2.951E-21	0.0000	4.377E-23	0.0000	5.532E-24	0.0000	3.816E-21
	Th-232	1.920E-23	0.0000	1.423E-22	0.0000	6.503E-22	0.0000	6.448E-24	0.0000	8.761E-25	0.0000	1.169E-21
	U-235	5.298E-13	0.0000	5.843E-16	0.0000	2.099E-14	0.0000	3.356E-16	0.0000	1.556E-15	0.0000	1.455E-14
	U-236	9.000E-16	0.0000	4.375E-15	0.0000	1.398E-13	0.0000	2.223E-15	0.0000	1.037E-14	0.0000	9.561E-14
	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
	Total	2.927E-09	0.0171	7.765E-09	0.0454	6.045E-08	0.3533	6.474E-10	0.0038	4.710E-11	0.0003	9.918E-08

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p) and Fraction of Total Risk at t= 3.000E+02 years												
Water Dependent Pathways												
	Water		Fish		Plant		Meat		Milk		All Pathways**	
	Radio-	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
	Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
	Ac-227	2.221E-15	0.0000	7.057E-17	0.0000	3.282E-16	0.0000	4.641E-19	0.0000	1.200E-18	0.0000	7.168E-15
	Cs-137	2.570E-11	0.0002	2.477E-11	0.0001	3.534E-12	0.0000	6.623E-12	0.0000	5.101E-12	0.0000	2.501E-09
	Pa-231	2.192E-16	0.0000	1.682E-18	0.0000	3.173E-17	0.0000	9.980E-18	0.0000	2.888E-20	0.0000	1.539E-15
	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	1.363E-07
	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	3.225E-08
	Ra-228	2.646E-21	0.0000	8.741E-23	0.0000	4.069E-22	0.0000	2.528E-23	0.0000	7.275E-23	0.0000	5.262E-19
	Th-228	1.595E-24	0.0000	2.352E-25	0.0000	1.724E-24	0.0000	1.774E-25	0.0000	2.477E-26	0.0000	4.047E-19
	Th-232	3.383E-25	0.0000	2.105E-26	0.0000	9.094E-26	0.0000	2.570E-27	0.0000	4.997E-28	0.0000	1.989E-21
	U-235	1.640E-14	0.0000	1.110E-16	0.0000	2.463E-15	0.0000	5.281E-17	0.0000	2.694E-16	0.0000	5.871E-13
	U-236	1.111E-13	0.0000	7.457E-16	0.0000	1.655E-14	0.0000	3.547E-16	0.0000	1.809E-15	0.0000	3.838E-13
	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
	Total	2.583E-11	0.0002	2.477E-11	0.0001	3.553E-12	0.0000	6.623E-12	0.0000	5.103E-12	0.0000	1.711E-07

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Attachment 3 Sheet No. 27 of 31
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:05 Page 28
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 3.000E+02 years

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+02 years

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	2.234E-09	0.0131	6.312E-16	0.0000	0.000E+00	0.0000	1.179E-10	0.0007	4.969E-11	0.0003	3.086E-11	0.0002	3.537E-12	0.0000
Pu-239	6.383E-10	0.0037	6.279E-09	0.0367	0.000E+00	0.0000	4.878E-08	0.2851	4.833E-10	0.0028	1.312E-11	0.0001	8.014E-08	0.4684
Pu-240	5.466E-11	0.0003	1.487E-09	0.0087	0.000E+00	0.0000	1.155E-08	0.0675	1.144E-10	0.0007	3.116E-12	0.0000	1.904E-08	0.1113
Total	2.927E-09	0.0171	7.765E-09	0.0454	0.000E+00	0.0000	6.045E-08	0.3533	6.474E-10	0.0038	4.710E-11	0.0003	9.918E-08	0.5797

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+02 years

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	2.570E-11	0.0002	2.477E-11	0.0001	0.000E+00	0.0000	3.534E-12	0.0000	6.623E-12	0.0000	5.101E-12	0.0000	2.501E-09	0.0146
Pu-239	1.884E-14	0.0000	1.833E-16	0.0000	0.000E+00	0.0000	2.823E-15	0.0000	6.325E-17	0.0000	2.706E-16	0.0000	1.363E-07	0.7969
Pu-240	1.111E-13	0.0000	7.457E-16	0.0000	0.000E+00	0.0000	1.655E-14	0.0000	3.547E-16	0.0000	1.809E-15	0.0000	3.225E-08	0.1885
Total	2.583E-11	0.0002	2.477E-11	0.0001	0.000E+00	0.0000	3.553E-12	0.0000	6.623E-12	0.0000	5.103E-12	0.0000	1.711E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 3 Sheet No. 28 of 31
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:05 Page 29
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_S2.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.000E+03 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Ac-227	5.549E-11	2.070E-07	3.515E-10	5.110E-10	8.544E-08	3.788E-06	8.981E-08	4.184E-07	6.053E-10	1.524E-09	4.591E-06
Cs-137	2.117E-13	1.258E-08	5.302E-09	3.293E-09	3.260E-10	1.140E-08	8.935E-09	1.275E-09	2.391E-09	1.841E-09	4.735E-08
Pa-231	5.945E-11	8.834E-07	9.094E-08	2.249E-10	9.156E-08	1.294E-06	7.602E-09	1.434E-07	4.519E-08	1.305E-10	2.557E-06
Pu-239	6.023E-03	8.956E+00	8.873E-02	2.408E-03	9.275E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.832E+01
Pu-240	1.353E-03	2.011E+00	1.993E-02	5.408E-04	2.083E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.115E+00
Ra-228	1.020E-15	6.037E-11	8.357E-13	1.960E-12	1.571E-12	2.341E-12	5.613E-14	2.609E-13	1.613E-14	4.688E-14	6.746E-11
Th-228	1.015E-15	2.304E-12	3.410E-14	4.311E-15	1.563E-12	4.998E-15	5.167E-16	3.760E-15	3.840E-16	5.415E-17	3.915E-12
Th-232	1.037E-15	1.543E-12	1.529E-14	2.075E-15	1.598E-12	2.855E-15	1.362E-16	4.162E-16	7.465E-18	1.389E-18	3.161E-12
U-235	5.727E-09	2.128E-05	3.383E-07	1.578E-06	8.819E-06	7.403E-05	3.688E-07	8.184E-06	1.757E-07	8.955E-07	1.157E-04
U-236	4.017E-08	1.493E-04	2.373E-06	1.107E-05	6.186E-05	5.330E-04	2.655E-06	5.891E-05	1.265E-06	6.447E-06	8.268E-04

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

0

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 1.000E+03 years

0

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Attachment 3 Sheet No. 29 of 31
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 30
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	4.217E-14	0.0000	3.575E-16	0.0000	4.174E-15	0.0000	7.085E-18	0.0000	1.030E-17	0.0000	3.065E-15	0.0000
Cs-137	1.926E-16	0.0000	5.442E-23	0.0000	1.017E-17	0.0000	4.284E-18	0.0000	2.661E-18	0.0000	3.049E-19	0.0000
Pa-231	4.271E-15	0.0000	8.347E-17	0.0000	6.160E-15	0.0000	6.341E-16	0.0000	1.568E-18	0.0000	1.057E-15	0.0000
Pu-239	6.106E-10	0.0038	6.012E-09	0.0376	4.671E-08	0.2923	4.627E-10	0.0029	1.256E-11	0.0001	7.673E-08	0.4802
Pu-240	4.958E-11	0.0003	1.348E-09	0.0084	1.048E-08	0.0656	1.038E-10	0.0006	2.817E-12	0.0000	1.727E-08	0.1081
Ra-228	2.378E-18	0.0000	1.647E-22	0.0000	2.671E-18	0.0000	3.697E-20	0.0000	8.670E-20	0.0000	1.109E-19	0.0000
Th-228	4.065E-18	0.0000	4.470E-21	0.0000	3.005E-20	0.0000	4.448E-22	0.0000	5.622E-23	0.0000	3.903E-20	0.0000
Th-232	1.870E-22	0.0000	1.387E-21	0.0000	6.333E-21	0.0000	6.276E-23	0.0000	8.520E-24	0.0000	1.139E-20	0.0000
U-235	1.595E-12	0.0000	1.759E-15	0.0000	6.318E-14	0.0000	1.004E-15	0.0000	4.685E-15	0.0000	4.381E-14	0.0000
U-236	2.636E-15	0.0000	1.282E-14	0.0000	4.096E-13	0.0000	6.512E-15	0.0000	3.037E-14	0.0000	2.801E-13	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	6.618E-10	0.0041	7.360E-09	0.0461	5.719E-08	0.3579	5.666E-10	0.0035	1.541E-11	0.0001	9.400E-08	0.5883

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Plant		Meat		Milk		All Pathways**	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ac-227	5.433E-14	0.0000	1.752E-15	0.0000	8.258E-15	0.0000	1.202E-17	0.0000	3.009E-17	0.0000	1.142E-13	0.0000
Cs-137	7.595E-18	0.0000	7.323E-18	0.0000	1.045E-18	0.0000	1.960E-18	0.0000	1.508E-18	0.0000	2.294E-16	0.0000
Pa-231	7.019E-15	0.0000	5.386E-17	0.0000	1.016E-15	0.0000	3.201E-16	0.0000	9.248E-19	0.0000	2.062E-14	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	1.305E-07	0.8169
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	2.926E-08	0.1831
Ra-228	7.727E-20	0.0000	2.550E-21	0.0000	1.186E-20	0.0000	7.223E-22	0.0000	2.107E-21	0.0000	5.378E-18	0.0000
Th-228	4.748E-23	0.0000	6.922E-24	0.0000	5.037E-23	0.0000	5.068E-24	0.0000	7.173E-25	0.0000	4.139E-18	0.0000
Th-232	9.142E-24	0.0000	5.750E-25	0.0000	1.745E-24	0.0000	3.077E-26	0.0000	5.725E-27	0.0000	1.938E-20	0.0000
U-235	1.642E-13	0.0000	1.112E-15	0.0000	2.468E-14	0.0000	5.299E-16	0.0000	2.701E-15	0.0000	1.903E-12	0.0000
U-236	1.103E-12	0.0000	7.403E-15	0.0000	1.643E-13	0.0000	3.527E-15	0.0000	1.798E-14	0.0000	2.038E-12	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.328E-12	0.0000	1.033E-14	0.0000	1.982E-13	0.0000	4.391E-15	0.0000	2.071E-14	0.0000	1.598E-07	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Attachment 3 Sheet No. 30 of 31
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 3

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 31
Intrisk : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 1.000E+03 years

0 Radonulides
Radon Pathway Rn-222 Po-218 Pb-214 Bi-214 Rn-220 Po-216 Pb-212 Bi-212
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 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 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 0.000E+00 0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

0 Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

0 Water Independent Pathways (Inhalation excludes radon)
0 Ground Inhalation Radon Plant Meat Milk Soil
Radio- Nuclide risk fract. risk fract. risk fract. risk fract. risk fract. risk fract. risk fract.
Cs-137 1.926E-16 0.0000 5.442E-23 0.0000 0.000E+00 0.0000 1.017E-17 0.0000 4.284E-18 0.0000 2.661E-18 0.0000 3.049E-19 0.0000
Pu-239 6.122E-10 0.0038 6.012E-09 0.0376 0.000E+00 0.0000 4.671E-08 0.2923 4.627E-10 0.0029 1.256E-11 0.0001 7.673E-08 0.4802
Pu-240 4.958E-11 0.0003 1.349E-09 0.0084 0.000E+00 0.0000 1.048E-08 0.0656 1.058E-10 0.0006 2.847E-12 0.0000 1.727E-08 0.1081
Total 6.618E-10 0.0041 7.360E-09 0.0461 0.000E+00 0.0000 5.719E-08 0.3579 5.666E-10 0.0035 1.541E-11 0.0001 9.400E-08 0.5883

0 Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Water Dependent Pathways
Radio- Nuclide Water Fish Radon Plant Meat Milk All pathways
risk fract. risk fract. risk fract. risk fract. risk fract. risk fract. risk fract.
Cs-137 7.595E-18 0.0000 7.323E-18 0.0000 0.000E+00 0.0000 1.045E-18 0.0000 1.960E-18 0.0000 1.508E-18 0.0000 2.294E-16 0.0000
Pu-239 2.255E-13 0.0000 2.918E-15 0.0000 0.000E+00 0.0000 3.395E-14 0.0000 8.620E-16 0.0000 2.732E-15 0.0000 1.305E-07 0.8169
Pu-240 1.103E-12 0.0000 7.403E-15 0.0000 0.000E+00 0.0000 1.643E-13 0.0000 3.527E-15 0.0000 1.798E-14 0.0000 2.926E-08 0.1831
Total 1.328E-12 0.0000 1.033E-14 0.0000 0.000E+00 0.0000 1.982E-13 0.0000 4.391E-15 0.0000 2.071E-14 0.0000 1.598E-07 1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 3 Sheet No. 31 of 31
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 4

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 1
Concent : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Table of Contents	
AAAAAAAAAAAAAAAAAAAA	
Part IV: Concentration of Radionuclides	
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii	

Concentration of radionuclides in different media	
Time= 0.000E+00	2
Time= 1.000E+00	3
Time= 3.000E+00	4
Time= 7.000E+00	5
Time= 1.100E+01	6
Time= 4.300E+01	7
Time= 1.350E+02	8
Time= 3.000E+02	9
Time= 1.000E+03	10

Attachment 4 Sheet No. 1 of 10
Originator: S. W. Clark gwc Date 8/15/07
Chk'd By M. W. Perrott mpw Date 8/16/07
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 4

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 2
Concent : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Concentration of radionuclides in environmental media
at t = 0.000E+00 years

Radio- Nuclide	Contaminat- ed Zone	Surface Soil*	Air Par- ticulate	Well Water	Surface Water
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
Ac-227	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Cs-137	6.900E-02	6.900E-02	8.147E-07	0.000E+00	0.000E+00
Pa-231	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pu-239	1.690E-01	1.690E-01	1.995E-06	0.000E+00	0.000E+00
Pu-240	4.100E-02	4.100E-02	4.841E-07	0.000E+00	0.000E+00
Ra-228	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-228	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-235	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-236	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 0.000E+00 years*

Radio- Nuclide	Drinking Water	Nonleafy Vegetable	Leafy Vegetable	Fodder Meat	Fodder Milk	Meat	Milk	Fish	Crustacea
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
Ac-227	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
Cs-137	0.000E+00	2.760E+00	2.760E+00	2.760E+00	2.760E+00	6.666E+00	1.491E+00	0.000E+00	0.000E+00
Pa-231	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	0.000E+00	1.691E-01	1.695E-01	1.696E-01	1.696E-01	9.603E-03	9.383E-05	0.000E+00	0.000E+00
Pu-240	0.000E+00	4.103E-02	4.113E-02	4.114E-02	4.114E-02	2.330E-03	2.276E-05	0.000E+00	0.000E+00
Ra-228	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
Th-228	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
Th-232	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
U-235	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
U-236	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
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.

For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 4 Sheet No. 2 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 4

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 3
Concent : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Concentration of radionuclides in environmental media
at t = 1.000E+00 years

Radio- Nuclide	Contaminat- ed Zone	Surface Soil*	Air Par- ticulate	Well Water	Surface Water
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Ac-227	1.853E-17	1.853E-17	2.188E-22	7.589E-16	2.199E-17
Cs-137	6.742E-02	6.742E-02	7.960E-07	1.736E-04	5.029E-06
Pa-231	1.761E-15	1.761E-15	2.079E-20	1.469E-16	4.257E-18
Pu-239	1.690E-01	1.690E-01	1.995E-06	0.000E+00	0.000E+00
Pu-240	4.099E-02	4.099E-02	4.840E-07	0.000E+00	0.000E+00
Ra-228	1.168E-21	1.168E-21	1.378E-26	5.619E-22	1.628E-23
Th-228	9.909E-23	9.909E-23	1.170E-27	1.024E-26	2.967E-28
Th-232	2.994E-20	2.994E-20	3.535E-25	0.000E+00	0.000E+00
U-235	1.664E-10	1.664E-10	1.965E-15	1.067E-13	3.090E-15
U-236	1.214E-09	1.214E-09	1.433E-14	7.765E-13	2.250E-14
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 1.000E+00 years*

Radio- Nuclide	Drinking Water	Nonleafy Vegetable	Leafy Vegetable	Fodder Meat	Fodder Milk	Meat	Milk	Fish	Crustacea
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Ac-227	7.390E-16	6.797E-16	4.573E-15	2.077E-15	1.116E-15	1.821E-17	3.714E-18	2.698E-16	1.799E-14
Cs-137	1.723E-04	2.697E+00	2.698E+00	2.701E+00	2.698E+00	6.514E+00	1.457E+00	9.542E-03	4.771E-04
Pa-231	1.440E-16	1.676E-14	1.843E-14	1.339E-14	1.539E-14	8.554E-15	1.234E-17	3.685E-17	4.053E-16
Pu-239	0.000E+00	1.691E-01	1.695E-01	1.696E-01	1.696E-01	9.603E-03	9.382E-05	0.000E+00	0.000E+00
Pu-240	0.000E+00	4.102E-02	4.112E-02	4.113E-02	4.113E-02	2.329E-03	2.276E-05	0.000E+00	0.000E+00
Ra-228	5.555E-22	4.216E-20	4.980E-20	2.612E-20	3.125E-20	2.287E-21	2.385E-21	7.471E-22	3.736E-21
Th-228	5.609E-25	6.663E-22	1.511E-22	1.183E-21	1.420E-21	5.672E-23	3.001E-24	5.200E-24	2.600E-23
Th-232	0.000E+00	3.327E-20	3.028E-20	3.594E-20	3.956E-20	2.279E-21	1.469E-22	0.000E+00	0.000E+00
U-235	1.052E-13	4.067E-10	4.165E-10	3.633E-10	3.851E-10	3.566E-11	6.251E-11	2.790E-14	1.674E-13
U-236	7.656E-13	2.966E-09	3.037E-09	2.649E-09	2.808E-09	2.600E-10	4.558E-10	2.031E-13	1.219E-12
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.

For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 4 Sheet No. 3 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 4

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 4
Concent : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_S2.RAD

Concentration of radionuclides in environmental media
at t = 3.000E+00 years

Radio-	Contaminat-	Surface	Air Par-	Well	Surface
Nuclide	ted Zone	Soil*	ticulate	Water	Water
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Ac-227	4.924E-16	4.924E-16	5.814E-21	7.074E-16	2.050E-17
Cs-137	6.435E-02	6.435E-02	7.598E-07	4.971E-04	1.441E-05
Pa-231	1.584E-14	1.584E-14	1.870E-19	5.325E-16	1.543E-17
Pu-239	1.690E-01	1.690E-01	1.995E-06	0.000E+00	0.000E+00
Pu-240	4.098E-02	4.098E-02	4.839E-07	0.000E+00	0.000E+00
Ra-228	2.974E-20	2.974E-20	3.511E-25	8.810E-20	2.553E-21
Th-228	6.699E-21	6.699E-21	7.910E-26	1.015E-22	2.941E-24
Th-232	2.694E-19	2.694E-19	3.180E-24	1.014E-22	2.939E-24
U-235	4.992E-10	4.992E-10	5.894E-15	9.600E-13	2.782E-14
U-236	3.640E-09	3.640E-09	4.297E-14	7.026E-12	2.036E-13
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 3.000E+00 years*

Radio-	Drinking	Nonleafy	Leafy	Fodder	Fodder	Meat	Milk	Fish	Crustacea
Nuclide	Water	Vegetable	Vegetable	Meat	Milk				
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Ac-227	7.340E-16	2.728E-15	6.028E-15	4.776E-15	5.648E-15	1.660E-16	1.356E-17	3.850E-16	2.566E-14
Cs-137	4.959E-04	2.575E+00	2.577E+00	2.581E+00	2.578E+00	6.224E+00	1.392E+00	2.832E-02	1.416E-03
Pa-231	5.353E-16	1.562E-13	1.616E-13	1.469E-13	1.518E-13	8.837E-14	9.271E-17	1.596E-16	1.755E-15
Pu-239	0.000E+00	1.691E-01	1.695E-01	1.695E-01	1.695E-01	9.601E-03	9.381E-05	0.000E+00	0.000E+00
Pu-240	0.000E+00	4.101E-02	4.111E-02	4.112E-02	4.112E-02	2.329E-03	2.275E-05	0.000E+00	0.000E+00
Ra-228	8.596E-20	1.216E-18	1.716E-18	9.913E-19	1.041E-18	8.323E-20	8.545E-20	1.060E-19	5.300E-19
Th-228	1.842E-22	2.325E-20	9.519E-21	4.863E-20	5.115E-20	2.271E-21	1.156E-22	9.766E-22	4.883E-21
Th-232	9.990E-23	2.799E-19	2.716E-19	2.919E-19	3.018E-19	1.716E-20	9.425E-22	2.456E-22	1.230E-21
U-235	9.554E-13	1.240E-09	1.255E-09	1.201E-09	1.223E-09	1.116E-10	1.901E-10	2.688E-13	1.613E-12
U-236	6.991E-12	9.040E-09	9.149E-09	8.755E-09	8.917E-09	8.137E-10	1.386E-09	1.965E-12	1.179E-11
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.

For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 4 Sheet No. 4 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 4

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 5
Concent : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Concentration of radionuclides in environmental media
at t = 7.000E+00 years

Radio- Nuclide	Contaminat- ed Zone	Surface Soil*	Air Par- ticulate	Well Water	Surface Water
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
Ac-227	6.060E-15	6.060E-15	7.155E-20	2.965E-15	8.591E-17
Cs-137	5.864E-02	5.864E-02	6.924E-07	1.057E-03	3.064E-05
Pa-231	8.621E-14	8.621E-14	1.018E-18	1.478E-15	4.284E-17
Pu-239	1.689E-01	1.689E-01	1.994E-06	0.000E+00	0.000E+00
Pu-240	4.096E-02	4.096E-02	4.836E-07	0.000E+00	0.000E+00
Ra-228	3.382E-19	3.382E-19	3.993E-24	3.588E-19	1.040E-20
Th-228	1.430E-19	1.430E-19	1.689E-24	4.177E-22	1.210E-23
Th-232	1.466E-18	1.466E-18	1.731E-23	4.180E-22	1.211E-23
U-235	1.164E-09	1.164E-09	1.375E-14	5.226E-12	1.514E-13
U-236	8.488E-09	8.488E-09	1.002E-13	3.818E-11	1.106E-12
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 7.000E+00 years*

Radio- Nuclide	Drinking Water	Nonleafy Vegetable	Leafy Vegetable	Fodder Meat	Fodder Milk	Meat	Milk	Fish	Crustacea
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
Ac-227	2.934E-15	1.935E-14	3.349E-14	3.247E-14	3.720E-14	9.734E-16	1.108E-16	1.198E-15	7.985E-14
Cs-137	1.056E-03	2.347E+00	2.353E+00	2.356E+00	2.353E+00	5.681E+00	1.271E+00	6.083E-02	3.041E-03
Pa-231	1.495E-15	8.573E-13	8.714E-13	8.395E-13	8.506E-13	4.984E-13	4.763E-16	4.618E-16	5.076E-15
Pu-239	0.000E+00	1.690E-01	1.694E-01	1.695E-01	1.695E-01	9.599E-03	9.379E-05	0.000E+00	0.000E+00
Pu-240	0.000E+00	4.099E-02	4.109E-02	4.110E-02	4.110E-02	2.327E-03	2.274E-05	0.000E+00	0.000E+00
Ra-228	3.592E-19	1.375E-17	1.578E-17	1.466E-17	1.536E-17	1.174E-18	1.071E-18	5.238E-19	2.619E-18
Th-228	7.740E-22	3.295E-19	1.636E-19	7.746E-19	8.093E-19	3.512E-20	1.641E-21	4.843E-21	2.421E-20
Th-232	4.237E-22	1.492E-18	1.475E-18	1.528E-18	1.551E-18	8.774E-20	4.528E-21	1.233E-21	6.177E-21
U-235	5.215E-12	2.909E-09	2.946E-09	2.892E-09	2.915E-09	2.639E-10	4.459E-10	1.492E-12	8.953E-12
U-236	3.809E-11	2.120E-08	2.148E-08	2.109E-08	2.125E-08	1.924E-09	3.250E-09	1.090E-11	6.538E-11
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.

For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 4 Sheet No. 5 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 4

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:05 Page 6
Concent : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_S2.RAD

Concentration of radionuclides in environmental media
at t = 1.100E+01 years

Radio-	Contaminat-	Surface	Air Par-	Well	Surface
Nuclide	ed Zone	Soil*	ticulate	Water	Water
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
Ac-227	2.279E-14	2.279E-14	2.691E-19	5.158E-15	1.494E-16
Cs-137	5.344E-02	5.344E-02	6.309E-07	1.515E-03	4.389E-05
Pa-231	2.128E-13	2.128E-13	2.512E-18	4.155E-15	1.204E-16
Pu-239	1.689E-01	1.689E-01	1.994E-06	0.000E+00	0.000E+00
Pu-240	4.094E-02	4.094E-02	4.833E-07	0.000E+00	0.000E+00
Ra-228	1.184E-18	1.184E-18	1.398E-23	7.719E-19	2.237E-20
Th-228	6.524E-19	6.524E-19	7.703E-24	9.007E-22	2.610E-23
Th-232	3.619E-18	3.619E-18	4.273E-23	9.039E-22	2.619E-23
U-235	1.829E-09	1.829E-09	2.159E-14	1.290E-11	3.738E-13
U-236	1.333E-08	1.333E-08	1.574E-13	9.419E-11	2.729E-12

*****
*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 1.100E+01 years*

Radio-	Drinking	Nonleafy	Leafy	Fodder	Fodder	Meat	Milk	Fish	Crustacea
Nuclide	Water	Vegetable	Vegetable	Meat	Milk				
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
Ac-227	5.248E-15	6.722E-14	9.078E-14	9.319E-14	1.000E-13	2.515E-15	3.550E-16	2.507E-15	1.671E-13
Cs-137	1.514E-03	2.139E+00	2.147E+00	2.150E+00	2.148E+00	5.185E+00	1.161E+00	8.736E-02	4.368E-03
Pa-231	4.131E-15	2.122E-12	2.154E-12	2.092E-12	2.118E-12	1.239E-12	1.158E-15	1.156E-15	1.271E-14
Pu-239	0.000E+00	1.690E-01	1.694E-01	1.695E-01	1.695E-01	9.597E-03	9.376E-05	0.000E+00	0.000E+00
Pu-240	0.000E+00	4.096E-02	4.106E-02	4.108E-02	4.108E-02	2.326E-03	2.273E-05	0.000E+00	0.000E+00
Ra-228	7.762E-19	4.779E-17	5.224E-17	4.928E-17	4.960E-17	3.951E-18	3.443E-18	1.159E-18	5.795E-18
Th-228	1.675E-21	1.299E-18	7.156E-19	2.769E-18	2.792E-18	1.278E-19	5.811E-21	1.072E-20	5.361E-20
Th-232	9.219E-22	3.661E-18	3.639E-18	3.724E-18	3.758E-18	2.127E-19	1.077E-20	2.746E-21	1.376E-20
U-235	1.289E-11	4.580E-09	4.658E-09	4.606E-09	4.630E-09	4.166E-10	7.026E-10	3.704E-12	2.222E-11
U-236	9.406E-11	3.339E-08	3.395E-08	3.358E-08	3.375E-08	3.037E-09	5.121E-09	2.703E-11	1.622E-10

*****
*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 4 Sheet No. 6 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 4

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:05 Page 7
Concent : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Concentration of radionuclides in environmental media
at t = 4.300E+01 years

Radio- Nuclide	Contaminat- ed Zone	Surface Soil*	Air Par- ticulate	Well Water	Surface Water
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
Ac-227	1.082E-12	1.082E-12	1.278E-17	3.629E-13	1.052E-14
Cs-137	2.540E-02	2.540E-02	2.999E-07	2.822E-03	8.178E-05
Pa-231	3.240E-12	3.240E-12	3.825E-17	1.525E-13	4.418E-15
Pu-239	1.685E-01	1.685E-01	1.990E-06	0.000E+00	0.000E+00
Pu-240	4.076E-02	4.076E-02	4.812E-07	0.000E+00	0.000E+00
Ra-228	3.795E-17	3.795E-17	4.480E-22	5.732E-19	1.661E-20
Th-228	3.268E-17	3.268E-17	3.859E-22	6.113E-22	1.771E-23
Th-232	5.514E-17	5.514E-17	6.510E-22	8.020E-22	2.324E-23
U-235	7.127E-09	7.127E-09	8.415E-14	1.968E-10	5.704E-12
U-236	5.188E-08	5.188E-08	6.126E-13	1.435E-09	4.158E-11
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 4.300E+01 years*

Radio- Nuclide	Drinking Water	Nonleafy Vegetable	Leafy Vegetable	Fodder Meat	Fodder Milk	Meat	Milk	Fish	Crustacea
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
Ac-227	3.641E-13	3.231E-12	5.010E-12	5.233E-12	5.189E-12	5.203E-14	1.770E-14	1.612E-13	1.075E-11
Cs-137	2.822E-03	1.020E+00	1.034E+00	1.037E+00	1.036E+00	2.498E+00	5.609E-01	1.634E-01	8.168E-03
Pa-231	1.526E-13	3.256E-11	3.336E-11	3.317E-11	3.328E-11	1.939E-11	1.753E-14	4.443E-14	4.886E-13
Pu-239	0.000E+00	1.687E-01	1.691E-01	1.691E-01	1.691E-01	9.578E-03	9.358E-05	0.000E+00	0.000E+00
Pu-240	0.000E+00	4.078E-02	4.088E-02	4.089E-02	4.089E-02	2.316E-03	2.263E-05	0.000E+00	0.000E+00
Ra-228	5.882E-19	1.509E-15	1.521E-15	1.493E-15	1.495E-15	1.197E-16	1.013E-16	9.818E-19	4.909E-18
Th-228	1.212E-21	5.304E-17	3.426E-17	9.668E-17	9.688E-17	4.600E-18	2.086E-19	8.921E-21	4.460E-20
Th-232	1.014E-21	5.533E-17	5.533E-17	5.573E-17	5.586E-17	3.162E-18	1.559E-19	3.076E-21	1.577E-20
U-235	1.968E-10	1.807E-08	1.908E-08	1.912E-08	1.915E-08	1.656E-09	2.789E-09	5.690E-11	3.414E-10
U-236	1.434E-09	1.316E-07	1.389E-07	1.392E-07	1.394E-07	1.205E-08	2.030E-08	4.148E-10	2.489E-09
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.

For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 4 Sheet No. 7 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 4

1RESRAD, Version 6.3 T_{1/2} Limit = 180 days 08/15/2007 18:05 Page 8
Concent : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Concentration of radionuclides in environmental media
at t = 1.350E+02 years

Radio- Nuclide	Contaminat- ed Zone	Surface Soil*	Air Par- ticulate	Well Water	Surface Water
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
Ac-227	2.018E-11	2.018E-11	2.383E-16	1.751E-11	5.074E-13
Cs-137	2.995E-03	2.995E-03	3.536E-08	1.053E-03	3.050E-05
Pa-231	3.159E-11	3.159E-11	3.730E-16	4.623E-12	1.340E-13
Pu-239	1.676E-01	1.676E-01	1.979E-06	0.000E+00	0.000E+00
Pu-240	4.024E-02	4.024E-02	4.751E-07	0.000E+00	0.000E+00
Ra-228	4.768E-16	4.768E-16	5.630E-21	1.559E-17	4.518E-19
Th-228	4.567E-16	4.567E-16	5.392E-21	1.715E-20	4.968E-22
Th-232	5.390E-16	5.390E-16	6.364E-21	1.931E-20	5.595E-22
U-235	2.218E-08	2.218E-08	2.618E-13	1.931E-09	5.596E-11
U-236	1.609E-07	1.609E-07	1.899E-12	1.406E-08	4.074E-10
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 1.350E+02 years*

Radio- Nuclide	Drinking Water	Nonleafy Vegetable	Leafy Vegetable	Fodder Meat	Fodder Milk	Meat	Milk	Fish	Crustacea
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
Ac-227	1.754E-11	7.400E-11	1.611E-10	1.711E-10	1.604E-10	7.958E-13	4.344E-13	7.682E-12	5.121E-10
Cs-137	1.053E-03	1.212E-01	1.265E-01	1.272E-01	1.271E-01	3.057E-01	6.924E-02	6.098E-02	3.049E-03
Pa-231	4.623E-12	3.219E-10	3.451E-10	3.466E-10	3.471E-10	1.979E-10	1.787E-13	1.339E-12	1.472E-11
Pu-239	0.000E+00	1.677E-01	1.681E-01	1.682E-01	1.682E-01	9.523E-03	9.304E-05	0.000E+00	0.000E+00
Pu-240	0.000E+00	4.026E-02	4.036E-02	4.037E-02	4.037E-02	2.286E-03	2.234E-05	0.000E+00	0.000E+00
Ra-228	1.552E-17	1.900E-14	1.916E-14	1.885E-14	1.887E-14	1.511E-15	1.278E-15	2.187E-17	1.094E-16
Th-228	3.244E-20	7.130E-16	4.768E-16	1.266E-15	1.267E-15	6.059E-17	2.756E-18	1.993E-19	9.967E-19
Th-232	2.113E-20	5.399E-16	5.408E-16	5.426E-16	5.430E-16	3.072E-17	1.506E-18	5.823E-20	2.950E-19
U-235	1.931E-09	5.798E-08	6.766E-08	6.868E-08	6.873E-08	5.390E-09	9.106E-09	5.592E-10	3.355E-09
U-236	1.406E-08	4.206E-07	4.911E-07	4.985E-07	4.989E-07	3.911E-08	6.607E-08	4.071E-09	2.442E-08
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.

For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 4 Sheet No. 8 of 10
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 4

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 9
Concent : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Concentration of radionuclides in environmental media
at t = 3.000E+02 years

Radio-	Contaminat-	Surface	Air Par-	Well	Surface
Nuclide	ated Zone	Soil*	ticulate	Water	Water
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Ac-227	1.237E-10	1.237E-10	1.460E-15	1.815E-10	5.258E-12
Cs-137	6.475E-05	6.475E-05	7.645E-10	5.127E-05	1.486E-06
Pa-231	1.530E-10	1.530E-10	1.807E-15	4.995E-11	1.447E-12
Pu-239	1.659E-01	1.659E-01	1.959E-06	0.000E+00	0.000E+00
Pu-240	3.932E-02	3.932E-02	4.643E-07	0.000E+00	0.000E+00
Ra-228	2.481E-15	2.481E-15	2.929E-20	1.191E-16	3.451E-18
Th-228	2.435E-15	2.435E-15	2.875E-20	1.322E-19	3.829E-21
Th-232	2.622E-15	2.622E-15	3.096E-20	1.473E-19	4.269E-21
U-235	4.849E-08	4.849E-08	5.726E-13	9.458E-09	2.740E-10
U-236	3.495E-07	3.495E-07	4.127E-12	6.870E-08	1.991E-09
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 3.000E+02 years*

Radio-	Drinking	Nonleafy	Leafy	Fodder	Fodder	Meat	Milk	Fish	Crustacea
Nuclide	Water	Vegetable	Vegetable	Meat	Milk				
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Ac-227	1.814E-10	5.486E-10	1.451E-09	1.560E-09	1.560E-09	5.329E-12	3.533E-12	7.880E-11	5.253E-09
Cs-137	5.127E-05	2.658E-03	2.914E-03	2.947E-03	2.944E-03	7.053E-03	1.620E-03	2.971E-03	1.485E-04
Pa-231	4.995E-11	1.596E-09	1.845E-09	1.872E-09	1.873E-09	1.032E-09	9.389E-13	1.447E-11	1.592E-10
Pu-239	0.000E+00	1.660E-01	1.664E-01	1.664E-01	1.664E-01	9.426E-03	9.210E-05	0.000E+00	0.000E+00
Pu-240	0.000E+00	3.935E-02	3.944E-02	3.946E-02	3.945E-02	2.234E-03	2.183E-05	0.000E+00	0.000E+00
Ra-228	1.195E-16	9.894E-14	9.998E-14	9.837E-14	9.839E-14	7.884E-15	6.669E-15	1.763E-16	8.816E-16
Th-228	2.511E-19	3.770E-15	2.541E-15	6.661E-15	6.663E-15	3.191E-16	1.453E-17	1.611E-18	8.057E-18
Th-232	1.571E-19	2.625E-15	2.631E-15	2.637E-15	2.638E-15	1.492E-16	7.302E-18	4.556E-19	2.297E-18
U-235	9.457E-09	1.337E-07	1.809E-07	1.863E-07	1.864E-07	1.271E-08	2.161E-08	2.739E-09	1.644E-08
U-236	6.870E-08	9.642E-07	1.307E-06	1.347E-06	1.347E-06	9.172E-08	1.559E-07	1.990E-08	1.194E-07
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.

For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 4 Sheet No. 9 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 4

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:05 Page 10
Concent : 118-F-2 Excavation Shallow Zone RESRAD Calculation
File : 118-F-2_Excavation_SZ.RAD

Concentration of radionuclides in environmental media
at t = 1.000E+03 years

Radio- Nuclide	Contaminat- ed Zone	Surface Soil*	Air Par- ticulate	Well Water	Surface Water
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Ac-227	1.463E-09	1.463E-09	1.727E-14	5.189E-09	1.503E-10
Cs-137	5.582E-12	5.582E-12	6.591E-17	1.562E-11	4.525E-13
Pa-231	1.568E-09	1.568E-09	1.851E-14	1.773E-09	5.137E-11
Pu-239	1.588E-01	1.588E-01	1.875E-06	0.000E+00	0.000E+00
Pu-240	3.567E-02	3.567E-02	4.211E-07	0.000E+00	0.000E+00
Ra-228	2.690E-14	2.690E-14	3.176E-19	3.207E-15	9.293E-17
Th-228	2.676E-14	2.676E-14	3.160E-19	3.671E-18	1.064E-19
Th-232	2.735E-14	2.735E-14	3.230E-19	3.812E-18	1.104E-19
U-235	1.510E-07	1.510E-07	1.783E-12	1.014E-07	2.939E-09
U-236	1.059E-06	1.059E-06	1.251E-11	7.301E-07	2.116E-08
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 1.000E+03 years*

Radio- Nuclide	Drinking Water	Nonleafy Vegetable	Leafy Vegetable	Fodder Meat	Fodder Milk	Meat	Milk	Fish	Crustacea
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Ac-227	5.188E-09	1.048E-08	3.631E-08	3.935E-08	3.936E-08	9.732E-11	7.452E-11	2.254E-09	1.502E-07
Cs-137	1.562E-11	2.440E-10	3.219E-10	3.315E-10	3.311E-10	7.825E-10	1.880E-10	9.050E-10	4.525E-11
Pa-231	1.773E-09	1.801E-08	2.685E-08	2.789E-08	2.790E-08	1.385E-08	1.301E-11	5.137E-10	5.650E-09
Pu-239	0.000E+00	1.589E-01	1.593E-01	1.594E-01	1.594E-01	9.025E-03	8.818E-05	0.000E+00	0.000E+00
Pu-240	0.000E+00	3.569E-02	3.578E-02	3.579E-02	3.579E-02	2.027E-03	1.980E-05	0.000E+00	0.000E+00
Ra-228	3.206E-15	1.075E-12	1.096E-12	1.082E-12	1.082E-12	8.665E-14	7.347E-14	4.639E-15	2.319E-14
Th-228	6.847E-18	4.128E-14	2.795E-14	7.331E-14	7.331E-14	3.508E-15	1.598E-16	4.270E-17	2.135E-16
Th-232	3.911E-18	2.738E-14	2.746E-14	2.751E-14	2.751E-14	1.556E-15	7.604E-17	1.125E-17	5.646E-17
U-235	1.014E-07	5.108E-07	1.016E-06	1.076E-06	1.077E-06	5.228E-08	9.057E-08	2.938E-08	1.763E-07
U-236	7.301E-07	3.607E-06	7.245E-06	7.680E-06	7.681E-06	3.700E-07	6.413E-07	2.115E-07	1.269E-06
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.

For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 4 Sheet No. 10 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

Table of Contents

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Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary ...	2
Site-Specific Parameter Summary	4
Summary of Pathway Selections	8
Contaminated Zone and Total Dose Summary	9
Total Dose Components	
Time = 0.000E+00	10
Time = 1.000E+00	11
Time = 3.000E+00	12
Time = 7.000E+00	13
Time = 1.100E+01	14
Time = 4.300E+01	15
Time = 1.350E+02	16
Time = 3.000E+02	17
Time = 1.000E+03	18
Dose/Source Ratios Summed Over All Pathways	19
Single Radionuclide Soil Guidelines	19
Dose Per Nuclide Summed Over All Pathways	20
Soil Concentration Per Nuclide	20

Attachment 5 Sheet No. 1 of 20
 Originator: S. W. Clark *Swe* Date 8/16/07
 Chk'd By M. W. Perrott *MW* Date 8/16/07
 Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 2
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

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

Menu	Parameter	Current Value	Base Case*	Parameter Name
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA				
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(1)
B-1	Pb-210+D	2.320E-02	1.360E-02	DCF2(2)
B-1	Pu-238	3.920E-01	3.920E-01	DCF2(3)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(5)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(6)
B-1	U-234	1.320E-01	1.320E-01	DCF2(7)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(1)
D-1	Pb-210+D	7.276E-03	5.370E-03	DCF3(2)
D-1	Pu-238	3.200E-03	3.200E-03	DCF3(3)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(5)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(6)
D-1	U-234	2.830E-04	2.830E-04	DCF3(7)
D-34	Food transfer factors:			
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(1,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(1,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(1,3)
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(2,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(2,3)
D-34	Pu-238 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(3,1)
D-34	Pu-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(3,2)
D-34	Pu-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(3,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(1,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(1,2)
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(2,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5	Pu-238 , fish	3.000E+01	3.000E+01	BIOFAC(3,1)
D-5	Pu-238 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)

Attachment 5 Sheet No. 2 of 20
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 3
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

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

Menu	Parameter	Current Value	Base Case*	Parameter Name
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5,2)
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)

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

Attachment 5 Sheet No. 3 of 20
Originator: S.W. Clark Date _____
Chk'd By M.W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3   T_k Limit = 180 days   08/15/2007 18:31 Page 4
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Site-Specific Parameter Summary				
Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)
R011	Area of contaminated zone (m**2)	4.592E+03	1.000E+04	---
R011	Thickness of contaminated zone (m)	7.500E+00	2.000E+00	---
R011	Length parallel to aquifer flow (m)	6.900E+01	1.000E+02	---
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---
R011	Times for calculations (yr)	7.000E+00	1.000E+01	---
R011	Times for calculations (yr)	1.100E+01	3.000E+01	---
R011	Times for calculations (yr)	4.300E+01	1.000E+02	---
R011	Times for calculations (yr)	1.350E+02	3.000E+02	---
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---
R011	Times for calculations (yr)	not used	0.000E+00	---
R012	Initial principal radionuclide (pCi/g): Cs-137	4.340E-01	0.000E+00	---
R012	Initial principal radionuclide (pCi/g): Pu-238	3.300E-01	0.000E+00	---
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---
R012	Concentration in groundwater (pCi/L): Pu-238	not used	0.000E+00	---
R013	Cover depth (m)	0.000E+00	0.000E+00	---
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	---
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---
R013	Contaminated zone field capacity	1.500E-01	2.000E-01	---
R013	Contaminated zone hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---
R013	Contaminated zone b parameter	4.050E+00	5.300E+00	---
R013	Average annual wind speed (m/sec)	3.400E+00	2.000E+00	---
R013	Humidity in air (g/m**3)	not used	8.000E+00	---
R013	Evapotranspiration coefficient	9.100E-01	5.000E-01	---
R013	Precipitation (m/yr)	1.600E-01	1.000E+00	---
R013	Irrigation (m/yr)	7.600E-01	2.000E-01	---
R013	Irrigation mode	overhead	overhead	---
R013	Runoff coefficient	2.000E-01	2.000E-01	---
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.500E+00	---
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---
R014	Saturated zone field capacity	1.500E-01	2.000E-01	---
R014	Saturated zone hydraulic conductivity (m/yr)	5.530E+03	1.000E+02	---
R014	Saturated zone hydraulic gradient	1.250E-03	2.000E-02	---
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---
R014	Well pump intake depth (m below water table)	4.600E+00	1.000E+01	---
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---

Attachment 5 Sheet No. 4 of 20
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 5
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Site-Specific Parameter Summary (continued)				
Menu	Parameter	User Input	Default (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	0	1	NS
R016	Distribution coefficients for Cs-137			
R016	Contaminated zone (cm**3/g)	5.000E+01	4.600E+03	DCNUCC(1)
R016	Saturated zone (cm**3/g)	5.000E+01	4.600E+03	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	SOLUBK(1)
R016	Distribution coefficients for Pu-238			
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	DCNUCC(3)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	SOLUBK(3)
R016	Distribution coefficients for daughter Pb-210			
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	DCNUCC(2)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	SOLUBK(2)
R016	Distribution coefficients for daughter Ra-226			
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	DCNUCC(5)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	SOLUBK(5)
R016	Distribution coefficients for daughter Th-230			
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	DCNUCC(6)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	SOLUBK(6)
R016	Distribution coefficients for daughter U-234			
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	DCNUCC(7)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	SOLUBK(7)
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	FS

Attachment 5 Sheet No. 5 of 20
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 6
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Site-Specific Parameter Summary (continued)					
Menu	Parameter	User Input	Default	Used by RESRAD	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.100E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	2.700E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	1.000E+02	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	3.600E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	1.970E+01	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	7.300E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.230E+00	FMEAT
R018	Contamination fraction of milk	-1	-1	0.230E+00	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LF15
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LF16
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LW15
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LW16
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI

Attachment 5 Sheet No. 6 of 20
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

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1RESRAD, Version 6.3      T $\alpha$  Limit = 180 days      08/15/2007 18:31 Page 7
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File    : 118-F-2 ACL.RAD
```

Site-Specific Parameter Summary (continued)					
Menu	Parameter	User Input	Default	Used by RESRAD	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	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	0.000E+00	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSEFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV

Attachment 5 Sheet No. 7 of 20
 Originator: S. W. Clark Date _____
 Chk'd By M. W. Perrott Date _____
 Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 8
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Site-Specific Parameter Summary (continued)					
0	Parameter	User	Default	Used by RESRAD	Parameter
Menu	Parameter	Input	(If different from user input)		Name
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
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	---	PH20CV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH20FL
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
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii

Summary of Pathway Selections

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

Attachment 5 Sheet No. 8 of 20
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 9
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
AAAAAAAAAAAAAAAAAAAAAAAAAAAA		AAAAAAAAAAAAAAAAAAAAAAAAAAAA	
Area:	4592.00 square meters	Cs-137	4.340E-01
Thickness:	7.50 meters	Pu-238	3.300E-01
Cover Depth:	0.00 meters		

0

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

t (years):	0.000E+00	1.000E+00	3.000E+00	7.000E+00	1.100E+01	4.300E+01	1.350E+02	3.000E+02	1.000E+03
TDOSE(t):	1.130E+00	1.106E+00	1.059E+00	9.726E-01	8.934E-01	4.606E-01	8.743E-02	1.270E-02	1.051E-04
M(t):	7.530E-02	7.370E-02	7.062E-02	6.484E-02	5.956E-02	3.071E-02	5.829E-03	8.465E-04	7.010E-06

0Maximum TDOSE(t): 1.130E+00 mrem/yr at t = 0.000E+00 years

Attachment 5 Sheet No. 9 of 20
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 10
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.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)														
0	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
0	Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
	Cs-137	9.247E-01	0.8186	5.156E-07	0.0000	0.000E+00	0.0000	4.891E-02	0.0433	1.733E-02	0.0153	1.076E-02	0.0095	1.267E-03
	Pu-238	3.336E-05	0.0000	4.818E-03	0.0043	0.000E+00	0.0000	5.955E-02	0.0527	4.960E-04	0.0004	1.346E-05	0.0000	6.167E-02
	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
	Total	9.247E-01	0.8187	4.818E-03	0.0043	0.000E+00	0.0000	1.085E-01	0.0960	1.782E-02	0.0158	1.078E-02	0.0095	6.294E-02
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														
Water Dependent Pathways														
0	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
0	Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
	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	1.003E+00
	Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.266E-01
	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
	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	1.130E+00
0*Sum of all water independent and dependent pathways.														

Attachment 5 Sheet No. 10 of 20
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 11
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)									
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years									
Water Independent Pathways (Inhalation excludes radon)									
	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil		
Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Nuclide	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr
	fract.	fract.	fract.	fract.	fract.	fract.	fract.	fract.	fract.
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	9.034E-01	5.038E-07	0.0000	0.000E+00	0.0000	4.779E-02	0.0432	1.693E-02	0.0153
Pu-238	3.310E-05	0.0000	4.780E-03	0.0043	0.000E+00	0.0000	5.908E-02	0.0534	4.921E-04
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
Total	9.035E-01	0.8172	4.780E-03	0.0043	0.000E+00	0.0000	1.069E-01	0.0967	1.742E-02
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									
Water Dependent Pathways									
	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*		
Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Nuclide	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr	mrem/yr
	fract.	fract.	fract.	fract.	fract.	fract.	fract.	fract.	fract.
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	3.956E-05	0.0000	2.707E-05	0.0000	0.000E+00	0.0000	4.010E-06	0.0000	3.849E-06
Pu-238	1.220E-10	0.0000	5.085E-13	0.0000	0.000E+00	0.0000	1.111E-11	0.0000	7.649E-14
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
Total	3.956E-05	0.0000	2.707E-05	0.0000	0.000E+00	0.0000	4.010E-06	0.0000	3.849E-06
0*Sum of all water independent and dependent pathways.									

Attachment 5 Sheet No. 11 of 20
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T_k Limit = 180 days 08/15/2007 18:31 Page 12
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

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

Radio- Nuclide	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	
Cs-137	8.624E-01	0.8142	4.809E-07	0.0000	0.000E+00	0.0000	4.562E-02	0.0431
Pu-238	3.258E-05	0.0000	4.705E-03	0.0044	0.000E+00	0.0000	5.815E-02	0.0549
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	
Total	8.624E-01	0.8142	4.705E-03	0.0044	0.000E+00	0.0000	1.038E-01	0.0980

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

Radio- Nuclide	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	
Cs-137	1.139E-04	0.0001	8.034E-05	0.0001	0.000E+00	0.0000	1.234E-05	0.0000
Pu-238	1.105E-09	0.0000	4.886E-12	0.0000	0.000E+00	0.0000	1.148E-10	0.0000
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	
Total	1.139E-04	0.0001	8.034E-05	0.0001	0.000E+00	0.0000	1.234E-05	0.0000

0*Sum of all water independent and dependent pathways.

Attachment 5 Sheet No. 12 of 20
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 13
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.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 = 7.000E+00 years														
Water Independent Pathways (Inhalation excludes radon)														
	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	7.858E-01	0.8080	4.382E-07	0.0000	0.000E+00	0.0000	4.157E-02	0.0427	1.473E-02	0.0151	9.147E-03	0.0094	1.077E-03	0.0011
Pu-238	3.156E-05	0.0000	4.558E-03	0.0047	0.000E+00	0.0000	5.633E-02	0.0579	4.692E-04	0.0005	1.275E-05	0.0000	5.834E-02	0.0600
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
Total	7.859E-01	0.8080	4.558E-03	0.0047	0.000E+00	0.0000	9.790E-02	0.1007	1.520E-02	0.0156	9.160E-03	0.0094	5.942E-02	0.0611
Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)														
As mrem/yr and Fraction of Total Dose At t = 7.000E+00 years														
Water Dependent Pathways														
	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	2.425E-04	0.0002	1.726E-04	0.0002	0.000E+00	0.0000	2.676E-05	0.0000	4.005E-05	0.0000	3.179E-05	0.0000	8.529E-01	0.8769
Pu-238	6.001E-09	0.0000	2.698E-11	0.0000	0.000E+00	0.0000	6.461E-10	0.0000	1.052E-11	0.0000	5.699E-11	0.0000	1.197E-01	0.1231
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
Total	2.425E-04	0.0002	1.726E-04	0.0002	0.000E+00	0.0000	2.676E-05	0.0000	4.005E-05	0.0000	3.179E-05	0.0000	9.726E-01	1.0000
0*Sum of all water independent and dependent pathways.														

Attachment 5 Sheet No. 13 of 20
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

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1RESRAD, Version 6.3      T« Limit = 180 days      08/15/2007 18:31 Page 14
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File    : 118-F-2 ACL.RAD
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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 = 1.100E+01 years
Water Independent Pathways (Inhalation excludes radon)

Water Independent Pathways (Inhalation excludes radon)														
0	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	mmem/yr	fract.	mmem/yr	fract.	mmem/yr	fract.	mmem/yr	fract.	mmem/yr	fract.	mmem/yr	fract.	mmem/yr	fract.
Nuclide	AAAAAAAAAAAA		AAAAAAAAAAAA		AAAAAAAAAAAA		AAAAAAAAAAAA		AAAAAAAAAAAA		AAAAAAAAAAAA		AAAAAAAAAAAA	
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	7.161E-01	0.8015	3.993E-07	0.0000	0.000E+00	0.0000	3.788E-02	0.0424	1.342E-02	0.0150	8.335E-03	0.0093	9.814E-04	0.0011
Pu-238	3.058E-05	0.0000	4.145E-03	0.0049	0.000E+00	0.0000	5.457E-02	0.0641	4.545E-04	0.0005	1.236E-05	0.0000	5.652E-02	0.0633
Total	7.161E-01	0.8015	4.146E-03	0.0049	0.000E+00	0.0000	9.245E-02	0.1035	1.387E-02	0.0155	8.347E-03	0.0093	5.750E-02	0.0644

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.100E+01 years

Water		Fish		Radon		Plant		Meat		Milk		All Pathways*		
Radio-	mem/yr	fract.	mem/yr	fract.	mem/yr	fract.	mem/yr	fract.	mem/yr	fract.	mem/yr	fract.	mem/yr	fract.
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	3.475E-04	0.0004	2.479E-04	0.0003	0.000E+00	0.0000	3.853E-05	0.0000	5.881E-05	0.0001	4.615E-05	0.0001	7.774E-01	0.8702
Pu-238	1.475E-08	0.0000	6.661E-11	0.0000	0.000E+00	0.0000	1.603E-09	0.0000	2.714E-11	0.0000	1.437E-10	0.0000	1.160E-01	0.1298
Total	3.475E-04	0.0004	2.479E-04	0.0003	0.000E+00	0.0000	3.853E-05	0.0000	5.881E-05	0.0001	4.615E-05	0.0001	8.934E-01	1.0000

Attachment 5 Sheet No. 14 of 20
 Originator: S. W. Clark Date _____
 Chk'd By M. W. Perrott Date _____
 Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 15
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.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 = 4.300E+01 years															
Water Independent Pathways (Inhalation excludes radon)															
0	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil		
0	Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	
	Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
	Cs-137	3.404E-01	0.7391	1.898E-07	0.0000	0.000E+00	0.0000	1.801E-02	0.0391	6.380E-03	0.0138	3.962E-03	0.0086	4.666E-04	0.0010
	Pu-238	2.373E-05	0.0001	3.426E-03	0.0074	0.000E+00	0.0000	4.234E-02	0.0919	3.526E-04	0.0008	9.655E-06	0.0000	4.385E-02	0.0952
	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
0	Total	3.404E-01	0.7391	3.426E-03	0.0074	0.000E+00	0.0000	6.035E-02	0.1310	6.732E-03	0.0146	3.972E-03	0.0086	4.431E-02	0.0962
Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)															
As mrem/yr and Fraction of Total Dose At t = 4.300E+01 years															
Water Dependent Pathways															
0	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*		
0	Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	
	Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
	Cs-137	6.478E-04	0.0014	4.635E-04	0.0010	0.000E+00	0.0000	7.228E-05	0.0002	1.131E-04	0.0002	8.746E-05	0.0002	3.706E-01	0.8046
	Pu-238	2.162E-07	0.0000	9.821E-10	0.0000	0.000E+00	0.0000	2.380E-08	0.0000	4.230E-10	0.0000	2.176E-09	0.0000	8.999E-02	0.1954
	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
	Total	6.480E-04	0.0014	4.635E-04	0.0010	0.000E+00	0.0000	7.231E-05	0.0002	1.131E-04	0.0002	8.746E-05	0.0002	4.606E-01	1.0000
0*Sum of all water independent and dependent pathways.															

Attachment 5 Sheet No. 15 of 20
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 16
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.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 = 1.350E+02 years														
Water Independent Pathways (Inhalation excludes radon)														
	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA
Cs-137	4.014E-02	0.4591	2.238E-08	0.0000	0.000E+00	0.0000	2.123E-03	0.0243	7.522E-04	0.0086	4.672E-04	0.0053	5.501E-05	0.0006
Pu-238	1.146E-05	0.0001	1.651E-03	0.0189	0.000E+00	0.0000	2.041E-02	0.2334	1.700E-04	0.0019	4.803E-06	0.0001	2.113E-02	0.2417
fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction
Total	4.015E-02	0.4592	1.651E-03	0.0189	0.000E+00	0.0000	2.253E-02	0.2577	9.222E-04	0.0105	4.720E-04	0.0054	2.119E-02	0.2423

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)														
As mrem/yr and Fraction of Total Dose At t = 1.350E+02 years														
Water Dependent Pathways														
	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	2.417E-04	0.0028	1.730E-04	0.0020	0.000E+00	0.0000	2.700E-05	0.0003	4.249E-05	0.0005	3.275E-05	0.0004	4.405E-02	0.5038
Pu-238	1.893E-06	0.0000	8.617E-09	0.0000	0.000E+00	0.0000	2.091E-07	0.0000	3.758E-09	0.0000	1.920E-08	0.0000	4.338E-02	0.4962
fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction	fraction
Total	2.436E-04	0.0028	1.730E-04	0.0020	0.000E+00	0.0000	2.721E-05	0.0003	4.249E-05	0.0005	3.277E-05	0.0004	8.743E-02	1.0000
*Sum of	all water dependent and dependent pathways.													

0*Sum of all water independent and dependent pathways.

Attachment 5 Sheet No. 16 of 20
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:31 Page 17
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.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	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
0	Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	Cs-137	8.677E-04	0.0683	4.839E-10	0.0000	0.000E+00	0.0000	4.590E-05	0.0036	1.626E-05	0.0013	1.010E-05	0.0008	1.189E-06
	Pu-238	3.181E-06	0.0003	4.464E-04	0.0352	0.000E+00	0.0000	5.515E-03	0.4344	4.596E-05	0.0036	1.506E-06	0.0001	5.709E-03
	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT
	Total	8.709E-04	0.0686	4.464E-04	0.0352	0.000E+00	0.0000	5.561E-03	0.4380	6.222E-05	0.0049	1.161E-05	0.0009	5.711E-03
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	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
0	Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	Cs-137	1.177E-05	0.0009	8.429E-06	0.0007	0.000E+00	0.0000	1.316E-06	0.0001	2.073E-06	0.0002	1.597E-06	0.0001	9.663E-04
	Pu-238	7.689E-06	0.0006	3.510E-08	0.0000	0.000E+00	0.0000	8.496E-07	0.0001	1.532E-08	0.0000	7.812E-08	0.0000	1.173E-02
	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT	TTTTT
	Total	1.946E-05	0.0015	8.464E-06	0.0007	0.000E+00	0.0000	2.165E-06	0.0002	2.088E-06	0.0002	1.675E-06	0.0001	1.270E-02
	0*Sum of all water independent and dependent pathways.													

Attachment 5 Sheet No. 17 of 20
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 18
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.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)														
	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA
Cs-137	7.481E-11	0.0000	4.172E-17	0.0000	0.000E+00	0.0000	3.957E-12	0.0000	1.402E-12	0.0000	8.707E-13	0.0000	1.025E-13	0.0000
Pu-238	1.075E-06	0.0102	2.253E-06	0.0214	0.000E+00	0.0000	2.656E-05	0.2526	2.470E-07	0.0023	2.845E-07	0.0027	2.394E-05	0.2277
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
Total	1.076E-06	0.0102	2.253E-06	0.0214	0.000E+00	0.0000	2.656E-05	0.2526	2.470E-07	0.0023	2.845E-07	0.0027	2.394E-05	0.2277
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														
Water Dependent Pathways														
	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
AAAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA	AAAAAA	AAAAA
Cs-137	3.586E-12	0.0000	2.568E-12	0.0000	0.000E+00	0.0000	4.009E-13	0.0000	6.322E-13	0.0000	4.867E-13	0.0000	8.881E-11	0.0000
Pu-238	4.504E-05	0.4284	2.161E-07	0.0021	0.000E+00	0.0000	4.979E-06	0.0474	9.029E-08	0.0009	4.578E-07	0.0044	1.051E-04	1.0000
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
Total	4.504E-05	0.4284	2.161E-07	0.0021	0.000E+00	0.0000	4.979E-06	0.0474	9.029E-08	0.0009	4.578E-07	0.0044	1.051E-04	1.0000
0*Sum of all water independent and dependent pathways.														

Attachment 5 Sheet No. 18 of 20
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 19
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

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

0 Parent	Product	Thread	Fraction	DSR(j,t) At Time in Years	(mrem/yr)/(pCi/g)
(i)	(j)				
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137-D	Cs-137-D	1.000E+00	2.311E+00	2.258E+00	2.156E+00
OPu-238	Pu-238	1.840E-09	7.058E-10	7.002E-10	6.892E-10
OPu-238	Pu-238	1.000E+00	3.836E-01	3.805E-01	3.745E-01
Pu-238	U-234	1.000E+00	0.000E+00	1.801E-07	5.439E-07
Pu-238	Th-230	1.000E+00	0.000E+00	1.013E-12	8.805E-12
Pu-238	Ra-226-D	1.000E+00	0.000E+00	1.981E-14	5.047E-13
Pu-238	Pb-210-D	1.000E+00	0.000E+00	6.760E-15	3.003E-14
Pu-238	aDSR(j)		3.836E-01	3.805E-01	3.745E-01
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

The DSR includes contributions from associated (half-life 6 180 days) daughters.

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

0Nuclide	t= 0.000E+00	1.000E+00	3.000E+00	7.000E+00	1.100E+01	4.300E+01	1.350E+02	3.000E+02	1.000E+03
(i)	(j)								
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	6.491E+00	6.643E+00	6.958E+00	7.633E+00	8.374E+00	1.756E+01	1.478E+02	6.737E+03	7.330E+10
Pu-238	3.911E+01	3.942E+01	4.005E+01	4.134E+01	4.267E+01	5.500E+01	1.141E+02	4.220E+02	4.708E+04
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

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	Initial	tmin	DSR(i,tmin)	G(i,tmin)	DSR(i,tmax)	G(i,tmax)
(i)	(pCi/g)	(years)		(pCi/g)		(pCi/g)
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	4.340E-01	0.000E+00	2.311E+00	6.491E+00	2.311E+00	6.491E+00
Pu-238	3.300E-01	0.000E+00	3.836E-01	3.911E+01	3.836E-01	3.911E+01
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

Attachment 5 Sheet No. 19 of 20
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 5

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:31 Page 20
Summary : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

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

ONuclide	Parent	THF(i)		DOSE(j,t), mrem/yr									
(j)	(i)		t=	0.000E+00	1.000E+00	3.000E+00	7.000E+00	1.100E+01	4.300E+01	1.350E+02	3.000E+02	1.000E+03	
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	
Cs-137	Cs-137	1.000E+00	1.003E+00	9.800E-01	9.356E-01	8.529E-01	7.774E-01	3.706E-01	4.405E-02	9.663E-04	8.881E-11		
OPu-238	Pu-238	1.840E-09	2.329E-10	2.311E-10	2.274E-10	2.203E-10	2.134E-10	1.656E-10	7.981E-11	2.156E-11	8.352E-14		
Pu-238	Pu-238	1.000E+00	1.266E-01	1.256E-01	1.236E-01	1.197E-01	1.160E-01	8.999E-02	4.337E-02	1.171E-02	4.539E-05		
Pu-238	DOSE(j)		1.266E-01	1.256E-01	1.236E-01	1.197E-01	1.160E-01	8.999E-02	4.337E-02	1.171E-02	4.539E-05		
OU-234	Pu-238	1.000E+00	0.000E+00	5.942E-08	1.795E-07	4.172E-07	6.519E-07	2.438E-06	7.088E-06	1.539E-05	5.739E-05		
OTh-230	Pu-238	1.000E+00	0.000E+00	3.342E-13	2.906E-12	1.552E-11	3.782E-11	5.301E-10	4.186E-09	1.476E-08	6.636E-08		
ORa-226	Pu-238	1.000E+00	0.000E+00	6.536E-15	1.665E-13	2.093E-12	8.053E-12	4.507E-10	1.166E-08	9.645E-08	1.537E-06		
OPb-210	Pu-238	1.000E+00	0.000E+00	2.231E-15	9.910E-15	7.873E-14	3.401E-13	5.533E-11	3.032E-09	3.486E-08	7.645E-07		
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

ONuclide	Parent	THF(i)		S(j,t), pCi/g									
(j)	(i)		t=	0.000E+00	1.000E+00	3.000E+00	7.000E+00	1.100E+01	4.300E+01	1.350E+02	3.000E+02	1.000E+03	
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	
Cs-137	Cs-137	1.000E+00	4.340E-01	4.240E-01	4.048E-01	3.688E-01	3.361E-01	1.598E-01	1.884E-02	4.073E-04	3.511E-11		
OPu-238	Pu-238	1.840E-09	6.072E-10	6.024E-10	5.929E-10	5.744E-10	5.565E-10	4.317E-10	2.081E-10	5.620E-11	2.177E-13		
Pu-238	Pu-238	1.000E+00	3.300E-01	3.274E-01	3.222E-01	3.122E-01	3.024E-01	2.346E-01	1.131E-01	3.054E-02	1.183E-04		
Pu-238	S(j):		3.300E-01	3.274E-01	3.222E-01	3.122E-01	3.024E-01	2.346E-01	1.131E-01	3.054E-02	1.183E-04		
OU-234	Pu-238	1.000E+00	0.000E+00	9.318E-07	2.773E-06	6.367E-06	9.847E-06	3.398E-05	7.669E-05	1.041E-04	1.047E-04		
OTh-230	Pu-238	1.000E+00	0.000E+00	4.199E-12	3.759E-11	2.025E-10	4.947E-10	6.956E-09	5.496E-08	1.938E-07	8.702E-07		
ORa-226	Pu-238	1.000E+00	0.000E+00	6.068E-16	1.631E-14	2.055E-13	7.905E-13	4.416E-11	1.141E-09	9.404E-09	1.471E-07		
OPb-210	Pu-238	1.000E+00	0.000E+00	4.688E-18	3.738E-16	1.074E-14	6.348E-14	1.172E-11	6.419E-10	7.221E-09	1.375E-07		
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	

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

ORESCALC.EXE execution time = 7.83 seconds

Attachment 5 Sheet No. 20 of 20
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3   T« Limit = 180 days   08/15/2007 18:31 Page 1
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Table of Contents
AAAAAAAAAAAAAAAAAAAA
Part III: Intake Quantities and Health Risk Factors
!!

Cancer Risk Slope Factors	2
Risk Slope and ETFG for the Ground Pathway	3
Amount of Intake Quantities and Excess Cancer Risks	
Time= 0.000E+00	4
Time= 1.000E+00	7
Time= 3.000E+00	10
Time= 7.000E+00	13
Time= 1.100E+01	16
Time= 4.300E+01	19
Time= 1.350E+02	22
Time= 3.000E+02	25
Time= 1.000E+03	28

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 2
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Cancer Risk Slope Factors Summary Table
Risk Library: HEAST 2001 Morbidity

Menu	Parameter	Current Value	Base Case*	Parameter Name
AAAAAA				
Sf-1	Ground external radiation slope factors, 1/yr per (pCi/g):			
Sf-1	Cs-137+D	2.55E-06	5.32E-10	SLPF(1,1)
Sf-1	Pb-210+D	4.21E-09	1.41E-09	SLPF(2,1)
Sf-1	Pu-238	7.22E-11	7.22E-11	SLPF(3,1)
Sf-1	Ra-226+D	8.49E-06	2.29E-08	SLPF(5,1)
Sf-1	Th-230	8.19E-10	8.19E-10	SLPF(6,1)
Sf-1	U-234	2.52E-10	2.52E-10	SLPF(7,1)
Sf-2	Inhalation, slope factors, 1/(pCi):			
Sf-2	Cs-137+D	1.19E-11	1.19E-11	SLPF(1,2)
Sf-2	Pb-210+D	1.39E-08	2.77E-09	SLPF(2,2)
Sf-2	Pu-238	3.36E-08	3.36E-08	SLPF(3,2)
Sf-2	Ra-226+D	1.16E-08	1.15E-08	SLPF(5,2)
Sf-2	Th-230	2.85E-08	2.85E-08	SLPF(6,2)
Sf-2	U-234	1.14E-08	1.14E-08	SLPF(7,2)
Sf-3	Food ingestion, slope factors, 1/(pCi):			
Sf-3	Cs-137+D	3.74E-11	3.74E-11	SLPF(1,3)
Sf-3	Pb-210+D	3.44E-09	1.18E-09	SLPF(2,3)
Sf-3	Pu-238	1.69E-10	1.69E-10	SLPF(3,3)
Sf-3	Ra-226+D	5.15E-10	5.14E-10	SLPF(5,3)
Sf-3	Th-230	1.19E-10	1.19E-10	SLPF(6,3)
Sf-3	U-234	9.55E-11	9.55E-11	SLPF(7,3)
Sf-3	Water ingestion, slope factors, 1/(pCi):			
Sf-3	Cs-137+D	3.04E-11	3.04E-11	SLPF(1,4)
Sf-3	Pb-210+D	1.27E-09	8.81E-10	SLPF(2,4)
Sf-3	Pu-238	1.31E-10	1.31E-10	SLPF(3,4)
Sf-3	Ra-226+D	3.86E-10	3.85E-10	SLPF(5,4)
Sf-3	Th-230	9.10E-11	9.10E-11	SLPF(6,4)
Sf-3	U-234	7.07E-11	7.07E-11	SLPF(7,4)
Sf-3	Soil ingestion, slope factors, 1/(pCi):			
Sf-3	Cs-137+D	4.33E-11	4.33E-11	SLPF(1,5)
Sf-3	Pb-210+D	2.66E-09	1.84E-09	SLPF(2,5)
Sf-3	Pu-238	2.72E-10	2.72E-10	SLPF(3,5)
Sf-3	Ra-226+D	7.30E-10	7.29E-10	SLPF(5,5)
Sf-3	Th-230	2.02E-10	2.02E-10	SLPF(6,5)
Sf-3	U-234	1.58E-10	1.58E-10	SLPF(7,5)
Sf-Rn	Radon Inhalation slope factors, 1/(pCi):			
Sf-Rn	Rn-222	1.80E-12	1.80E-12	SLPFRN(1,1)
Sf-Rn	Po-218	3.70E-12	3.70E-12	SLPFRN(1,2)
Sf-Rn	Pb-214	6.20E-12	6.20E-12	SLPFRN(1,3)
Sf-Rn	Bi-214	1.50E-11	1.50E-11	SLPFRN(1,4)
Sf-Rn	Radon K factors, (mrem/WLM):			
Sf-Rn	Rn-222 Indoor	7.60E+02	7.60E+02	KFACTR(1,1)
Sf-Rn	Rn-222 Outdoor	5.70E+02	5.70E+02	KFACTR(1,2)

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

Attachment 6 Sheet No. 2 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 3
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

ONuclide	Slope(i)*	Risk Slope and Environmental Transport Factors for the Ground Pathway									
		ETFG(i,t) At Time in Years (dimensionless)									
(i)	t=	0.000E+00	1.000E+00	3.000E+00	7.000E+00	1.100E+01	4.300E+01	1.350E+02	3.000E+02	1.000E+03	
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	
At-218	3.570E-09	6.478E-01	6.478E-01	6.478E-01	6.478E-01	6.478E-01	6.478E-01	6.478E-01	6.478E-01	6.478E-01	
Ba-137m	2.690E-06	6.246E-01	6.246E-01	6.246E-01	6.246E-01	6.246E-01	6.246E-01	6.246E-01	6.246E-01	6.246E-01	
Bi-210	2.760E-09	6.322E-01	6.322E-01	6.322E-01	6.322E-01	6.322E-01	6.322E-01	6.322E-01	6.322E-01	6.322E-01	
Bi-214	7.480E-06	6.288E-01	6.288E-01	6.288E-01	6.288E-01	6.288E-01	6.288E-01	6.288E-01	6.288E-01	6.288E-01	
Cs-137	5.320E-10	6.364E-01	6.364E-01	6.364E-01	6.364E-01	6.364E-01	6.364E-01	6.364E-01	6.364E-01	6.364E-01	
Pb-210	1.410E-09	6.552E-01	6.552E-01	6.552E-01	6.552E-01	6.552E-01	6.552E-01	6.552E-01	6.552E-01	6.552E-01	
Pb-214	9.820E-07	6.318E-01	6.318E-01	6.318E-01	6.318E-01	6.318E-01	6.318E-01	6.318E-01	6.318E-01	6.318E-01	
Po-210	3.950E-11	6.280E-01	6.280E-01	6.280E-01	6.280E-01	6.280E-01	6.280E-01	6.280E-01	6.280E-01	6.280E-01	
Po-214	3.860E-10	6.246E-01	6.246E-01	6.246E-01	6.246E-01	6.246E-01	6.246E-01	6.246E-01	6.246E-01	6.246E-01	
Po-218	4.260E-11	6.280E-01	6.280E-01	6.280E-01	6.280E-01	6.280E-01	6.280E-01	6.280E-01	6.280E-01	6.280E-01	
Pu-238	7.220E-11	6.682E-01	6.682E-01	6.682E-01	6.682E-01	6.682E-01	6.682E-01	6.682E-01	6.682E-01	6.682E-01	
Ra-226	2.290E-08	6.381E-01	6.381E-01	6.381E-01	6.381E-01	6.381E-01	6.381E-01	6.381E-01	6.381E-01	6.381E-01	
Rn-222	1.740E-09	6.252E-01	6.252E-01	6.252E-01	6.252E-01	6.252E-01	6.252E-01	6.252E-01	6.252E-01	6.252E-01	
Th-230	8.190E-10	6.418E-01	6.418E-01	6.418E-01	6.418E-01	6.418E-01	6.418E-01	6.418E-01	6.418E-01	6.418E-01	
Tl-210	0.000E+00	6.800E-01	6.800E-01	6.800E-01	6.800E-01	6.800E-01	6.800E-01	6.800E-01	6.800E-01	6.800E-01	
U-234	2.520E-10	6.467E-01	6.467E-01	6.467E-01	6.467E-01	6.467E-01	6.467E-01	6.467E-01	6.467E-01	6.467E-01	
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	

* - Units are 1/yr per (pCi/g) at infinite depth and area. Multiplication by ETFG(i,t) converts to site conditions.

Attachment 6 Sheet No. 3 of 30
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:31 Page 4
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 0.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	1.616E-02	9.783E+02	3.466E+02	2.153E+02	2.535E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.565E+03
Pb-210	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	0.000E+00
Pu-238	1.229E-02	1.861E+01	1.550E-01	4.207E-03	1.927E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.804E+01
Ra-226	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	0.000E+00
Th-230	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	0.000E+00
U-234	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	0.000E+00
U-238	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	0.000E+00
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

0 Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 0.000E+00 years

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

0 Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	1.490E-05	0.9074	4.155E-12	0.0000	7.904E-07	0.0481	2.800E-07	0.0170	1.739E-07	0.0106	2.371E-08	0.0014
Pb-210	5.119E-20	0.0000	9.830E-21	0.0000	3.767E-17	0.0000	5.435E-19	0.0000	4.924E-19	0.0000	2.954E-18	0.0000
Pu-238	4.250E-10	0.0000	1.102E-08	0.0007	8.396E-08	0.0051	6.993E-10	0.0000	1.898E-11	0.0000	1.399E-07	0.0085
Ra-226	6.248E-16	0.0000	5.040E-20	0.0000	1.351E-16	0.0000	1.571E-18	0.0000	3.685E-18	0.0000	4.990E-18	0.0000
Th-230	1.877E-17	0.0000	3.790E-17	0.0000	2.409E-16	0.0000	2.032E-18	0.0000	2.812E-19	0.0000	4.212E-16	0.0000
U-234	6.339E-14	0.0000	1.651E-13	0.0000	5.227E-12	0.0000	6.972E-14	0.0000	3.260E-13	0.0000	3.589E-12	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.490E-05	0.9074	1.103E-08	0.0007	8.743E-07	0.0532	2.807E-07	0.0171	1.739E-07	0.0106	1.637E-07	0.0100

Attachment 6 Sheet No. 4 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:31 Page 5
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Water Dependent Pathways

Radio-	Water	Fish	Plant	Meat	Milk	All Pathways**
Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
Cs-137	7.116E-09 0.0004	6.251E-09 0.0004	9.728E-10 0.0001	1.498E-09 0.0001	1.169E-09 0.0001	1.619E-05 0.9856
Pb-210	2.115E-19 0.0000	7.064E-20 0.0000	7.843E-20 0.0000	2.871E-21 0.0000	2.785E-21 0.0000	4.208E-17 0.0000
Pu-238	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	2.361E-07 0.0144
Ra-226	1.585E-19 0.0000	5.094E-21 0.0000	2.768E-20 0.0000	1.278E-21 0.0000	3.367E-21 0.0000	7.704E-16 0.0000
Th-230	1.594E-20 0.0000	7.771E-22 0.0000	1.776E-20 0.0000	6.946E-22 0.0000	1.421E-22 0.0000	7.212E-16 0.0000
U-234	2.700E-13 0.0000	1.653E-15 0.0000	3.996E-14 0.0000	6.968E-16 0.0000	3.624E-15 0.0000	9.756E-12 0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	7.116E-09 0.0004	6.251E-09 0.0004	9.729E-10 0.0001	1.498E-09 0.0001	1.169E-09 0.0001	1.642E-05 1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

0 Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 0.000E+00 years

0 Radionuclides

Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

0 Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

0 Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
Cs-137	1.490E-05 0.9074	4.155E-12 0.0000	0.000E+00 0.0000	7.904E-07 0.0481	2.800E-07 0.0170	1.739E-07 0.0106	2.371E-08 0.0014
Pu-238	4.251E-10 0.0000	1.103E-08 0.0007	0.000E+00 0.0000	8.396E-08 0.0051	6.994E-10 0.0000	1.930E-11 0.0000	1.399E-07 0.0085
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.490E-05 0.9074	1.103E-08 0.0007	0.000E+00 0.0000	8.743E-07 0.0532	2.807E-07 0.0171	1.739E-07 0.0106	1.637E-07 0.0100

Attachment 6 Sheet No. 5 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 6
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Radio-	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	7.116E-09	0.0004	6.251E-09	0.0004	0.000E+00	0.0000	9.728E-10	0.0001	1.498E-09	0.0001	1.169E-09	0.0001	1.619E-05	0.9856
Pu-238	2.700E-13	0.0000	1.653E-15	0.0000	0.000E+00	0.0000	3.996E-14	0.0000	6.968E-16	0.0000	3.624E-15	0.0000	2.361E-07	0.0144
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	7.116E-09	0.0004	6.251E-09	0.0004	0.000E+00	0.0000	9.729E-10	0.0001	1.498E-09	0.0001	1.169E-09	0.0001	1.642E-05	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 6 Sheet No. 6 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T_a Limit = 180 days 08/15/2007 18:31 Page 7
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	1.579E-02	9.558E+02	3.386E+02	2.103E+02	2.476E+01	7.911E-01	5.415E-01	8.019E-02	7.698E-02	8.148E-02	1.531E+03
Pb-210	1.746E-19	3.690E-15	6.201E-17	5.230E-17	2.738E-16	2.499E-13	2.585E-14	2.536E-14	2.809E-16	1.150E-15	3.066E-13
Pu-238	1.219E-02	1.846E+01	1.538E-01	4.173E-03	1.912E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.774E+01
Ra-226	2.260E-17	1.225E-12	9.873E-15	2.768E-14	3.543E-14	3.670E-13	7.652E-15	3.743E-14	5.040E-16	5.516E-15	1.716E-12
Th-230	1.564E-13	2.624E-10	2.642E-12	4.728E-13	2.453E-10	1.138E-14	3.407E-16	1.299E-14	2.039E-16	7.776E-17	5.108E-10
U-234	3.470E-08	1.284E-04	1.650E-06	8.033E-06	5.442E-05	4.311E-07	1.796E-09	3.927E-08	2.703E-10	2.627E-09	1.929E-04
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil and water-dependent water, fish, plant, meat, milk pathways											

0 Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 1.000E+00 years

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	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 Water-ind. == Water-independent Water-dep. == Water-dependent

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	1.456E-05	0.9071	4.060E-12	0.0000	7.722E-07	0.0481	2.736E-07	0.0170	1.699E-07	0.0106	2.316E-08	0.0014
Pb-210	5.993E-20	0.0000	1.151E-20	0.0000	4.407E-17	0.0000	6.351E-19	0.0000	5.758E-19	0.0000	3.458E-18	0.0000
Pu-238	4.217E-10	0.0000	1.094E-08	0.0007	8.329E-08	0.0052	6.938E-10	0.0000	1.883E-11	0.0000	1.388E-07	0.0086
Ra-226	7.112E-16	0.0000	5.737E-20	0.0000	1.538E-16	0.0000	1.789E-18	0.0000	4.196E-18	0.0000	5.680E-18	0.0000
Th-230	2.067E-17	0.0000	4.174E-17	0.0000	2.652E-16	0.0000	2.236E-18	0.0000	3.093E-19	0.0000	4.638E-16	0.0000
U-234	6.743E-14	0.0000	1.757E-13	0.0000	5.561E-12	0.0000	7.416E-14	0.0000	3.467E-13	0.0000	3.818E-12	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.456E-05	0.9071	1.094E-08	0.0007	8.555E-07	0.0533	2.743E-07	0.0171	1.699E-07	0.0106	1.620E-07	0.0101

Attachment 6 Sheet No. 7 of 30
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:31 Page 8
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Water Dependent Pathways

Radio-	Water	Fish	Plant	Meat	Milk	All Pathways**
Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	7.476E-09 0.0005	6.567E-09 0.0004	1.022E-09 0.0001	1.572E-09 0.0001	1.228E-09 0.0001	1.582E-05 0.9854
Pb-210	1.976E-19 0.0000	5.632E-20 0.0000	5.670E-20 0.0000	2.771E-21 0.0000	3.304E-21 0.0000	4.912E-17 0.0000
Pu-238	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	2.342E-07 0.0146
Ra-226	1.682E-19 0.0000	4.889E-21 0.0000	2.491E-20 0.0000	1.353E-21 0.0000	4.117E-21 0.0000	8.769E-16 0.0000
Th-230	1.784E-20 0.0000	8.710E-22 0.0000	1.961E-20 0.0000	7.671E-22 0.0000	1.568E-22 0.0000	7.941E-16 0.0000
U-234	2.977E-13 0.0000	1.823E-15 0.0000	4.406E-14 0.0000	7.692E-16 0.0000	3.998E-15 0.0000	1.039E-11 0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	7.477E-09 0.0005	6.567E-09 0.0004	1.022E-09 0.0001	1.572E-09 0.0001	1.228E-09 0.0001	1.605E-05 1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

0

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 1.000E+00 years

0

Radon	Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Water-ind.	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
Water-dep.	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
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	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

Water-ind. == Water-independent Water-dep. == Water-dependent

0

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

0

Radio-	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.456E-05 0.9071	4.060E-12 0.0000	0.000E+00 0.0000	7.722E-07 0.0481	2.736E-07 0.0170	1.699E-07 0.0106	2.316E-08 0.0014
Pu-238	4.217E-10 0.0000	1.094E-08 0.0007	0.000E+00 0.0000	8.330E-08 0.0052	6.938E-10 0.0000	1.918E-11 0.0000	1.388E-07 0.0086
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.456E-05 0.9071	1.094E-08 0.0007	0.000E+00 0.0000	8.555E-07 0.0533	2.743E-07 0.0171	1.699E-07 0.0106	1.620E-07 0.0101

Attachment 6 Sheet No. 8 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:31 Page 9
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Radio-	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	7.476E-09	0.0005	6.567E-09	0.0004	0.000E+00	0.0000	1.022E-09	0.0001	1.572E-09	0.0001	1.228E-09	0.0001	1.582E-05	0.9854
Pu-238	2.977E-13	0.0000	1.823E-15	0.0000	0.000E+00	0.0000	4.406E-14	0.0000	7.692E-16	0.0000	3.998E-15	0.0000	2.342E-07	0.0146
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	7.477E-09	0.0005	6.567E-09	0.0004	0.000E+00	0.0000	1.022E-09	0.0001	1.572E-09	0.0001	1.228E-09	0.0001	1.605E-05	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 6 Sheet No. 9 of 30
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

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1RESRAD, Version 6.3      T« Limit = 180 days      08/15/2007 18:31 Page 10
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File    : 118-F-2_ACL.RAD
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Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 3.000E+00 years

Radio-Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
CS-137	1.508E-02	9.124E+02	3.232E+02	2.008E+02	2.364E+01	2.277E+00	1.607E+00	2.467E-01	3.419E-01	2.844E-01	1.465E+03
Pb-210	1.392E-17	2.414E-13	4.022E-15	3.382E-15	2.183E-14	8.998E-13	9.368E-14	9.099E-14	2.808E-15	3.722E-15	1.362E-12
Pu-238	1.200E-02	1.817E+01	1.513E-01	4.108E-03	1.882E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.714E+01
Ra-226	6.075E-16	3.545E-11	3.707E-13	9.141E-13	9.526E-13	1.322E-12	2.771E-14	1.342E-13	5.114E-15	1.817E-14	3.919E-11
Th-230	1.400E-12	2.198E-09	1.978E-11	3.016E-12	2.195E-09	1.076E-13	3.456E-15	1.365E-13	4.462E-15	1.042E-15	4.416E-09
U-234	1.033E-07	3.878E-04	5.120E-06	2.421E-05	1.619E-04	3.905E-06	1.726E-08	4.055E-07	5.663E-09	3.742E-08	5.835E-04
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil and water-dependent water, fish, plant, meat, milk pathways

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of Radon and its Decay Products as pCi/yr at t= 3.000E+00 years

[illegible]

Water-ind. == Water-independent   Water-dep. == Water-dependent

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+00 years

0		Water Independent Pathways (Inhalation excludes radon)													
		Ground		Inhalation		Plant		Meat		Milk		Soil			
Radio-	NUclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.		
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA		
Cs-137		1.390E-05	0.9066	3.875E-12	0.0000	7.371E-07	0.0481	2.611E-07	0.0170	1.622E-07	0.0106	2.211E-08	0.0014		
Pb-210		8.089E-20	0.0000	1.553E-20	0.0000	5.942E-17	0.0000	8.548E-19	0.0000	7.757E-19	0.0000	4.668E-18	0.0000		
Pu-238		4.150E-10	0.0000	1.077E-08	0.0007	8.198E-08	0.0053	6.829E-10	0.0000	1.853E-11	0.0000	1.367E-07	0.0089		
Ra-226		9.101E-16	0.0000	7.342E-20	0.0000	1.969E-16	0.0000	2.292E-18	0.0000	5.374E-18	0.0000	7.269E-18	0.0000		
Th-230		2.482E-17	0.0000	5.011E-17	0.0000	3.184E-16	0.0000	2.682E-18	0.0000	3.705E-19	0.0000	5.569E-16	0.0000		
U-234		7.542E-14	0.0000	1.965E-13	0.0000	6.221E-12	0.0000	8.299E-14	0.0000	3.879E-13	0.0000	4.271E-12	0.0000		
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii		
Total		1.390E-05	0.9066	1.077E-08	0.0007	8.191E-07	0.0534	2.618E-07	0.0171	1.622E-07	0.0106	1.588E-07	0.0104		

Attachment 6 Sheet No. 10 of 30
 Originator: S. W. Clark Date _____
 Chk'd By M. W. Perrott Date _____
 Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 11
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water risk fract.	Fish risk fract.	Plant risk fract.	Meat risk fract.	Milk risk fract.	All Pathways** risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	8.139E-09 0.0005	7.151E-09 0.0005	1.113E-09 0.0001	1.718E-09 0.0001	1.339E-09 0.0001	1.510E-05 0.9850
Pb-210	2.656E-19 0.0000	7.592E-20 0.0000	7.529E-20 0.0000	3.316E-21 0.0000	3.629E-21 0.0000	6.624E-17 0.0000
Pu-238	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	2.305E-07 0.0150
Ra-226	2.292E-19 0.0000	6.697E-21 0.0000	3.398E-20 0.0000	1.726E-21 0.0000	5.031E-21 0.0000	1.122E-15 0.0000
Th-230	2.215E-20 0.0000	1.088E-21 0.0000	2.371E-20 0.0000	9.261E-22 0.0000	1.890E-22 0.0000	9.533E-16 0.0000
U-234	3.581E-13 0.0000	2.193E-15 0.0000	5.304E-14 0.0000	9.281E-16 0.0000	4.817E-15 0.0000	1.165E-11 0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	8.139E-09 0.0005	7.151E-09 0.0005	1.113E-09 0.0001	1.718E-09 0.0001	1.339E-09 0.0001	1.533E-05 1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

0

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 3.000E+00 years

0

Radon Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

0

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+00 years

0

0

	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
Radio- Nuclide	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.390E-05 0.9066	3.875E-12 0.0000	0.000E+00 0.0000	7.371E-07 0.0481	2.611E-07 0.0170	1.622E-07 0.0106	2.211E-08 0.0014
Pu-238	4.151E-10 0.0000	1.077E-08 0.0007	0.000E+00 0.0000	8.199E-08 0.0053	6.829E-10 0.0000	1.892E-11 0.0000	1.367E-07 0.0089
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.390E-05 0.9066	1.077E-08 0.0007	0.000E+00 0.0000	8.191E-07 0.0534	2.618E-07 0.0171	1.622E-07 0.0106	1.588E-07 0.0104

Attachment 6 Sheet No. 11 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:31 Page 12
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Radio-	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	8.139E-09	0.0005	7.151E-09	0.0005	0.000E+00	0.0000	1.113E-09	0.0001	1.718E-09	0.0001	1.339E-09	0.0001	1.510E-05	0.9850
Pu-238	3.581E-13	0.0000	2.193E-15	0.0000	0.000E+00	0.0000	5.304E-14	0.0000	9.281E-16	0.0000	4.817E-15	0.0000	2.305E-07	0.0150
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	8.139E-09	0.0005	7.151E-09	0.0005	0.000E+00	0.0000	1.113E-09	0.0001	1.718E-09	0.0001	1.339E-09	0.0001	1.533E-05	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 6 Sheet No. 12 of 30
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 13
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 7.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	1.374E-02	8.314E+02	2.945E+02	1.829E+02	2.154E+01	4.850E+00	3.452E+00	5.351E-01	8.010E-01	6.359E-01	1.341E+03
Pb-210	3.999E-16	6.448E-12	9.951E-14	8.696E-14	6.270E-13	2.990E-12	2.873E-13	2.540E-13	9.784E-15	1.019E-14	1.081E-11
Pu-238	1.163E-02	1.760E+01	1.466E-01	3.979E-03	1.823E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.598E+01
Ra-226	7.652E-15	4.559E-10	5.115E-12	1.220E-11	1.200E-11	4.403E-12	8.557E-14	3.793E-13	1.869E-14	5.061E-14	4.902E-10
Th-230	7.542E-12	1.160E-08	1.001E-10	1.434E-11	1.183E-08	6.649E-13	2.254E-14	7.794E-13	2.950E-14	6.285E-15	2.354E-08
U-234	2.371E-07	8.944E-04	1.189E-05	5.579E-05	3.718E-04	2.120E-05	9.532E-08	2.283E-06	3.716E-08	2.014E-07	1.358E-03
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil and water-dependent water, fish, plant, meat, milk pathways											

0 Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 7.000E+00 years

Radionuclides								
Radon	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Pathway	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	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 Water-ind. == Water-independent Water-dep. == Water-dependent

0 Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 7.000E+00 years

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	1.267E-05	0.9054	3.531E-12	0.0000	6.717E-07	0.0480	2.380E-07	0.0170	1.478E-07	0.0106	2.015E-08	0.0014
Pb-210	1.398E-19	0.0000	2.685E-20	0.0000	1.025E-16	0.0000	1.470E-18	0.0000	1.336E-18	0.0000	8.068E-18	0.0000
Pu-238	4.021E-10	0.0000	1.043E-08	0.0007	7.942E-08	0.0057	6.615E-10	0.0000	1.795E-11	0.0000	1.324E-07	0.0095
Ra-226	1.427E-15	0.0000	1.151E-19	0.0000	3.089E-16	0.0000	3.602E-18	0.0000	8.438E-18	0.0000	1.140E-17	0.0000
Th-230	3.449E-17	0.0000	6.964E-17	0.0000	4.421E-16	0.0000	3.719E-18	0.0000	5.126E-19	0.0000	7.740E-16	0.0000
U-234	9.103E-14	0.0000	2.372E-13	0.0000	7.510E-12	0.0000	1.002E-13	0.0000	4.682E-13	0.0000	5.154E-12	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.267E-05	0.9055	1.043E-08	0.0007	7.511E-07	0.0537	2.386E-07	0.0171	1.478E-07	0.0106	1.525E-07	0.0109

Attachment 6 Sheet No. 13 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 14
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 7.000E+00 years

Water Dependent Pathways

	Water	Fish	Plant	Meat	Milk	All Pathways**
Radio-	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	9.243E-09 0.0007	8.126E-09 0.0006	1.266E-09 0.0001	1.962E-09 0.0001	1.525E-09 0.0001	1.377E-05 0.9840
Pb-210	3.002E-19 0.0000	9.030E-20 0.0000	9.391E-20 0.0000	4.633E-21 0.0000	4.540E-21 0.0000	1.140E-16 0.0000
Pu-238	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	2.233E-07 0.0160
Ra-226	3.230E-19 0.0000	9.587E-21 0.0000	4.952E-20 0.0000	2.700E-21 0.0000	7.682E-21 0.0000	1.760E-15 0.0000
Th-230	3.280E-20 0.0000	1.627E-21 0.0000	3.339E-20 0.0000	1.300E-21 0.0000	2.647E-22 0.0000	1.325E-15 0.0000
U-234	4.996E-13 0.0000	3.062E-15 0.0000	7.408E-14 0.0000	1.302E-15 0.0000	6.740E-15 0.0000	1.415E-11 0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	9.243E-09 0.0007	8.126E-09 0.0006	1.266E-09 0.0001	1.962E-09 0.0001	1.525E-09 0.0001	1.399E-05 1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

0 Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 7.000E+00 years

	Radon	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Pathway	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Water-ind.	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
Water-dep.	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
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	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

Water-ind. == Water-independent Water-dep. == Water-dependent

0 Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 7.000E+00 years

	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
Radio-	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.267E-05 0.9054	3.531E-12 0.0000	0.000E+00 0.0000	6.717E-07 0.0480	2.380E-07 0.0170	1.478E-07 0.0106	2.015E-08 0.0014
Pu-238	4.022E-10 0.0000	1.043E-08 0.0007	0.000E+00 0.0000	7.943E-08 0.0057	6.616E-10 0.0000	1.842E-11 0.0000	1.324E-07 0.0095
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.267E-05 0.9055	1.043E-08 0.0007	0.000E+00 0.0000	7.511E-07 0.0537	2.386E-07 0.0171	1.478E-07 0.0106	1.525E-07 0.0109

Attachment 6 Sheet No. 14 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 15
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 7.000E+00 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Radio-	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
cs-137	9.243E-09	0.0007	8.126E-09	0.0006	0.000E+00	0.0000	1.266E-09	0.0001	1.962E-09	0.0001	1.525E-09	0.0001	1.377E-05	0.9840
Pu-238	4.996E-13	0.0000	3.062E-15	0.0000	0.000E+00	0.0000	7.408E-14	0.0000	1.302E-15	0.0000	6.740E-15	0.0000	2.233E-07	0.0160
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	9.243E-09	0.0007	8.126E-09	0.0006	0.000E+00	0.0000	1.266E-09	0.0001	1.962E-09	0.0001	1.525E-09	0.0001	1.399E-05	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 6 Sheet No. 15 of 30
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 16
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.100E+01 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
Cs-137	1.252E-02	7.576E+02	2.684E+02	1.667E+02	1.963E+01	6.950E+00	4.958E+00	7.706E-01	1.176E+00	9.230E-01	1.227E+03
Pb-210	2.364E-15	3.731E-11	5.578E-13	4.958E-13	3.707E-12	3.780E-12	4.068E-13	4.116E-13	1.372E-14	1.868E-14	4.670E-11
Pu-238	1.126E-02	1.705E+01	1.420E-01	3.855E-03	1.766E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.486E+01
Ra-226	2.944E-14	1.764E-09	2.017E-11	4.769E-11	4.617E-11	6.019E-12	1.305E-13	6.587E-13	2.729E-14	9.771E-14	1.885E-09
Th-230	1.843E-11	2.818E-08	2.401E-10	3.375E-11	2.889E-08	1.827E-12	6.410E-14	1.957E-12	7.633E-14	1.590E-14	5.735E-08
U-234	3.668E-07	1.385E-03	1.845E-05	8.636E-05	5.751E-04	5.212E-05	2.354E-07	5.666E-06	9.589E-08	5.077E-07	2.123E-03
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

0

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 1.100E+01 years

0

Radionuclides								
Radon	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Pathway	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

0

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.100E+01 years

0

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	1.154E-05	0.9042	3.218E-12	0.0000	6.121E-07	0.0480	2.168E-07	0.0170	1.347E-07	0.0106	1.836E-08	0.0014
Pb-210	2.277E-19	0.0000	4.372E-20	0.0000	1.667E-16	0.0000	2.384E-18	0.0000	2.171E-18	0.0000	1.314E-17	0.0000
Pu-238	3.895E-10	0.0000	1.010E-08	0.0008	7.694E-08	0.0060	6.409E-10	0.0001	1.739E-11	0.0000	1.283E-07	0.0100
Ra-226	2.129E-15	0.0000	1.717E-19	0.0000	4.609E-16	0.0000	5.382E-18	0.0000	1.260E-17	0.0000	1.700E-17	0.0000
Th-230	4.594E-17	0.0000	9.277E-17	0.0000	5.887E-16	0.0000	4.946E-18	0.0000	6.803E-19	0.0000	1.031E-15	0.0000
U-234	1.061E-13	0.0000	2.765E-13	0.0000	8.757E-12	0.0000	1.169E-13	0.0000	5.460E-13	0.0000	6.009E-12	0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.154E-05	0.9043	1.011E-08	0.0008	6.890E-07	0.0540	2.175E-07	0.0170	1.347E-07	0.0106	1.466E-07	0.0115

Attachment 6 Sheet No. 16 of 30
Originator: S. W. Clark Date
Chk'd By: M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 17
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.100E+01 years

Water Dependent Pathways

Radio-	Water	Fish	Plant	Meat	Milk	All Pathways**
Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.009E-08 0.0008	8.872E-09 0.0007	1.382E-09 0.0001	2.149E-09 0.0002	1.668E-09 0.0001	1.255E-05 0.9830
Pb-210	4.297E-19 0.0000	1.306E-19 0.0000	1.354E-19 0.0000	5.821E-21 0.0000	5.538E-21 0.0000	1.854E-16 0.0000
Pu-238	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	2.163E-07 0.0169
Ra-226	5.181E-19 0.0000	1.495E-20 0.0000	7.478E-20 0.0000	3.978E-21 0.0000	1.095E-20 0.0000	2.625E-15 0.0000
Th-230	4.660E-20 0.0000	2.333E-21 0.0000	4.510E-20 0.0000	1.749E-21 0.0000	3.552E-22 0.0000	1.764E-15 0.0000
U-234	6.684E-13 0.0000	4.097E-15 0.0000	9.918E-14 0.0000	1.749E-15 0.0000	9.036E-15 0.0000	1.659E-11 0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.009E-08 0.0008	8.872E-09 0.0007	1.382E-09 0.0001	2.149E-09 0.0002	1.668E-09 0.0001	1.276E-05 1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

0
Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 1.100E+01 years

Radon	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Pathway	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

0
Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.100E+01 years

Radio-	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.154E-05 0.9042	3.218E-12 0.0000	0.000E+00 0.0000	6.121E-07 0.0480	2.168E-07 0.0170	1.347E-07 0.0106	1.836E-08 0.0014
Pu-238	3.896E-10 0.0000	1.010E-08 0.0008	0.000E+00 0.0000	7.695E-08 0.0060	6.410E-10 0.0001	1.794E-11 0.0000	1.283E-07 0.0100
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.154E-05 0.9043	1.011E-08 0.0008	0.000E+00 0.0000	6.890E-07 0.0540	2.175E-07 0.0170	1.347E-07 0.0106	1.466E-07 0.0115

Attachment 6 Sheet No. 17 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 18
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.100E+01 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	1.009E-08	0.0008	8.872E-09	0.0007	0.000E+00	0.0000	1.382E-09	0.0001	2.149E-09	0.0002	1.668E-09	0.0001	1.255E-05	0.9830
Pu-238	6.684E-13	0.0000	4.097E-15	0.0000	0.000E+00	0.0000	9.918E-14	0.0000	1.749E-15	0.0000	9.036E-15	0.0000	2.164E-07	0.0170
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.009E-08	0.0008	8.872E-09	0.0007	0.000E+00	0.0000	1.382E-09	0.0001	2.149E-09	0.0002	1.668E-09	0.0001	1.276E-05	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 6 Sheet No. 18 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 19
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 4.300E+01 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA
Cs-137	5.951E-03	3.602E+02	1.276E+02	7.925E+01	9.331E+00	1.296E+01	9.270E+00	1.446E+00	2.262E+00	1.749E+00	6.040E+02
Pb-210	4.364E-13	6.690E-09	9.508E-11	8.686E-11	6.843E-10	3.312E-11	3.547E-12	3.535E-12	1.420E-13	1.401E-13	7.596E-09
Pu-238	8.738E-03	1.323E+01	1.102E-01	2.991E-03	1.370E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.704E+01
Ra-226	1.645E-12	9.930E-08	1.163E-09	2.719E-09	2.579E-09	1.742E-10	3.833E-12	1.945E-11	9.657E-13	2.707E-12	1.060E-07
Th-230	2.591E-10	3.932E-07	3.294E-09	4.510E-10	4.062E-07	5.008E-11	1.967E-12	3.165E-11	1.205E-12	2.434E-13	8.033E-07
U-234	1.266E-06	4.786E-03	6.393E-05	2.984E-04	1.984E-03	7.638E-04	3.470E-06	8.409E-05	1.495E-06	7.687E-06	7.993E-03
iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

0

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 4.300E+01 years

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

0

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.300E+01 years

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA
Cs-137	5.487E-06	0.8924	1.530E-12	0.0000	2.910E-07	0.0473	1.031E-07	0.0168	6.403E-08	0.0104	8.728E-09	0.0014
Pb-210	3.113E-18	0.0000	5.978E-19	0.0000	2.265E-15	0.0000	3.201E-17	0.0000	2.934E-17	0.0000	1.797E-16	0.0000
Pu-238	3.022E-10	0.0000	7.838E-09	0.0013	5.969E-08	0.0097	4.972E-10	0.0001	1.349E-11	0.0000	9.950E-08	0.0162
Ra-226	1.783E-14	0.0000	1.439E-18	0.0000	3.868E-15	0.0000	4.542E-17	0.0000	1.061E-16	0.0000	1.424E-16	0.0000
Th-230	1.953E-16	0.0000	3.943E-16	0.0000	2.497E-15	0.0000	2.088E-17	0.0000	2.852E-18	0.0000	4.382E-15	0.0000
U-234	2.109E-13	0.0000	5.493E-13	0.0000	1.741E-11	0.0000	2.325E-13	0.0000	1.085E-12	0.0000	1.194E-11	0.0000
iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii	iiiiiiii
Total	5.487E-06	0.8925	7.840E-09	0.0013	3.507E-07	0.0570	1.036E-07	0.0168	6.404E-08	0.0104	1.082E-07	0.0176

Attachment 6 Sheet No. 19 of 30
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 20
Intrisk : 118-F-2 Staging File ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.300E+01 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Plant		Meat		Milk		All Pathways**
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
Cs-137	1.115E-08	0.0018	9.815E-09	0.0016	1.531E-09	0.0002	2.400E-09	0.0004	1.854E-09	0.0003	5.981E-06
Pb-210	4.520E-18	0.0000	1.304E-18	0.0000	1.304E-18	0.0000	4.777E-20	0.0000	5.840E-20	0.0000	2.517E-15
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.678E-07
Ra-226	7.191E-18	0.0000	2.086E-19	0.0000	1.052E-18	0.0000	5.199E-20	0.0000	1.567E-19	0.0000	2.201E-14
Th-230	3.128E-19	0.0000	1.645E-20	0.0000	2.149E-19	0.0000	7.917E-21	0.0000	1.592E-21	0.0000	7.494E-15
U-234	2.945E-12	0.0000	1.808E-14	0.0000	4.385E-13	0.0000	7.830E-15	0.0000	4.016E-14	0.0000	3.487E-11
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.115E-08	0.0018	9.815E-09	0.0016	1.532E-09	0.0002	2.400E-09	0.0004	1.854E-09	0.0003	6.148E-06

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

0

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 4.300E+01 years

0

Radionuclides								
Radon	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Pathway	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

0

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.300E+01 years

0

Water Independent Pathways (Inhalation excludes radon)											
Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Soil
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk
Cs-137	5.487E-06	0.8924	1.530E-12	0.0000	0.000E+00	0.0000	2.910E-07	0.0473	1.031E-07	0.0168	8.728E-09
Pu-238	3.024E-10	0.0000	7.839E-09	0.0013	0.000E+00	0.0000	5.971E-08	0.0097	4.974E-10	0.0001	9.951E-08
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	5.487E-06	0.8925	7.840E-09	0.0013	0.000E+00	0.0000	3.507E-07	0.0570	1.036E-07	0.0168	1.082E-07

Attachment 6 Sheet No. 20 of 30
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 21
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.300E+01 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Radio-	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	1.115E-08	0.0018	9.815E-09	0.0016	0.000E+00	0.0000	1.531E-09	0.0002	2.400E-09	0.0004	1.854E-09	0.0003	5.981E-06	0.9727
Pu-238	2.945E-12	0.0000	1.808E-14	0.0000	0.000E+00	0.0000	4.385E-13	0.0000	7.830E-15	0.0000	4.016E-14	0.0000	1.679E-07	0.0273
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.115E-08	0.0018	9.815E-09	0.0016	0.000E+00	0.0000	1.532E-09	0.0002	2.400E-09	0.0004	1.854E-09	0.0003	6.148E-06	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 6 Sheet No. 21 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T< Limit = 180 days 08/15/2007 18:31 Page 22
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.350E+02 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	7.017E-04	4.246E+01	1.504E+01	9.344E+00	1.100E+00	4.833E+00	3.461E+00	5.401E-01	8.497E-01	6.550E-01	7.829E+01
Pb-210	2.391E-11	3.640E-07	5.104E-09	4.698E-09	3.749E-08	4.063E-09	4.470E-10	4.612E-10	1.981E-11	2.111E-11	4.163E-07
Pu-238	4.212E-03	6.376E+00	5.311E-02	1.441E-03	6.604E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.303E+01
Ra-226	4.248E-11	2.569E-06	3.026E-08	7.057E-08	6.661E-08	1.434E-08	3.161E-10	1.616E-09	8.458E-11	2.438E-10	2.753E-06
Th-230	2.047E-09	3.102E-06	2.588E-08	3.520E-09	3.210E-06	1.049E-09	4.404E-11	3.455E-10	1.107E-11	2.201E-12	6.342E-06
U-234	2.856E-06	1.081E-02	1.444E-04	6.736E-04	4.479E-03	6.690E-03	3.044E-05	7.387E-04	1.328E-05	6.785E-05	2.364E-02
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil and water-dependent water, fish, plant, meat, milk pathways											

0 Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 1.350E+02 years

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

0 Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.350E+02 years

Radio- Nuclide	Ground		Inhalation		Plant		Meat		Milk		Soil	
	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	6.469E-07	0.8175	1.804E-13	0.0000	3.431E-08	0.0434	1.215E-08	0.0154	7.549E-09	0.0095	1.029E-09	0.0013
Pb-210	7.364E-17	0.0000	1.414E-17	0.0000	5.336E-14	0.0000	7.478E-16	0.0000	6.885E-16	0.0000	4.249E-15	0.0000
Pu-238	1.456E-10	0.0002	3.778E-09	0.0048	2.877E-08	0.0364	2.396E-10	0.0003	6.503E-12	0.0000	4.795E-08	0.0606
Ra-226	2.456E-13	0.0000	1.981E-17	0.0000	5.332E-14	0.0000	6.283E-16	0.0000	1.465E-15	0.0000	1.961E-15	0.0000
Th-230	1.036E-15	0.0000	2.092E-15	0.0000	1.323E-14	0.0000	1.104E-16	0.0000	1.502E-17	0.0000	2.325E-14	0.0000
U-234	3.959E-13	0.0000	1.031E-12	0.0000	3.269E-11	0.0000	4.369E-13	0.0000	2.038E-12	0.0000	2.241E-11	0.0000
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
Total	6.471E-07	0.8177	3.779E-09	0.0048	6.311E-08	0.0798	1.239E-08	0.0157	7.558E-09	0.0096	4.901E-08	0.0619

Attachment 6 Sheet No. 22 of 30
Originator: S.W. Clark Date
Chk'd By M.W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 23
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.350E+02 years

Water Dependent Pathways

	Water	Fish	Plant	Meat	Milk	All Pathways**
Radio- Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.490E-09 0.0044	3.074E-09 0.0039	4.798E-10 0.0006	7.551E-10 0.0010	5.820E-10 0.0007	7.104E-07 0.8977
Pb-210	2.621E-16 0.0000	7.744E-17 0.0000	7.901E-17 0.0000	3.356E-18 0.0000	3.626E-18 0.0000	5.955E-14 0.0000
Pu-238	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	8.089E-08 0.1022
Ra-226	2.572E-16 0.0000	7.527E-18 0.0000	3.831E-17 0.0000	2.000E-18 0.0000	5.795E-18 0.0000	3.033E-13 0.0000
Th-230	3.842E-18 0.0000	2.117E-19 0.0000	1.550E-18 0.0000	4.830E-20 0.0000	9.586E-21 0.0000	3.975E-14 0.0000
U-234	1.723E-11 0.0000	1.059E-13 0.0000	2.571E-12 0.0000	4.624E-14 0.0000	2.361E-13 0.0000	7.920E-11 0.0001
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	3.507E-09 0.0044	3.074E-09 0.0039	4.824E-10 0.0006	7.552E-10 0.0010	5.822E-10 0.0007	7.913E-07 1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

0

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 1.350E+02 years

0

	Radon	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Pathway	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Water-ind.	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
Water-dep.	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
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	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

Water-ind. == Water-independent Water-dep. == Water-dependent

0

Total Excess Cancer Risk CNRS1(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.350E+02 years

0

	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
Radio- Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	6.469E-07 0.8175	1.804E-13 0.0000	0.000E+00 0.0000	3.431E-08 0.0434	1.215E-08 0.0154	7.549E-09 0.0095	1.029E-09 0.0013
Pu-238	1.463E-10 0.0002	3.779E-09 0.0048	0.000E+00 0.0000	2.880E-08 0.0364	2.401E-10 0.0003	8.544E-12 0.0000	4.798E-08 0.0606
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	6.471E-07 0.8177	3.779E-09 0.0048	0.000E+00 0.0000	6.311E-08 0.0798	1.239E-08 0.0157	7.558E-09 0.0096	4.901E-08 0.0619

Attachment 6 Sheet No. 23 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 24
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.350E+02 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Radio-	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.490E-09	0.0044	3.074E-09	0.0039	0.000E+00	0.0000	4.798E-10	0.0006	7.551E-10	0.0010	5.820E-10	0.0007	7.104E-07	0.8977
Pu-238	1.723E-11	0.0000	1.060E-13	0.0000	0.000E+00	0.0000	2.571E-12	0.0000	4.624E-14	0.0000	2.361E-13	0.0000	8.097E-08	0.1023
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	3.507E-09	0.0044	3.074E-09	0.0039	0.000E+00	0.0000	4.824E-10	0.0006	7.552E-10	0.0010	5.822E-10	0.0007	7.913E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 6 Sheet No. 24 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 25
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 3.000E+02 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.517E-05	9.180E-01	3.252E-01	2.020E-01	2.378E-02	2.354E-01	1.686E-01	2.632E-02	4.146E-02	3.193E-02	1.973E+00
Pb-210	2.689E-10	4.088E-06	5.714E-08	5.269E-08	4.217E-07	1.353E-07	1.471E-08	1.500E-08	6.363E-10	6.890E-10	4.786E-06
Pu-238	1.138E-03	1.722E+00	1.434E-02	3.893E-04	1.784E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.521E+00
Ra-226	3.502E-10	2.119E-05	2.500E-07	5.825E-07	5.492E-07	3.079E-07	6.754E-09	3.440E-08	1.799E-09	5.211E-09	2.293E-05
Th-230	7.216E-09	1.093E-05	9.108E-08	1.237E-08	1.132E-05	9.030E-09	3.881E-10	1.930E-09	4.790E-11	9.359E-12	2.236E-05
U-234	3.877E-06	1.467E-02	1.960E-04	9.144E-04	6.079E-03	2.717E-02	1.236E-04	3.002E-03	5.412E-05	2.760E-04	5.248E-02
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil and water-dependent water, fish, plant, meat, milk pathways											

0 Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 3.000E+02 years

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	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 Water-ind. == Water-independent Water-dep. == Water-dependent

0 Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+02 years

Radio- Nuclide	Water Independent Pathways (Inhalation excludes radon)					Soil				
	Ground	Inhalation	Plant	Meat	Milk	Soil	Ground	Inhalation	Plant	Milk
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.399E-08 0.3723	3.899E-15 0.0000	7.417E-10 0.0197	2.627E-10 0.0070	1.632E-10 0.0043	2.225E-11 0.0006	1.399E-08 0.3723	3.899E-15 0.0000	7.417E-10 0.0197	2.627E-10 0.0070
Pb-210	6.695E-16 0.0000	1.286E-16 0.0000	4.844E-13 0.0000	6.770E-15 0.0000	6.243E-15 0.0000	3.863E-14 0.0000	6.695E-16 0.0000	1.286E-16 0.0000	4.844E-13 0.0000	6.770E-15 0.0000
Pu-238	3.934E-11 0.0010	1.020E-09 0.0272	7.770E-09 0.2069	6.472E-11 0.0017	1.757E-12 0.0000	1.295E-08 0.3448	3.934E-11 0.0010	1.020E-09 0.0272	7.770E-09 0.2069	6.472E-11 0.0017
Ra-226	1.705E-12 0.0000	1.375E-16 0.0000	3.704E-13 0.0000	4.369E-15 0.0000	1.018E-14 0.0000	1.362E-14 0.0000	1.705E-12 0.0000	1.375E-16 0.0000	3.704E-13 0.0000	4.369E-15 0.0000
Th-230	3.278E-15 0.0000	6.619E-15 0.0000	4.186E-14 0.0000	3.488E-16 0.0000	4.738E-17 0.0000	7.357E-14 0.0000	3.278E-15 0.0000	6.619E-15 0.0000	4.186E-14 0.0000	3.488E-16 0.0000
U-234	5.137E-13 0.0000	1.338E-12 0.0000	4.242E-11 0.0011	5.670E-13 0.0000	2.645E-12 0.0001	2.909E-11 0.0008	5.137E-13 0.0000	1.338E-12 0.0000	4.242E-11 0.0011	5.670E-13 0.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.403E-08 0.3734	1.022E-09 0.0272	8.555E-09 0.2277	3.280E-10 0.0087	1.676E-10 0.0045	1.300E-08 0.3462	1.403E-08 0.3734	1.022E-09 0.0272	8.555E-09 0.2277	3.280E-10 0.0087

Attachment 6 Sheet No. 25 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 26
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+02 years

Water Dependent Pathways

Radio-	Water	Fish	Plant	Meat	Milk	All Pathways**
Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.616E-10 0.0043	1.424E-10 0.0038	2.223E-11 0.0006	3.502E-11 0.0009	2.697E-11 0.0007	1.556E-08 0.4143
Pb-210	6.326E-15 0.0000	1.869E-15 0.0000	1.906E-15 0.0000	8.092E-17 0.0000	8.751E-17 0.0000	5.471E-13 0.0000
Pu-238	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	2.185E-08 0.5816
Ra-226	4.291E-15 0.0000	1.257E-16 0.0000	6.400E-16 0.0000	3.351E-17 0.0000	9.692E-17 0.0000	2.109E-12 0.0001
Th-230	2.811E-17 0.0000	1.582E-18 0.0000	7.673E-18 0.0000	1.865E-19 0.0000	3.639E-20 0.0000	1.258E-13 0.0000
U-234	6.248E-11 0.0017	3.841E-13 0.0000	9.326E-12 0.0002	1.682E-13 0.0000	8.576E-13 0.0000	1.498E-10 0.0040
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	2.241E-10 0.0060	1.428E-10 0.0038	3.156E-11 0.0008	3.519E-11 0.0009	2.783E-11 0.0007	3.757E-08 1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

0

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 3.000E+02 years

0

Radon	Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Water-ind.	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
Water-dep.	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
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	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

Water-ind. == Water-independent Water-dep. == Water-dependent

0

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+02 years

0

Radio-	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.399E-08 0.3723	3.899E-15 0.0000	0.000E+00 0.0000	7.417E-10 0.0197	2.627E-10 0.0070	1.632E-10 0.0043	2.225E-11 0.0006
Pu-238	4.156E-11 0.0011	1.022E-09 0.0272	0.000E+00 0.0000	7.814E-09 0.2080	6.530E-11 0.0017	4.418E-12 0.0001	1.298E-08 0.3456
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	1.403E-08 0.3734	1.022E-09 0.0272	0.000E+00 0.0000	8.555E-09 0.2277	3.280E-10 0.0087	1.676E-10 0.0045	1.300E-08 0.3462

Attachment 6 Sheet No. 26 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 27
Inrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+02 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Radio-	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Cs-137	1.616E-10	0.0043	1.424E-10	0.0038	0.000E+00	0.0000	2.223E-11	0.0006	3.502E-11	0.0009	2.697E-11	0.0007	1.556E-08	0.4143
Pu-238	6.249E-11	0.0017	3.861E-13	0.0000	0.000E+00	0.0000	9.329E-12	0.0002	1.683E-13	0.0000	8.578E-13	0.0000	2.200E-08	0.5857
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	2.241E-10	0.0060	1.428E-10	0.0038	0.000E+00	0.0000	3.156E-11	0.0008	3.519E-11	0.0009	2.783E-11	0.0007	3.757E-08	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 6 Sheet No. 27 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 28
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.000E+03 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total Ingestion*
	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.308E-12	7.914E-08	2.804E-08	1.741E-08	2.051E-09	7.171E-08	5.136E-08	8.018E-09	1.264E-08	9.733E-09	2.801E-07
Pb-210	5.120E-09	7.776E-05	1.085E-06	1.001E-06	8.028E-06	1.391E-05	1.513E-06	1.542E-06	6.556E-08	7.088E-08	1.050E-04
Pu-238	4.407E-06	6.673E-03	5.558E-05	1.508E-06	6.911E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.364E-02
Ra-226	5.479E-09	3.316E-04	3.914E-06	9.118E-06	8.591E-06	2.285E-05	5.013E-07	2.554E-06	1.341E-07	3.874E-07	3.796E-04
Th-230	3.241E-08	4.908E-05	4.088E-07	5.549E-08	5.082E-05	1.901E-07	8.296E-09	2.646E-08	3.610E-10	6.638E-11	1.006E-04
U-234	3.900E-06	1.475E-02	1.972E-04	9.198E-04	6.115E-03	1.587E-01	7.223E-04	1.754E-02	3.167E-04	1.614E-03	2.009E-01
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil and water-dependent water, fish, plant, meat, milk pathways											

0
Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 1.000E+03 years

Radon Pathway	Radionuclides							
	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

0
Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Radio- Nuclide	Water Independent Pathways (Inhalation excludes radon)					Soil				
	Ground risk fract.	Inhalation risk fract.	Plant risk fract.	Meat risk fract.	Milk risk fract.	Soil risk fract.	Soil risk fract.	Soil risk fract.	Soil risk fract.	Soil risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.206E-15 0.0000	3.362E-22 0.0000	6.394E-17 0.0000	2.265E-17 0.0000	1.407E-17 0.0000	1.918E-18 0.0000	1.918E-18 0.0000	1.918E-18 0.0000	1.918E-18 0.0000	1.918E-18 0.0000
Pb-210	1.146E-14 0.0000	2.201E-15 0.0000	8.289E-12 0.0137	1.157E-13 0.0002	1.068E-13 0.0002	6.615E-13 0.0011	6.615E-13 0.0011	6.615E-13 0.0011	6.615E-13 0.0011	6.615E-13 0.0011
Pu-238	1.524E-13 0.0003	3.954E-12 0.0065	3.011E-11 0.0499	2.508E-13 0.0004	6.806E-15 0.0000	5.019E-11 0.0831	5.019E-11 0.0831	5.019E-11 0.0831	5.019E-11 0.0831	5.019E-11 0.0831
Ra-226	2.429E-11 0.0402	1.960E-15 0.0000	5.278E-12 0.0087	6.231E-14 0.0001	1.451E-13 0.0002	1.940E-13 0.0003	1.940E-13 0.0003	1.940E-13 0.0003	1.940E-13 0.0003	1.940E-13 0.0003
Th-230	1.394E-14 0.0000	2.816E-14 0.0000	1.780E-13 0.0003	1.483E-15 0.0000	2.013E-16 0.0000	3.129E-13 0.0005	3.129E-13 0.0005	3.129E-13 0.0005	3.129E-13 0.0005	3.129E-13 0.0005
U-234	5.109E-13 0.0008	1.331E-12 0.0022	4.219E-11 0.0699	5.639E-13 0.0009	2.630E-12 0.0044	2.893E-11 0.0479	2.893E-11 0.0479	2.893E-11 0.0479	2.893E-11 0.0479	2.893E-11 0.0479
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii
Total	2.498E-11 0.0414	5.317E-12 0.0088	8.604E-11 0.1425	9.942E-13 0.0016	2.889E-12 0.0048	8.028E-11 0.1330	8.028E-11 0.1330	8.028E-11 0.1330	8.028E-11 0.1330	8.028E-11 0.1330

Attachment 6 Sheet No. 28 of 30
Originator: S. W. Clark Date
Chk'd By: M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 29
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Water Dependent Pathways

Radio-	Water	Fish	Plant	Meat	Milk	All Pathways**
Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	4.777E-17 0.0000	4.209E-17 0.0000	6.571E-18 0.0000	1.036E-17 0.0000	7.977E-18 0.0000	1.423E-15 0.0000
Pb-210	5.573E-13 0.0009	1.647E-13 0.0003	1.679E-13 0.0003	7.136E-15 0.0000	7.716E-15 0.0000	1.009E-11 0.0167
Pu-238	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	0.000E+00 0.0000	8.466E-11 0.1403
Ra-226	2.778E-13 0.0005	8.139E-15 0.0000	4.147E-14 0.0001	2.178E-15 0.0000	6.290E-15 0.0000	3.031E-11 0.0502
Th-230	5.377E-16 0.0000	3.069E-17 0.0000	9.751E-17 0.0000	1.320E-18 0.0000	2.424E-19 0.0000	5.354E-13 0.0009
U-234	3.429E-10 0.5681	2.108E-12 0.0035	5.120E-11 0.0848	9.245E-13 0.0015	4.711E-12 0.0078	4.780E-10 0.7919
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	3.437E-10 0.5695	2.281E-12 0.0038	5.141E-11 0.0852	9.338E-13 0.0015	4.725E-12 0.0078	6.036E-10 1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

0

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 1.000E+03 years

0

Radon	Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Water-ind.	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
Water-dep.	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
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	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

Water-ind. == Water-independent Water-dep. == Water-dependent

0

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

0

Radio-	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
Nuclide	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.	risk fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	1.206E-15 0.0000	3.362E-22 0.0000	0.000E+00 0.0000	6.394E-17 0.0000	2.265E-17 0.0000	1.407E-17 0.0000	1.918E-18 0.0000
Pu-238	2.498E-11 0.0414	5.317E-12 0.0088	0.000E+00 0.0000	8.604E-11 0.1425	9.942E-13 0.0016	2.889E-12 0.0048	8.028E-11 0.1330
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	2.498E-11 0.0414	5.317E-12 0.0088	0.000E+00 0.0000	8.604E-11 0.1425	9.942E-13 0.0016	2.889E-12 0.0048	8.028E-11 0.1330

Attachment 6 Sheet No. 29 of 30
Originator: S.W. Clark Date
Chk'd By M.W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 6

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 30
Intrisk : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Radio- Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	4.777E-17	0.0000	4.209E-17	0.0000	0.000E+00	0.0000	6.571E-18	0.0000	1.036E-17	0.0000	7.977E-18	0.0000	1.423E-15	0.0000
Pu-238	3.437E-10	0.5695	2.281E-12	0.0038	0.000E+00	0.0000	5.141E-11	0.0852	9.338E-13	0.0015	4.725E-12	0.0078	6.036E-10	1.0000
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii
Total	3.437E-10	0.5695	2.281E-12	0.0038	0.000E+00	0.0000	5.141E-11	0.0852	9.338E-13	0.0015	4.725E-12	0.0078	6.036E-10	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Attachment 6 Sheet No. 30 of 30
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 7

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1RESRAD, Version 6.3      T« Limit = 180 days      08/15/2007 18:31 Page 1
Concent : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File    : 118-F-2_ACL.RAD
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Table of Contents
AAAAAAAAAAAAAAAAAAAA

Part IV: Concentration of Radionuclides
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii

Concentration of radionuclides in different media	
Time= 0.000E+00	2
Time= 1.000E+00	3
Time= 3.000E+00	4
Time= 7.000E+00	5
Time= 1.100E+01	6
Time= 4.300E+01	7
Time= 1.350E+02	8
Time= 3.000E+02	9
Time= 1.000E+03	10

ATTACHMENT 7

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 2
Concent : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Concentration of radionuclides in environmental media
at t = 0.000E+00 years

Radio- Nuclide	Contaminat- ed Zone pCi/g	Surface Soil* pCi/g	Air Par- ticulate pCi/m*3	Well Water pCi/L	Surface Water pCi/L
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA
Cs-137	4.340E-01	4.340E-01	5.032E-06	0.000E+00	0.000E+00
Pb-210	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pu-238	3.300E-01	3.300E-01	3.826E-06	0.000E+00	0.000E+00
Ra-226	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-230	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-234	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 0.000E+00 years*

Radio- Nuclide	Drinking Water pCi/L	Nonleafy Vegetable pCi/kg	Leafy Vegetable pCi/kg	Fodder Meat pCi/kg	Fodder Milk pCi/kg	Meat pCi/kg	Milk pCi/L	Fish pCi/kg	Crustacea pCi/kg
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA
Cs-137	0.000E+00	1.736E+01	1.736E+01	1.736E+01	1.736E+01	4.193E+01	9.375E+00	0.000E+00	0.000E+00
Pb-210	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-238	0.000E+00	3.302E-01	3.310E-01	3.311E-01	3.311E-01	1.875E-02	1.832E-04	0.000E+00	0.000E+00
Ra-226	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
Th-230	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
U-234	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
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 7 Sheet No. 2 of 10
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 7

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page .3
Concent : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Concentration of radionuclides in environmental media
at t = 1.000E+00 years

Radio- Nuclide	Contaminat- ed Zone	Surface Soil*	Air Par- ticulate	Well Water	Surface Water
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	4.240E-01	4.240E-01	4.917E-06	1.092E-03	2.891E-05
Pb-210	4.688E-18	4.688E-18	5.436E-23	3.452E-16	9.140E-18
Pu-238	3.274E-01	3.274E-01	3.796E-06	0.000E+00	0.000E+00
Ra-226	6.068E-16	6.068E-16	7.036E-21	5.072E-16	1.343E-17
Th-230	4.199E-12	4.199E-12	4.869E-17	1.054E-18	2.792E-20
U-234	9.318E-07	9.318E-07	1.080E-11	5.989E-10	1.586E-11
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 1.000E+00 years*

Radio- Nuclide	Drinking Water	Nonleafy Vegetable	Leafy Vegetable	Fodder Meat	Fodder Milk	Meat	Milk	Fish	Crustacea
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	1.084E-03	1.696E+01	1.697E+01	1.699E+01	1.697E+01	4.097E+01	9.163E+00	5.484E-02	2.742E-03
Pb-210	3.423E-16	4.745E-16	2.185E-15	4.702E-16	2.137E-15	4.149E-17	5.237E-17	2.585E-15	8.634E-16
Pu-238	0.000E+00	3.276E-01	3.284E-01	3.286E-01	3.285E-01	1.860E-02	1.818E-04	0.000E+00	0.000E+00
Ra-226	5.028E-16	2.228E-14	2.723E-14	1.427E-14	1.936E-14	1.255E-15	1.446E-15	6.324E-16	3.162E-15
Th-230	1.559E-17	4.667E-12	4.247E-12	5.042E-12	5.548E-12	3.197E-13	2.059E-14	2.724E-17	1.609E-16
U-234	5.905E-10	2.277E-06	2.332E-06	2.035E-06	2.156E-06	1.997E-07	3.500E-07	1.431E-10	8.587E-10
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 7 Sheet No. 3 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 7

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 4
Concent : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Concentration of radionuclides in environmental media
at t = 3.000E+00 years

Radio- Nuclide	Contaminat- ed Zone	Surface Soil*	Air Par- ticulate	Well Water	Surface Water
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	4.048E-01	4.048E-01	4.693E-06	3.127E-03	8.280E-05
Pb-210	3.738E-16	3.738E-16	4.334E-21	1.241E-15	3.287E-17
Pu-238	3.222E-01	3.222E-01	3.736E-06	0.000E+00	0.000E+00
Ra-226	1.631E-14	1.631E-14	1.891E-19	1.825E-15	4.832E-17
Th-230	3.759E-11	3.759E-11	4.359E-16	1.569E-17	4.155E-19
U-234	2.773E-06	2.773E-06	3.215E-11	5.375E-09	1.423E-10
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 3.000E+00 years*

Radio- Nuclide	Drinking Water	Nonleafy Vegetable	Leafy Vegetable	Fodder Meat	Fodder Milk	Meat	Milk	Fish	Crustacea
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.119E-03	1.620E+01	1.621E+01	1.623E+01	1.621E+01	3.915E+01	8.756E+00	1.628E-01	8.138E-03
Pb-210	1.233E-15	5.761E-15	1.149E-14	1.045E-14	1.160E-14	8.263E-16	3.094E-16	9.367E-15	3.129E-15
Pu-238	0.000E+00	3.224E-01	3.232E-01	3.235E-01	3.233E-01	1.831E-02	1.789E-04	0.000E+00	0.000E+00
Ra-226	1.811E-15	6.307E-13	6.622E-13	5.533E-13	5.851E-13	4.547E-14	4.060E-14	2.290E-15	1.145E-14
Th-230	1.474E-16	3.904E-11	3.781E-11	4.073E-11	4.210E-11	2.394E-12	1.314E-13	2.768E-16	1.621E-15
U-234	5.349E-09	6.888E-06	6.970E-06	6.673E-06	6.795E-06	6.201E-07	1.056E-06	1.375E-09	8.253E-09
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 7 Sheet No. 4 of 10
Originator: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 7

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 5
Concent : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Concentration of radionuclides in environmental media
at t = 7.000E+00 years

Radio-	Contaminat-	Surface	Air Par-	Well	Surface
Nuclide	ted Zone	Soil*	ticulate	Water	Water
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	3.688E-01	3.688E-01	4.277E-06	6.651E-03	1.761E-04
Pb-210	1.074E-14	1.074E-14	1.245E-19	4.177E-15	1.106E-16
Pu-238	3.122E-01	3.122E-01	3.620E-06	0.000E+00	0.000E+00
Ra-226	2.055E-13	2.055E-13	2.382E-18	6.148E-15	1.628E-16
Th-230	2.025E-10	2.025E-10	2.348E-15	1.958E-16	5.184E-18
U-234	6.367E-06	6.367E-06	7.383E-11	2.911E-08	7.707E-10
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 7.000E+00 years*

Radio-	Drinking	Nonleafy	Leafy	Fodder	Fodder	Meat	Milk	Fish	Crustacea
Nuclide	Water	Vegetable	Vegetable	Meat	Milk				
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	6.644E-03	1.476E+01	1.480E+01	1.482E+01	1.480E+01	3.573E+01	7.995E+00	3.496E-01	1.748E-02
Pb-210	4.096E-15	1.186E-13	1.332E-13	1.455E-13	1.446E-13	1.322E-14	4.232E-15	2.873E-14	9.597E-15
Pu-238	0.000E+00	3.124E-01	3.131E-01	3.133E-01	3.132E-01	1.774E-02	1.733E-04	0.000E+00	0.000E+00
Ra-226	6.032E-15	8.094E-12	8.247E-12	7.652E-12	7.819E-12	6.211E-13	5.336E-13	7.072E-15	3.536E-14
Th-230	9.108E-16	2.059E-10	2.034E-10	2.106E-10	2.136E-10	1.211E-11	6.247E-13	1.814E-15	1.038E-14
U-234	2.905E-08	1.591E-05	1.612E-05	1.583E-05	1.595E-05	1.443E-06	2.439E-06	7.595E-09	4.557E-08
iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii	iiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 7 Sheet No. 5 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 7

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 6
Concent : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Concentration of radionuclides in environmental media
at t = 1.100E+01 years

Radio- Nuclide	Contaminat- ed Zone	Surface Soil*	Air Par- ticulate	Well Water	Surface Water
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	3.361E-01	3.361E-01	3.897E-06	9.527E-03	2.523E-04
Pb-210	6.348E-14	6.348E-14	7.360E-19	5.188E-15	1.374E-16
Pu-238	3.024E-01	3.024E-01	3.507E-06	0.000E+00	0.000E+00
Ra-226	7.905E-13	7.905E-13	9.166E-18	8.262E-15	2.188E-16
Th-230	4.947E-10	4.947E-10	5.737E-15	7.443E-16	1.971E-17
U-234	9.847E-06	9.847E-06	1.142E-10	7.149E-08	1.893E-09
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 1.100E+01 years*

Radio- Nuclide	Drinking Water	Nonleafy Vegetable	Leafy Vegetable	Fodder Meat	Fodder Milk	Meat	Milk	Fish	Crustacea
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	9.521E-03	1.346E+01	1.351E+01	1.353E+01	1.351E+01	3.261E+01	7.301E+00	5.022E-01	2.511E-02
Pb-210	5.179E-15	6.694E-13	6.695E-13	7.353E-13	7.558E-13	6.915E-14	2.241E-14	4.068E-14	1.359E-14
Pu-238	0.000E+00	3.026E-01	3.033E-01	3.036E-01	3.034E-01	1.718E-02	1.679E-04	0.000E+00	0.000E+00
Ra-226	8.245E-15	3.131E-11	3.165E-11	3.019E-11	3.064E-11	2.443E-12	2.081E-12	1.079E-14	5.394E-14
Th-230	2.502E-15	5.002E-10	4.966E-10	5.082E-10	5.129E-10	2.906E-11	1.471E-12	5.177E-15	2.912E-14
U-234	7.140E-08	2.467E-05	2.509E-05	2.483E-05	2.495E-05	2.244E-06	3.784E-06	1.875E-08	1.125E-07
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.

For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 7 Sheet No. 6 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 7

1RESRAD, Version 6.3   T« Limit = 180 days   08/15/2007 18:31 Page 7
Concent : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Concentration of radionuclides in environmental media
at t = 4.300E+01 years

Radio-	Contaminat-	Surface	Air Par-	Well	Surface
Nuclide	ed Zone	Soil*	ticulate	Water	Water
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA
Cs-137	1.598E-01	1.598E-01	1.853E-06	1.775E-02	4.700E-04
Pb-210	1.172E-11	1.172E-11	1.359E-16	4.547E-14	1.204E-15
Pu-238	2.346E-01	2.346E-01	2.720E-06	0.000E+00	0.000E+00
Ra-226	4.416E-11	4.416E-11	5.121E-16	2.385E-13	6.316E-15
Th-230	6.956E-09	6.956E-09	8.066E-14	4.284E-14	1.134E-15
U-234	3.398E-05	3.398E-05	3.940E-10	1.047E-06	2.771E-08
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 4.300E+01 years*

Radio-	Drinking	Nonleafy	Leafy	Fodder	Fodder	Meat	Milk	Fish	Crustacea
Nuclide	Water	Vegetable	Vegetable	Meat	Milk				
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA
Cs-137	1.775E-02	6.415E+00	6.504E+00	6.521E+00	6.514E+00	1.571E+01	3.528E+00	9.389E-01	4.695E-02
Pb-210	4.538E-14	1.188E-10	1.176E-10	1.219E-10	1.224E-10	1.152E-11	3.789E-12	3.547E-13	1.191E-13
Pu-238	0.000E+00	2.348E-01	2.353E-01	2.355E-01	2.354E-01	1.333E-02	1.303E-04	0.000E+00	0.000E+00
Ra-226	2.387E-13	1.762E-09	1.768E-09	1.747E-09	1.753E-09	1.408E-10	1.186E-10	3.168E-13	1.584E-12
Th-230	6.861E-14	6.979E-09	6.979E-09	7.027E-09	7.043E-09	3.987E-10	1.965E-11	1.608E-13	8.517E-13
U-234	1.046E-06	8.630E-05	9.163E-05	9.191E-05	9.204E-05	7.915E-06	1.333E-05	2.765E-07	1.659E-06
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 7 Sheet No. 7 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 7

1RESRAD, Version 6.3 T« Limit = 180 days 08/15/2007 18:31 Page 8
Concent : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Concentration of radionuclides in environmental media
at t = 1.350E+02 years

Radio- Nuclide	Contaminat- ed Zone	Surface Soil*	Air Par- ticulate	Well Water	Surface Water
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	1.884E-02	1.884E-02	2.184E-07	6.622E-03	1.753E-04
Pb-210	6.419E-10	6.419E-10	7.443E-15	5.554E-12	1.471E-13
Pu-238	1.131E-01	1.131E-01	1.311E-06	0.000E+00	0.000E+00
Ra-226	1.141E-09	1.141E-09	1.323E-14	1.964E-11	5.199E-13
Th-230	5.496E-08	5.496E-08	6.373E-13	1.212E-12	3.209E-14
U-234	7.669E-05	7.669E-05	8.892E-10	9.166E-06	2.427E-07
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 1.350E+02 years*

Radio- Nuclide	Drinking Water	Nonleafy Vegetable	Leafy Vegetable	Fodder Meat	Fodder Milk	Meat	Milk	Fish	Crustacea
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA	AAAAA
Cs-137	6.621E-03	7.624E-01	7.954E-01	8.002E-01	7.993E-01	1.923E+00	4.355E-01	3.505E-01	1.753E-02
Pb-210	5.566E-12	6.467E-09	6.459E-09	6.582E-09	6.590E-09	6.199E-10	2.055E-10	4.470E-11	1.497E-11
Pu-238	0.000E+00	1.132E-01	1.134E-01	1.135E-01	1.135E-01	6.426E-03	6.278E-05	0.000E+00	0.000E+00
Ra-226	1.965E-11	4.562E-08	4.575E-08	4.560E-08	4.565E-08	3.672E-09	3.084E-09	2.612E-11	1.306E-10
Th-230	1.438E-12	5.504E-08	5.514E-08	5.532E-08	5.535E-08	3.132E-09	1.534E-10	3.624E-12	1.854E-11
U-234	9.165E-06	2.038E-04	2.496E-04	2.546E-04	2.548E-04	1.908E-05	3.229E-05	2.425E-06	1.455E-05
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.
For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 7 Sheet No. 8 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 7

1RESRAD, Version 6.3   T_{1/2} Limit = 180 days   08/15/2007 18:31 Page 9
Concent : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Concentration of radionuclides in environmental media
at t = 3.000E+02 years

Radio- Nuclide	Contaminat- ed Zone	Surface Soil*	Air Par- ticulate	Well Water	Surface Water
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	4.073E-04	4.073E-04	4.722E-09	3.225E-04	8.539E-06
Pb-210	7.221E-09	7.221E-09	8.373E-14	1.853E-10	4.907E-12
Pu-238	3.054E-02	3.054E-02	3.541E-07	0.000E+00	0.000E+00
Ra-226	9.404E-09	9.404E-09	1.090E-13	4.218E-10	1.117E-11
Th-230	1.938E-07	1.938E-07	2.247E-12	1.145E-11	3.033E-13
U-234	1.041E-04	1.041E-04	1.207E-09	3.721E-05	9.854E-07
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 3.000E+02 years*

Radio- Nuclide	Drinking Water	Nonleafy Vegetable	Leafy Vegetable	Fodder Meat	Fodder Milk	Meat	Milk	Fish	Crustacea
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA	AAAAAA
Cs-137	3.225E-04	1.672E-02	1.833E-02	1.854E-02	1.852E-02	4.436E-02	1.019E-02	1.708E-02	8.538E-04
Pb-210	1.853E-10	7.279E-08	7.342E-08	7.455E-08	7.459E-08	6.990E-09	2.325E-09	1.471E-09	4.918E-10
Pu-238	0.000E+00	3.056E-02	3.063E-02	3.066E-02	3.064E-02	1.735E-03	1.696E-05	0.000E+00	0.000E+00
Ra-226	4.218E-10	3.766E-07	3.788E-07	3.785E-07	3.787E-07	3.046E-08	2.560E-08	5.582E-10	2.791E-09
Th-230	1.237E-11	1.940E-07	1.944E-07	1.949E-07	1.949E-07	1.103E-08	5.393E-10	3.201E-11	1.618E-10
U-234	3.721E-05	3.091E-04	4.947E-04	5.164E-04	5.166E-04	3.027E-05	5.185E-05	9.851E-06	5.910E-05
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.

For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters,
i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 7 Sheet No. 9 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

ATTACHMENT 7

1RESRAD, Version 6.3   T« Limit = 180 days   08/15/2007 18:31 Page 10
Concent : 118-F-2 Staging Pile ACL Footprint RESRAD Evaluation
File : 118-F-2_ACL.RAD

Concentration of radionuclides in environmental media
at t = 1.000E+03 years

Radio- Nuclide	Contaminat- ed Zone	Surface Soil*	Air Par- ticulate	Well Water	Surface Water
	pCi/g	pCi/g	pCi/m**3	pCi/L	pCi/L
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA
Cs-137	3.511E-11	3.511E-11	4.071E-16	9.824E-11	2.601E-12
Pb-210	1.375E-07	1.375E-07	1.594E-12	1.906E-08	5.047E-10
Pu-238	1.183E-04	1.183E-04	1.372E-09	0.000E+00	0.000E+00
Ra-226	1.471E-07	1.471E-07	1.706E-12	3.130E-08	8.287E-10
Th-230	8.702E-07	8.702E-07	1.009E-11	2.551E-10	6.754E-12
U-234	1.047E-04	1.047E-04	1.214E-09	2.174E-04	5.756E-06
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*The Surface Soil is the top layer of soil within the user specified mixing zone/depth.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Concentration of radionuclides in foodstuff media
at t = 1.000E+03 years*

Radio- Nuclide	Drinking Water	Nonleafy Vegetable	Leafy Vegetable	Fodder Meat	Fodder Milk	Meat	Milk	Fish	Crustacea
	pCi/L	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/kg	pCi/L	pCi/kg	pCi/kg
AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA	AAAAAAA
Cs-137	9.823E-11	1.535E-09	2.025E-09	2.085E-09	2.082E-09	4.922E-09	1.182E-09	5.202E-09	2.601E-10
Pb-210	1.906E-08	1.405E-06	1.496E-06	1.523E-06	1.524E-06	1.392E-07	4.671E-08	1.513E-07	5.055E-08
Pu-238	0.000E+00	1.184E-04	1.187E-04	1.188E-04	1.187E-04	6.724E-06	6.570E-08	0.000E+00	0.000E+00
Ra-226	3.130E-08	5.926E-06	6.083E-06	6.098E-06	6.099E-06	4.898E-07	4.140E-07	4.143E-08	2.071E-07
Th-230	2.604E-10	8.713E-07	8.746E-07	8.767E-07	8.768E-07	4.950E-08	2.420E-09	6.853E-10	3.436E-09
U-234	2.174E-04	5.472E-04	1.630E-03	1.760E-03	1.760E-03	6.218E-05	1.104E-04	5.756E-05	3.453E-04
iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii	iiiiiii

*Concentrations are at consumption time and include radioactive decay and ingrowth during storage time.

For livestock fodder, consumption time is t minus meat or milk storage time.

Concentrations in the media occurring in pathways that are suppressed are calculated using the current input parameters, i.e. using parameters appearing in the input screen when the pathways are active.

Attachment 7 Sheet No. 10 of 10
Originator: S. W. Clark Date _____
Chk'd By M. W. Perrott Date _____
Calc. No. 0100F-CA-V0286 Rev. No. 0

CALCULATION COVER SHEET

Project Title: 118-F-2 Burial Ground Cleanup Verification **Job No.** 14655
Area 100-F Area
Discipline Environmental ***Calc. No.** 0100F-CA-V0287
Subject 118-F-2 Burial Ground Comparison to Drinking Water Standards (MCL) Calculation
Computer Program Excel **Program No.** Excel 2003

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

Committed Calculation **X** Preliminary Superseded Voided

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover - 1 Calculations - 3 Total - 4	S. W. Clark <i>Approved</i> 8/16/2007	M. W. Perrott <i>Approved</i> 8/16/2007	H. M. Sulloway <i>Approved</i> 8/16/2007	S. W. Callison <i>Approved</i> 8/16/2007	<i>Approved</i> 8/16/2007
1	Cover - 1 Calculations - 3 Total - 4	S. W. Clark <i>S.W. Clark</i> 8/29/07	M. W. Perrott <i>M. Perrott</i> 9/10/07	H. M. Sulloway <i>H.M. Sulloway</i> 9/11/07	S. W. Callison <i>SW Call</i> 9-12-07	9-12-07

SUMMARY OF REVISIONS

1	The calculation brief was replaced in its entirety to correct typographical errors that did not affect the results or conclusions.

Washington Closure Hanford

CALCULATION SHEET

Originator	S. W. Clark <i>swc</i>	Date	8/29/07	Calc. No.	0100F-CA-V0287	Rev. No.	1
Project	118-F-2 Burial Ground Cleanup Verification	Job No.	14855	Checked	M. W. Perrott <i>MWP</i>	Date	9/4/07
Subject	118-F-2 Burial Ground Comparison to Drinking Water Standards (MCL) Calculation					Sheet No.	1 of 3

- 1 **Purpose:**
- 2 Compare RESRAD derived groundwater radionuclide concentrations to remedial action goals and maximum contaminant levels (MCLs) for groundwater.
- 3 Compare beta/gamma emitter dose contributions to the maximum allowable dose of 4 mrem/yr. Compare alpha emitter dose contributions to the maximum
- 4 allowable gross particle activity of 15 pCi/L or 1/25th of the derived concentration guide (DCG).
- 5
- 6 **Table of Contents:**
- 7 1. Calculation Summary
- 8 2. Comparison to MCLs
- 9 3. Cumulative Dose Comparison
- 10
- 11 **Given/References:**
- 12 1) RESRAD derived groundwater radionuclide concentrations from Calculation 0100F-CA-V0286, *118-F-2 Burial Ground Cleanup Verification RESRAD*
- 13 *Calculation Brief*. Only the predicted groundwater concentrations from the Staging Pile shallow zone are evaluated in this MCL calculation brief because these
- 14 concentrations are the highest for the 118-F-2 remediation areas. The Excavation shallow zone and the overburden/below cleanup level stockpile area soil all
- 15 have lower predicted groundwater concentrations and will have lesser contributions to the maximum allowable dose of 4 mrem/yr.
- 16
- 17 2) Remedial action goals for groundwater and MCLs summarized in Table 2-3 of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area*
- 18 (RDR/RAWP), DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations office, Richland, WA.
- 19
- 20 3) Maximum allowable dose of 4 mrem/yr for beta/gamma emitters and maximum allowable gross particle activity of 15 pCi/L for alpha emitters from: 40 CFR
- 21 141, "National Primary Drinking Water Regulation," *Code of Federal Regulations*, as amended (40 CFR Part 141, Subpart G, 141.66).
- 22
- 23 4) 1/25th of the derived concentration guide (DCG) values from *Radiation Protection of the Public and Environment*, DOE Order 5400.5, U.S. Department of
- 24 Energy, Washington D.C.
- 25
- 26 5) Individual organ-dose calculation methodology for beta/gamma emitter dose contribution to the maximum allowable dose of 4 mrem/yr from: *Maximum*
- 27 *Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air or Water for Occupational Exposure*, National Bureau of Standards
- 28 (NBS) Handbook 69, as amended, U.S. Department of Commerce, Washington D.C., and National Primary Drinking Water Regulations, EPA-570/9-76-003,
- 29 U.S. Environmental Protection Agency, Office of Water Supply, Washington D.C.
- 30
- 31 **Solution:**
- 32 1. The site data for the calculation are the groundwater concentrations for the contaminants of concern (COCs) (daughter products are not considered) over time
- 33 from the RESRAD groundwater concentration file.
- 34
- 35 2. Compare the concentrations for each radionuclide to the groundwater remedial action goal and MCL given in the RDR/RAWP, Table 2-3.
- 36
- 37 3. The cumulative dose for each organ for all detected beta and gamma emitting COCs (Cs-137) at time t is calculated separately using the concentration
- 38 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
- 39 computed are total body, bone, liver and gastrointestinal tract [lower large intestine] (GI(LLI)). The individual organ doses are compared to 4 mrem/yr.
- 40
- 41
$$\text{Doseorgan } x(t) = [\text{ConcA}(t)/\text{C4A}(x) + \text{ConcB}(t)/\text{C4B}(x) + \dots] \times (4 \text{ mrem/yr})$$
- 42
- 43 **Where:**
- 44 Doseorgan x(t) is the total dose to organ x in mrem/yr.
- 45 ConcA(t), ConcB(t), etc., are the concentrations of isotope A, B, etc., at time t in pCi/L, for all gamma emitting COCs.
- 46 C4A(x), C4B(x), etc., are the 4 mrem/yr dose equivalent concentrations for organ x of isotope A, B, etc., at time t in pCi/L, for all organs and for all gamma
- 47 emitting COCs.
- 48 If the dose for organ x < 4 mrem/yr, then the standard is met.
- 49
- 50 **Conclusions:**
- 51 1. The concentrations for each of the radionuclide COCs are less than the groundwater remedial action goals and MCLs given in the RDR/RAWP, Table 2-3.
- 52
- 53 2. 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
- 54
- 55 3. RESRAD modeling indicates that the alpha emitting COCs (Pu-238, Pu-239, and Pu-240) will not impact groundwater. Therefore, concentrations for the
- 56 alpha emitting COCs are less than the maximum allowable gross particle activity of 15 pCi/L and the 1/25th of the DCG.
- 57
- 58 4. The total uranium COCs (U-233/234, U-235, and U-238) are present at concentrations less than natural background.
- 59
- 60

Washington Closure Hanford

CALCULATION SHEET

Originator S. W. Clark *SWC* Date *8/29/07* Calc. No. 0100F-CA-V0287
Project 118-F-2 Burial Ground Cleanup Verification Job 14855 Checked M. W. Perrott *MWP*
Subject 118-F-2 Burial Ground Comparison to Drinking Water Standards (MCL) Calculation

Rev. No. *1*
Date *8/29/07*
Sheet No. *2 of 3*

1 Table of Comparisons of the Maximum Concentration of Each Radionuclide to its Groundwater MCL
2 Data derived from RESRAD modelling, units are pCi/L.
3
4
5
6
7
8

Radionuclide	Time (years)									MCL	Exceeds MCL?	Peak Conc.	Year of Peak Conc.
	0	1	3	7	11	43	135	300	1000				
Cs-137	0	1.09E-03	3.13E-03	6.65E-03	9.53E-03	1.78E-02	6.62E-03	3.23E-04	9.82E-11	60	No	1.78E-02	43

Washington Closure Hanford

CALCULATION SHEET

Originator S. W. Clark
Project 118-F-2 Burial Ground Cleanup Verification
Subject 118-F-2 Burial Ground Comparison to Drinking Water Standards (MCL) Calculation

Date 8/29/07
Job 14655

Calc. No. 0100C-CA-V0036
Checked M. W. Perrott

Rev. No. 1
Date 9/16/07
Sheet No. 3 of 3

- 1 Table Showing the Calculation of the Cumulative Dose for All Radionuclides and Comparison to the 4 mrem/yr Drinking Water Standard
2 Data derived from RESRAD modelling, units are pCi/L.
3

Radionuclide	Time (years)									Organ	C ₄	Exceeds 4 mrem/yr?	Peak Conc.	Year of Peak Conc.
	0	1	3	7	11	43	135	300	1000					
Cs-137	0	1.09E-03	3.13E-03	6.65E-03	9.53E-03	1.78E-02	6.62E-03	3.23E-04	9.82E-11	Bone	80	No	1.78E-02	43
										GI(LLI)	2,000	No		
										Total Body	200	No		
										Liver	80	No		
Cumulative dose for each organ (with time)														
Organ	Time (years)									Exceeds 4 mrem/yr?	Peak Conc.	Year of Peak Conc.		
	0	1	3	7	11	43	135	300	1000					
Bone	0	5.45E-05	1.57E-04	3.33E-04	4.77E-04	8.90E-04	3.31E-04	1.62E-05	4.91E-12	No	8.90E-04	43		
GI(LLI)	0	2.18E-06	6.26E-06	1.33E-05	1.91E-05	3.56E-05	1.32E-05	6.46E-07	1.96E-13	No	3.56E-05	43		
Total Body	0	2.18E-05	6.26E-05	1.33E-04	1.91E-04	3.56E-04	1.32E-04	6.46E-06	1.96E-12	No	3.56E-04	43		
Liver	0	7.27E-05	2.09E-04	4.43E-04	6.35E-04	1.19E-03	4.41E-04	2.15E-05	6.55E-12	No	1.19E-03	43		

APPENDIX D
FOCUSED SAMPLING RESULTS

Table D-1. 118-F-2 Focused Sampling Results. (Sheet 1 of 7)

Sample Location	Sample Number	Sample Date	Carbon-14			Nickel-63			Strontium-90			Tritium		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Animal Laboratory Waste Caisson														
1	J15DV7	7/25/07	-1.76	U	3.25	1.97	U	3.03	-0.028	U	0.254	-0.420	U	3.44
2	J15DV8	7/25/07	-2.68	U	3.94	2.48	U	2.98	-0.019	U	0.225	2.26	U	4.35
3	J15DV9	7/25/07	-1.22	U	4.03	1.69	U	3.08	-0.115	U	0.273	2.11	U	4.31
Animal Laboratory Waste Trench														
4	J15DW0	7/25/07	-1.54	U	3.35	2.19	U	3.06	0.106	U	0.242	2.27	U	3.62
5	J15DW1	7/25/07	-0.479	U	3.48	2.33	U	2.99	0.035	U	0.259	2.41	U	3.84
6	J15DW2	7/25/07	-2.33	U	3.30	1.23	U	3.11	0.036	U	0.243	2.91	U	3.66

Sample Location	Sample Number	Sample Date	Americium-241 GEA			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
General Debris																	
13	J15DW9	7/25/07	0.079	U	0.079	0.026	U	0.026	0.026	U	0.026	0.135		0.064	0.092	U	0.092
14	J15DX0	7/25/07	0.034	U	0.034	0.044		0.028	0.026	U	0.026	0.072	U	0.072	0.091	U	0.091
15	J15DX1	7/25/07	0.036	U	0.036	0.062		0.018	0.024	U	0.024	0.059	U	0.059	0.072	U	0.072

Sample Location	Sample Number	Sample Date	Europium-155			Nickel-63			Plutonium-238			Plutonium-239/240			Potassium-40		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
General Debris																	
13	J15DW9	7/25/07	0.068	U	0.068	5.07		2.92	0	U	0.069	0	U	0.039	11.6		0.256
14	J15DX0	7/25/07	0.064	U	0.064	4.30		3.14	0	U	0.284	0.037	U	0.284	10.4		0.309
15	J15DX1	7/25/07	0.056	U	0.056	2.39	U	3.02	-0.034	U	0.261	0	U	0.261	11.4		0.163

Sample Location	Sample Number	Sample Date	Radium-226			Radium-228			Silver-108m			Thorium-228 GEA			Thorium-232 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
General Debris																	
13	J15DW9	7/25/07	0.382		0.039	0.530		0.096	0.018	U	0.018	0.652		0.050	0.530		0.096
14	J15DX0	7/25/07	0.354		0.046	0.505		0.101	0.019	U	0.019	0.527		0.033	0.505		0.101
15	J15DX1	7/25/07	0.368		0.040	0.522		0.097	0.015	U	0.015	0.538		0.028	0.522		0.097

Note: The following abbreviations apply to all tables. Data qualified with B and/or J are considered acceptable values.

B = blank contamination (organics)

GEA = gamma energy analysis

J = estimated

MDA = minimum detectable activity

PQL = practical quantitation limit

Q = qualifier

U = undetected

Table D-1. 118-F-2 Focused Sampling Results. (Sheet 2 of 7)

Sample Location	Sample Number	Sample Date	Total beta radiostrontium			Uranium-233/234			Uranium-235			Uranium-235 GEA			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
General Debris																	
13	J15DW9	7/25/07	-0.009	U	0.242	0.397		0.028	0.018	U	0.034	0.106	U	0.106	0.433		0.028
14	J15DX0	7/25/07	0.081	U	0.246	0.388		0.033	0.029	U	0.032	0.124	U	0.124	0.405		0.026
15	J15DX1	7/25/07	0.248	U	0.263	0.519		0.221	0.035	U	0.267	0.170	U	0.170	0.404		0.221

Sample Location	Sample Number	Sample Date	Uranium-238 GEA			Barium-133		
			pCi/g	Q	MDA	pCi/g	Q	MDA
General Debris								
13	J15DW9	7/25/07	3.05	U	3.05	0.033	U	0.033
14	J15DX0	7/25/07	3.24	U	3.24	0.029	U	0.029
15	J15DX1	7/25/07	2.59	U	2.59	0.020	U	0.020

Table D-1. 118-F-2 Focused Sampling Results. (Sheet 3 of 7)

Sample Location	Sample Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
General Debris																	
13	J15DW9	7/25/07	4800		5.3	0.75		0.64	1.5		1.2	56.0		0.06	0.37		0.03
14	J15DX0	7/25/07	5070		5.2	0.78		0.63	1.4		1.2	58.8		0.06	0.32		0.03
15	J15DX1	7/25/07	4390		5.1	0.63	U	0.63	1.2	U	1.2	55.5		0.06	0.31		0.03

Sample Location	Sample Number	Sample Date	Boron			Cadmium			Calcium			Chromium			Cobalt		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
General Debris																	
13	J15DW9	7/25/07	1.1	U	1.1	0.15	U	0.15	3590		5.9	6.2		0.29	5.7		0.23
14	J15DX0	7/25/07	1.2		1.0	0.22		0.14	3730		5.7	6.6		0.29	6.8		0.23
15	J15DX1	7/25/07	1.0	U	1.0	0.17		0.14	3470		5.7	6.1		0.29	6.3		0.23

Sample Location	Sample Number	Sample Date	Copper			Iron			Lead			Magnesium			Manganese		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
General Debris																	
13	J15DW9	7/25/07	10.0		0.26	17400		1.0	2.5		0.97	3830		10.8	244		0.21
14	J15DX0	7/25/07	10.3		0.26	21600		0.97	3.8		0.95	4190		10.6	274		0.20
15	J15DX1	7/25/07	10.4		0.26	19600		0.97	3.3		0.94	3850		10.5	265		0.20

Sample Location	Sample Number	Sample Date	Mercury			Molybdenum			Nickel			Potassium			Selenium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
General Debris																	
13	J15DW9	7/25/07	0.02	U	0.02	0.47	U	0.47	9.7		0.79	863		144	1.3	U	1.3
14	J15DX0	7/25/07	0.01	U	0.01	0.48		0.46	10.7		0.77	1040		141	1.2	U	1.2
15	J15DX1	7/25/07	0.02	U	0.02	0.46	U	0.46	8.7		0.77	884		141	1.2	U	1.2

Sample Location	Sample Number	Sample Date	Silicon			Silver			Sodium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
General Debris																	
13	J15DW9	7/25/07	889		2.5	0.26	U	0.26	164		4.8	41.9		0.23	34.4		0.12
14	J15DX0	7/25/07	766		2.5	0.26	U	0.26	171		4.7	56.8		0.23	40.8		0.11
15	J15DX1	7/25/07	955		2.5	0.26	U	0.26	158		4.7	50.2		0.23	40.9		0.11

D-3

Table D-1. 118-F-2 Focused Sampling Results. (Sheet 4 of 7)

Constituent	J15DW3 Breached Drums Sample Location 7 Sample Date 7/25/07			J15DW4 Breached Drums Sample Location 8 Sample Date 7/25/07			J15DW5 Breached Drums Sample Location 9 Sample Date 7/25/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
	Semivolatile Organic Analytes								
1,2,4-Trichlorobenzene	330	U	330	330	U	330	330	U	330
1,2-Dichlorobenzene	330	U	330	330	U	330	330	U	330
1,3-Dichlorobenzene	330	U	330	330	U	330	330	U	330
1,4-Dichlorobenzene	330	U	330	330	U	330	330	U	330
2,4,5-Trichlorophenol	830	U	830	830	U	830	830	U	830
2,4,6-Trichlorophenol	330	U	330	330	U	330	330	U	330
2,4-Dichlorophenol	330	U	330	330	U	330	330	U	330
2,4-Dimethylphenol	330	U	330	330	U	330	330	U	330
2,4-Dinitrophenol	830	U	830	830	U	830	830	U	830
2,4-Dinitrotoluene	330	U	330	330	U	330	330	U	330
2,6-Dinitrotoluene	330	U	330	330	U	330	330	U	330
2-Chloronaphthalene	330	U	330	330	U	330	330	U	330
2-Chlorophenol	330	U	330	330	U	330	330	U	330
2-Methylnaphthalene	330	U	330	330	U	330	330	U	330
2-Methylphenol (cresol, o-)	330	U	330	330	U	330	330	U	330
2-Nitroaniline	830	U	830	830	U	830	830	U	830
2-Nitrophenol	330	U	330	330	U	330	330	U	330
3+4 Methylphenol (cresol, m+p)	330	U	330	330	U	330	330	U	330
3,3'-Dichlorobenzidine	330	U	330	330	U	330	330	U	330
3-Nitroaniline	830	U	830	830	U	830	830	U	830
4,6-Dinitro-2-methylphenol	830	U	830	830	U	830	830	U	830
4-Bromophenylphenyl ether	330	U	330	330	U	330	330	U	330
4-Chloro-3-methylphenol	330	U	330	330	U	330	330	U	330
4-Chloroaniline	330	U	330	330	U	330	330	U	330
4-Chlorophenylphenyl ether	330	U	330	330	U	330	330	U	330
4-Nitroaniline	830	U	830	830	U	830	830	U	830
4-Nitrophenol	830	U	830	830	U	830	830	U	830
Acenaphthene	330	U	330	330	U	330	330	U	330
Acenaphthylene	330	U	330	330	U	330	330	U	330
Anthracene	330	U	330	330	U	330	330	U	330
Benzo(a)anthracene	330	U	330	330	U	330	330	U	330
Benzo(a)pyrene	330	U	330	330	U	330	330	U	330
Benzo(b)fluoranthene	330	U	330	330	U	330	330	U	330
Benzo(ghi)perylene	22	JB	330	330	U	330	330	U	330
Benzo(k)fluoranthene	330	U	330	330	U	330	330	U	330
Bis(2-chloro-1-methylethyl)ether	330	U	330	330	U	330	330	U	330
Bis(2-Chloroethoxy)methane	330	U	330	330	U	330	330	U	330
Bis(2-chloroethyl) ether	330	U	330	330	U	330	330	U	330
Bis(2-ethylhexyl) phthalate	63	JB	830	68	JB	830	73	JB	830
Butylbenzylphthalate	330	U	330	330	U	330	23	J	330
Carbazole	330	U	330	330	U	330	330	U	330
Chrysene	330	U	330	330	U	330	330	U	330

Table D-1. 118-F-2 Focused Sampling Results. (Sheet 5 of 7)

Constituent	J15DW3 Breached Drums Sample Location 7 Sample Date 7/25/07			J15DW4 Breached Drums Sample Location 8 Sample Date 7/25/07			J15DW5 Breached Drums Sample Location 9 Sample Date 7/25/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
	Semivolatile Organic Analytes (continued)								
Di-n-butylphthalate	44	J	330	43	J	330	36	J	330
Di-n-octylphthalate	330	U	330	330	U	330	330	U	330
Dibenz[a,h]anthracene	330	U	330	330	U	330	330	U	330
Dibenzofuran	330	U	330	330	U	330	330	U	330
Diethylphthalate	330	U	330	330	U	330	330	U	330
Dimethyl phthalate	330	U	330	330	U	330	330	U	330
Fluoranthene	330	U	330	330	U	330	330	U	330
Fluorene	330	U	330	330	U	330	330	U	330
Hexachlorobenzene	330	U	330	330	U	330	330	U	330
Hexachlorobutadiene	330	U	330	330	U	330	330	U	330
Hexachlorocyclopentadiene	330	U	330	330	U	330	330	U	330
Hexachloroethane	330	U	330	330	U	330	330	U	330
Indeno(1,2,3-cd)pyrene	330	U	330	330	U	330	330	U	330
Isophorone	330	U	330	330	U	330	330	U	330
N-Nitroso-di-n-propylamine	330	U	330	330	U	330	330	U	330
N-Nitrosodiphenylamine	330	U	330	330	U	330	330	U	330
Naphthalene	330	U	330	330	U	330	330	U	330
Nitrobenzene	330	U	330	330	U	330	330	U	330
Pentachlorophenol	830	U	830	830	U	830	830	U	830
Phenanthrene	330	U	330	330	U	330	330	U	330
Phenol	330	U	330	330	U	330	330	U	330
Pyrene	330	U	330	330	U	330	330	U	330
Total petroleum hydrocarbons	134	U	134	155	U	155	135	U	135

Table D-1. 118-F-2 Focused Sampling Results. (Sheet 6 of 7)

Constituent	J15DW6 Breached Drums Sample Location 10 Sample Date 7/25/07			J15DW7 Breached Drums Sample Location 11 Sample Date 7/25/07			J15DW8 Breached Drums Sample Location 12 Sample Date 7/25/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
	Semivolatile Organic Analytes								
1,2,4-Trichlorobenzene	330	U	330	330	U	330	330	U	330
1,2-Dichlorobenzene	330	U	330	330	U	330	330	U	330
1,3-Dichlorobenzene	330	U	330	330	U	330	330	U	330
1,4-Dichlorobenzene	330	U	330	330	U	330	330	U	330
2,4,5-Trichlorophenol	830	U	830	830	U	830	830	U	830
2,4,6-Trichlorophenol	330	U	330	330	U	330	330	U	330
2,4-Dichlorophenol	330	U	330	330	U	330	330	U	330
2,4-Dimethylphenol	330	U	330	330	U	330	330	U	330
2,4-Dinitrophenol	830	U	830	830	U	830	830	U	830
2,4-Dinitrotoluene	330	U	330	330	U	330	330	U	330
2,6-Dinitrotoluene	330	U	330	330	U	330	330	U	330
2-Chloronaphthalene	330	U	330	330	U	330	330	U	330
2-Chlorophenol	330	U	330	330	U	330	330	U	330
2-Methylnaphthalene	330	U	330	330	U	330	330	U	330
2-Methylphenol (cresol, o-)	330	U	330	330	U	330	330	U	330
2-Nitroaniline	830	U	830	830	U	830	830	U	830
2-Nitrophenol	330	U	330	330	U	330	330	U	330
3+4 Methylphenol (cresol, m+p)	330	U	330	330	U	330	330	U	330
3,3'-Dichlorobenzidine	330	U	330	330	U	330	330	U	330
3-Nitroaniline	830	U	830	830	U	830	830	U	830
4,6-Dinitro-2-methylphenol	830	U	830	830	U	830	830	U	830
4-Bromophenylphenyl ether	330	U	330	330	U	330	330	U	330
4-Chloro-3-methylphenol	330	U	330	330	U	330	330	U	330
4-Chloroaniline	330	U	330	330	U	330	330	U	330
4-Chlorophenylphenyl ether	330	U	330	330	U	330	330	U	330
4-Nitroaniline	830	U	830	830	U	830	830	U	830
4-Nitrophenol	830	U	830	830	U	830	830	U	830
Acenaphthene	330	U	330	330	U	330	330	U	330
Acenaphthylene	330	U	330	330	U	330	330	U	330
Anthracene	330	U	330	330	U	330	330	U	330
Benzo(a)anthracene	330	U	330	330	U	330	39	J	330
Benzo(a)pyrene	330	U	330	330	U	330	29	J	330
Benzo(b)fluoranthene	330	U	330	330	U	330	37	J	330
Benzo(ghi)perylene	330	U	330	330	U	330	27	JB	330
Benzo(k)fluoranthene	330	U	330	330	U	330	49	J	330
Bis(2-chloro-1-methylethyl)ether	330	U	330	330	U	330	330	U	330
Bis(2-Chloroethoxy)methane	330	U	330	330	U	330	330	U	330
Bis(2-chloroethyl) ether	330	U	330	330	U	330	330	U	330
Bis(2-ethylhexyl) phthalate	90	JB	830	80	JB	830	50	JB	830
Butylbenzylphthalate	330	U	330	330	U	330	330	U	330
Carbazole	330	U	330	330	U	330	330	U	330
Chrysene	330	U	330	330	U	330	61	J	330

Table D-1. 118-F-2 Focused Sampling Results. (Sheet 7 of 7)

Constituent	J15DW6 Breached Drums Sample Location 10 Sample Date 7/25/07			J15DW7 Breached Drums Sample Location 11 Sample Date 7/25/07			J15DW8 Breached Drums Sample Location 12 Sample Date 7/25/07		
	µg/kg	Q	PQL	µg/kg	Q	PQL	µg/kg	Q	PQL
	Semivolatile Organic Analytes (continued)								
Di-n-butylphthalate	39	J	330	330	U	330	330	U	330
Di-n-octylphthalate	330	U	330	330	U	330	330	U	330
Dibenz[a,h]anthracene	330	U	330	330	U	330	330	U	330
Dibenzofuran	330	U	330	330	U	330	330	U	330
Diethylphthalate	330	U	330	330	U	330	330	U	330
Dimethyl phthalate	330	U	330	330	U	330	330	U	330
Fluoranthene	330	U	330	330	U	330	330	U	330
Fluorene	330	U	330	330	U	330	79	J	330
Hexachlorobenzene	330	U	330	330	U	330	330	U	330
Hexachlorobutadiene	330	U	330	330	U	330	330	U	330
Hexachlorocyclopentadiene	330	U	330	330	U	330	330	U	330
Hexachloroethane	330	U	330	330	U	330	330	U	330
Indeno(1,2,3-cd)pyrene	330	U	330	330	U	330	22	J	330
Isophorone	330	U	330	330	U	330	330	U	330
N-Nitroso-di-n-propylamine	330	U	330	330	U	330	330	U	330
N-Nitrosodiphenylamine	330	U	330	330	U	330	330	U	330
Naphthalene	330	U	330	330	U	330	330	U	330
Nitrobenzene	330	U	330	330	U	330	330	U	330
Pentachlorophenol	830	U	830	830	U	830	830	U	830
Phenanthrene	330	U	330	330	U	330	330	U	330
Phenol	330	U	330	330	U	330	330	U	330
Pyrene	330	U	330	330	U	330	73	J	330
Phenol	330	U	330	330	U	330	330	U	330
Total petroleum hydrocarbons	160	U	160	133	U	133	133	U	133

APPENDIX E
DATA QUALITY ASSESSMENT

APPENDIX E

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data requirements specified by the project objectives and performance specifications. This DQA review was performed in accordance with the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005).

A review of the field logbooks (WCH 2006a, 2006b) and analytical data packages has been performed as part of this DQA. To ensure quality data, the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2001) data assurance requirements and the data validation procedures for chemical and radiochemical analysis (BHI 2000a, 2000b) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., closeout decisions). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2000).

The closeout sampling approach for the 118-F-2 Burial Ground included a sample design with multiple subunit areas (DOE-RL 2001). Verification sample data collected at this burial ground were provided by the laboratories in nine sample delivery groups (SDGs). For the overburden stockpiles, verification sample data were provided in three SDGs: SDG K0793, SDG K0817, and SDG J00112. For the shallow zone excavation, verification sample data were provided in two SDGs: SDG K0894, and SDG J00120. SDG K0894 was submitted for third-party validation. SDG K0894 also contains data from waste sites 118-F-5 and 100-F-26:15, in addition to the 118-F-2 shallow zone data. This DQA limited the data review for SDG K0894 to the data from 118-F-2. The verification sample data for the staging pile (above cleanup level [ACL]) footprint at the 118-F-2 Burial Ground are provided in two SDGs: SDG K0872 and SDG J00117. The shallow zone focused sample data was provided in two SDGs: SDG K0884 and SDG K0889. Major and minor deficiencies were identified in the analytical data set, and are discussed below.

SDG K0793

This SDG comprises four field samples (J152J8, J152J9, J152N0, and J152N1) collected from the overburden stockpiles. One field duplicate pair is included in this SDG (J152N0/J152N1). These samples were analyzed for inductively coupled plasma (ICP) metals, mercury, by alpha spectroscopy and gamma spectroscopy, total strontium by gas proportional counting, and nickel by liquid scintillation counting (LSC). No major deficiencies were found in SDG K0793. Minor deficiencies are as follows:

In the ICP metals analysis, the method blanks (MBs) for barium, calcium, chromium, iron, magnesium, manganese, molybdenum, sodium, silicon, and zinc are greater than the practical quantitation limit (PQL). However, all the sample results were greater than

five times the MB concentration requirement for the program. The data are not impacted by the method blank results and are useable for decision-making purposes.

In addition, the matrix spike (MS) recoveries for five ICP metals (aluminum, iron, manganese, antimony, and silicon) are out of project acceptance criteria. For most of these analytes, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. To confirm quantitation, post digestion spikes (PDSs) and serial dilutions were prepared for each analyte with results ranging between 97.8-105.6%. Antimony did not have mismatched spike and native concentrations in the original MS. The original MS recovery for antimony was 71.6%. The antimony data for SDG K0793 may be considered estimated. Estimated data are useable for decision-making purposes.

SDG J00112

This SDG comprises one field sample (J152P3), a split of sample J152N0 from SDG K0793. This sample was analyzed at Severn Trent Laboratories, Inc., with the analyses including ICP metals, mercury, by alpha spectroscopy and gamma spectroscopy, total strontium by gas proportional counting, and nickel by LSC. No major deficiencies were found in SDG J00112. Minor deficiencies are as follows:

For the alpha spectroscopy, the original analysis had low tracer yields, at 18% tracer recovery. The alpha spectroscopy results may be considered estimated. Estimated data are useable for decision-making purposes.

For the gamma spectroscopy, insufficient sample material was available to prepare a laboratory duplicate of sample J152P3. The duplicate result was obtained by recounting sample J152P3 on a different detector.

Elevated relative percent difference (RPD) values were reported for radionuclides in SDG J00112 with one or both results from the duplicate pair below the detection limit. When the duplicate pair is near the detection limit, analysis of RPDs is not considered useful in the precision determination. The data are useable for decision-making purposes.

In the ICP metals analysis, barium was reported in the MB at a concentration below the contract-required quantitation limit (CRQL) but not less than 1/5th of the concentration reported in the field sample (i.e., the field sample concentration was low enough that the MB concentration is of similar magnitude). The barium analytical result may be considered estimated. Estimated data are useable for decision-making purposes.

In addition, the MS and/or matrix spike duplicate (MSD) recoveries for seven ICP metals (aluminum, barium, calcium, iron, manganese, antimony, and silicon) are out of project acceptance criteria. For aluminum, iron, and manganese, the spiking concentration was

insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS and/or MSD is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. Antimony, barium, calcium, and silicon did not have mismatched spike and native concentrations in the original MS. The original MS and MSD recoveries for antimony were 54% and 51% respectively. The original MS and MSD recoveries for barium were 74% and 76% respectively. The original MSD recovery for calcium was 131%, and the original MS recovery for silicon was zero. The data for these analytes in SDG J00112 may be considered estimated. Estimated data are useable for decision-making purposes.

SDG K0817

This SDG comprises one field sample (J152J7) collected from the overburden stockpiles. This sample was analyzed for ICP metals, mercury, by alpha spectroscopy and gamma spectroscopy, total strontium by gas proportional counting, and nickel by LSC. No major deficiencies were found in SDG K0817. Minor deficiencies are as follows:

In the ICP metals analysis, the laboratory control sample recovery for silicon is below the acceptance criteria at 70.8%. The silicon result for the field sample may be considered estimated. Estimated data are considered acceptable for the intended use of the data.

In addition, the MS recoveries for four ICP metals (aluminum, iron, antimony, and silicon) are out of project acceptance criteria. For most of these analytes, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. To confirm quantitation, PDSs and serial dilutions were prepared for each analyte with results ranging between 99.3-105.0%. Antimony did not have mismatched spike and native concentrations in the original MS. The original MS recovery for antimony was 71.9%. The antimony data for SDG K0817 may be considered estimated. Estimated data are useable for decision-making purposes.

SDG K0872

This SDG comprises five verification samples (J152N7 through J152N9 and J152P0 and J152P1) from the staging pile (ACL) footprint. These samples were analyzed for ICP metals, mercury, by alpha spectroscopy and gamma spectroscopy, total strontium by gas proportional counting, and nickel by LSC. No major deficiencies were found in SDG K0872. Minor deficiencies are as follows:

The laboratory duplicate RPD for uranium-233/234, uranium-238, and cesium-137 are 71%, 58%, and 38%, respectively. These RPDs exceeds the criteria (30%); however, there is no requirement to qualify the data and no qualifier flags were assigned. As

elevated RPDs are attributed to heterogeneity naturally occurring in the soil matrix, the data are found to be useable for decision-making purposes.

In the ICP metals analysis, the MS recoveries for six analytes (aluminum, calcium, iron, manganese, antimony, and silicon) are out of acceptance criteria. For aluminum, iron, and silicon, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. For these analytes, the deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. To confirm quantitation, PDSs and serial dilutions were prepared for all six analytes with results in the range of 92.3% to 101.7%. The analytes calcium, manganese, and antimony did not have mismatched spike and native concentrations in the original MS. The original MS recoveries for calcium, manganese, and antimony were 63.5%, 33.4%, and 74.3%, respectively. The calcium, manganese, and antimony data for SDG K0872 may be considered estimated. Estimated data are useable for decision-making purposes.

The RPDs calculated for chromium (43.5%) and nickel (38.6%) in the laboratory duplicate pair (sample J152P1, and J152P1 duplicate), are above the acceptance criteria of 30%. Elevated RPDs in environmental soil samples are generally attributed to heterogeneities in the sample matrix and not to deficiencies in the laboratory procedures. The data are useable for decision-making purposes.

SDG J00117

This SDG comprises one field sample (J152P2), a split of sample J152N7 from SDG K0872. This sample was analyzed at Severn Trent Laboratories, with the analyses including ICP metals, mercury, by alpha spectroscopy and gamma spectroscopy, total strontium by gas proportional counting, and nickel by LSC. No major deficiencies were found in SDG J00117. Minor deficiencies are as follows:

In the ICP metals analysis, the MB for boron is greater than the PQL, suggesting a high bias in the data. However, the data are listed as nondetected and a high bias has no affect on nondetected analytical data. All other analytes were reported in the MB at concentrations that were below the CRQLs or less than 1/5th of some of the concentrations reported in the field samples (i.e., the field sample concentrations were high enough that the MB concentration does not significantly impact the sample results). The data are useable for decision-making purposes.

In addition, the MS recoveries for five ICP metals (aluminum, iron, manganese, antimony, and silicon) are out of acceptance criteria. For aluminum, iron, and silicon, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. For these analytes, the deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. Antimony and silicon did not have mismatched spike and native concentrations in the original MS. The original MS and MSD recoveries for antimony were 34% and 40%, respectively. The original MS and

MSD recoveries for silicon were 6.4% and 7.1%, respectively. The antimony and silicon data for SDG J00117 may be considered estimated. The data are useable for decision-making purposes.

For the alpha spectroscopy, the original analysis was failed because of low tracer yields. The samples were reanalyzed with acceptable results.

The RPD calculated for uranium-238 in the laboratory duplicate pair is above the acceptance criteria at 48%. Elevated RPDs in environmental soil samples are generally attributed to heterogeneities in the sample matrix and not to deficiencies in the laboratory procedures. The data are useable for decision-making purposes.

Elevated RPDs were reported for other radionuclides in SDG J00117. For each of these elevated RPDs, one or both results from the duplicate pair were below the detection limit. When the duplicate pair is near the detection limit, analysis of RPDs is not considered to be useful in the precision determination. The data are useable for decision-making purposes.

SDG K0894

This SDG comprises five field samples (J152N2 through J152N6) collected from the 118-F-2 shallow zone. One field duplicate pair is included in this SDG (J152N4/J152N5). These samples were analyzed for ICP metals, mercury, by alpha spectroscopy and gamma spectroscopy, total strontium by gas proportional counting, and nickel by LSC. SDG K0894 was submitted for formal third-party validation. No major deficiencies were found in SDG K0894. Minor deficiencies are as follows:

Gross beta was detected in the MB at a concentration greater than the minimum detectable activity, indicating MB contamination. Third-party validation qualified all gross beta results in SDG K0894 as estimated and flagged "J." The data are useable for decision-making purposes.

The RPD value for uranium-238 in the laboratory duplicate pair is above the acceptance criteria at 79%. Elevated RPDs are attributed to natural heterogeneity of the sample matrixes. The data are usable for decision-making purposes.

In the ICP metals analysis, the MS recoveries for four ICP metals (aluminum, iron, antimony, and silicon) are out of project acceptance criteria. For most of these analytes, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. The deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. To confirm quantitation, PDSs and serial dilutions were prepared for each analyte with results ranging between 103.3-110.7%. Antimony did not have mismatched spike and native concentrations in the original MS. The original MS recovery for antimony was 73.3%. The antimony data for SDG K0793

was qualified as estimated with a "J" flag by third-party validation. Estimated data are useable for decision-making purposes.

The RPD value for arsenic in the laboratory duplicate pair is above the acceptance criteria at 34%. Elevated RPDs are attributed to natural heterogeneity of the sample matrixes. The data are usable for decision-making purposes.

SDG J00120

This SDG comprises one field sample (J152P4), a split of sample J152N4 from SDG K0894. This sample was analyzed at Severn Trent Laboratories, with the analyses including ICP metals, mercury, by alpha spectroscopy and gamma spectroscopy, total strontium by gas proportional counting, and nickel by LSC. One major deficiency was found in SDG J00120. The MS and MSD recoveries for silicon were less than 10%, with both reported at zero. Therefore, the silicon data in SDG J00120 are rejected and flagged "R." Silicon is not a COPC for the 118-F-2 Burial Ground, and the rejected silicon data do not impact completeness of the verification sampling data. Minor deficiencies are as follows:

For the alpha spectroscopy, the MS recovery for plutonium-238 was out of project acceptance criteria, at 63%. The plutonium-238 result for sample J152P4 may be considered estimated. Estimated data are useable for decision-making purposes.

Elevated RPDs were reported for the plutonium-238, plutonium-239/240, uranium-234, and uranium-238 laboratory duplicates for sample J152P4. For the plutonium isotopes, the results were all below the detection limits, and for the uranium isotopes the results were near the detection limits. When the duplicate pair is near the detection limit, analysis of RPD is not considered useful in the precision determination. The data are useable for decision-making purposes.

In the ICP metals analysis, the MS and MSD recoveries for nine analytes (aluminum, calcium, chromium, iron, manganese, potassium, silicon, silver, and zinc) are out of acceptance criteria. For aluminum, iron, and manganese, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. For these analytes, the deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. Calcium, silver, and zinc had high MS and MSD recoveries, indicating a potential high bias to the data for these analytes. Chromium, potassium, and silicon did not have mismatched spike and native concentrations, but had low MS and/or MSD recoveries. The original MS recovery for chromium was 66%. The original MS and MSD recoveries for potassium were 61% and 69%, respectively. The chromium and potassium data in SDG J00120 may be considered estimated. Estimated data are useable for decision-making purposes.

SDG K0884

This SDG comprises nine verification samples (J15DV7 through J15DV9, J15DW0 through J15DW2, J15DW9, and J15DX0 through J15DX1), which are focused samples from the shallow zone of the 118-F-2 Burial Ground. Samples J15DV7 through J15DV9 and J15DW0 through J15DW2 were analyzed by beta counting and LSC. Samples J15DW9, J15DX0, and J15DX1 were analyzed for ICP metals, by alpha spectroscopy, gamma spectroscopy, and LSC. No major deficiencies were found in SDG K0884. Minor deficiencies are as follows:

In the ICP metals analysis, the MS recoveries for four analytes (aluminum, iron, antimony, and silicon) are out of acceptance criteria. For aluminum, iron, and silicon, the spiking concentration was insignificant compared to the native concentration in the sample from which the MS was prepared. For these analytes, the deficiency in the MS is a reflection of the analytical variability of the native concentration rather than a measure of the recovery from the sample. To confirm quantitation, PDSs and serial dilutions were prepared for all six analytes with results in the range of 97.3% to 106.3%. Antimony did not have mismatched spike and native concentrations in the original MS. The original MS recovery for antimony was 56.5%. The antimony data for SDG K0884 may be considered estimated. Estimated data are useable for decision-making purposes.

SDG K0889

This SDG comprises six field samples (J15DW3 through J15DW8) which are focused samples from the shallow zone of the 118-F-2 Burial Ground. These samples were analyzed for total petroleum hydrocarbons (TPH) and semivolatile organic compounds (SVOCs). Toxicity characteristics leaching procedure (TCLP) samples were generated from the six focused samples and analyzed for SVOCs. No major deficiencies were found in SDG K0889. Minor deficiencies are as follows:

In the SVOC analysis, 32 of 128 MS recoveries are below the acceptance criteria. The MS for 2-methylnaphthalene is 59%, and the MSD recovery is 45%. The benzo(b) fluoranthene MS and MSD are 59% and 41%, respectively. The 1,3-dichlorobenzene, 1,4-dichlorobenzene, and 1,2-dichlorobenzene MSD recoveries are 28%, 30%, and 35%, respectively. The hexachloroethane MSD recovery is 26%, the 2-methylphenol MSD recovery is 57%, and the 1,2,4-trichlorobenzene MSD is 41%. The hexachlorobutadiene MSD recovery is 37%, the acenaphthalene MSD is 52%, the 2,6-dinitrotoluene MSD is 56%, the 3-nitroaniline MSD is 43%, the dibenzofuran MSD is 51%, phenanthrene MSD is 55%, the anthracene MSD is 54%, the chrysene MSD is 43%, and the benzo (a) pyrene MSD is 44%. The MSD recovery for pyrene and indeno (1,2,3-cd)pyrene is 46%. The MSD for 4-chlorophenyl-phenylether, 4-bromophenyl-phenylether, and bis (2-ethylhexyl)phthalate is 49%. The MSD is 45% for di-n-octyl phthalate, benzo(k)fluoranthene, and dibenz(a,h) anthracene. The MSD recovery for fluorine and benzo(g,h,i) perylene is 48%. The MSD recovery is 47% for N-nitrosodiphenylamine, 4-bromophenyl-phenylether, and benzo(a)anthracene, and 4-methylphenol. The data may be considered estimated. Estimated data are useable for decision-making purposes.

The common laboratory contaminant Bis (2-Ethylhexyl)phthalate and the target compound Benzo (g,h,i) perylene are detected in the method blank (MB) at concentrations less than the CRQL. The data are not otherwise affected and are useable for decision-making purposes.

In the SVOC analysis for the TCLP samples, the MS recoveries for pentachlorophenol are 110% and 112%, and the MB result is 113%, indicating the sample results for pentachlorophenol may be biased high. The sample results were reported as undetected. The data are useable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

RPD evaluations of main sample(s) versus the laboratory duplicate(s) are routinely performed and reported by the laboratory. Any deficiencies in those calculations are reported by SDG in the previous sections.

Field quality assurance (QA)/quality control (QC) measures are used to assess potential sources of error and cross contamination of samples that could bias results. Field QA/QC samples, listed in the field logbooks (WCH 2006a, 2006b), are summarized in Table E-1. The main and QA/QC sample results are presented in Appendix C.

Table E-1. Field Quality Assurance/Quality Control Samples.

Sample Area	Main Sample	Duplicate Sample	Split Sample
Overburden Stockpiles	J152N0	J152N1	J152P3
Shallow Zone Excavation	J152N4	J152N5	J152P4
Staging Pile (ACL) Footprint	J152N7	J152N8	J152P2

ACL = above cleanup level

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

Radionuclides. None of the RPDs calculated for radionuclide field duplicates or splits are above the acceptance criteria (30%). The data are useable for decision-making purposes.

Nonradionuclides. The RPDs calculated for aluminum in the overburden (J152P3) and staging pile (ACL) footprint (J152P2) split samples are above the acceptance criteria (30%) at 42% and 39%, respectively. The RPD calculated for chromium in the overburden (J152P3) and staging pile (ACL) footprint (J152P2) split samples is above the acceptance criteria, with both at 36%. The RPD calculated for iron in the overburden (J152P3) split is above the acceptance criteria (30%) at 33%. The RPDs calculated for magnesium in the overburden (J152P3) and staging pile (ACL) footprint (J152P2) split samples are above the acceptance criteria (30%) at 34% and 32%, respectively. The RPDs calculated for silicon in the overburden (J152P3) and staging pile (ACL) footprint (J152P2) split samples and the overburden (J152N1) duplicate sample are above the acceptance criteria (30%) at 33%, 128%, and 47%, respectively. The RPDs calculated for vanadium in the overburden (J152P3) and staging pile (ACL) footprint (J152P2) split samples are above the acceptance criteria (30%) at 46% and 44%, respectively. Elevated RPDs, such as these in the analysis of environmental soil samples, are largely attributed to heterogeneities in the soil matrix and only in small part attributed to precision and accuracy issues at the laboratory. The data are useable for decision-making purposes.

RPDs for the remaining radionuclides and nonradionuclide analytes are not calculated because an evaluation of the data shows that the analytes are not detected in both the main and duplicate sample at more than 5 times the target detection limit. RPDs of analytes detected at low concentrations (less than five times the detection limit) are not considered indicative of the analytical system performance. The data are useable for decision-making purposes.

A secondary check of the data variability is used when one or both of the samples being evaluated (main and duplicate) is less than 5 times the target detection limit (TDL), including undetected analytes. In these cases, a control limit of ± 2 times the TDL is used (Appendix C) to indicate that a visual check of the data is required by the reviewer. For the overburden stockpile split samples, the cobalt and sodium results required this check. For the staging pile (ACL) footprint split samples, antimony, boron, and cobalt also required this check. These results are attributed to heterogeneities in the sample matrix from which the samples were collected. A visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are useable for decision-making purposes.

Summary

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above, are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 118-F-2 verification sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for 118-F-2 waste site concludes that the reviewed data are of the right type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and sampling data group completeness were assessed to determine if any analytical results should be rejected as a result of QA and QC deficiencies. The analytical data were found acceptable for decision-making purposes, with the exception of the silicon results reported in SDG J00120. Silicon is not a COPC for the 118-F-2 waste site, and the rejected silicon data do not impact completeness of the verification sampling data. The verification sample analytical data are stored in the Environmental Restoration project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The verification sample analytical data are also included in Appendix C.

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