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OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
ANALYSIS/MODEL COVER SHEET

1. QA: QA
Page: 1 of: 45

Complete Only Applicable Items

2. ☑ Analysis	☐ Engineering	3. ☐ Model	☐ Conceptual Model Documentation
	☑ Performance Assessment		☐ Model Documentation
	☐ Scientific		☐ Model Validation Documentation

4. Title:
Disruptive Event Biosphere Dose Conversion Factor Analysis

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8. Originator	Maryla A. Wasiolek	Maryla Wasiolek	12/28/99
9. Checker	Timothy W. Smith / D. (Wesley) Wu	D. Wu	12/28/99
10. Lead/Supervisor	John F. Schmitt	John F Schmitt	12/28/99
11. Responsible Manager	Larry D. Croft	John F Schmitt for LD CROFT	12/28/99

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AP-3.10Q.3 Rev. 06/30/1999

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
ANALYSIS/MODEL REVISION RECORD

1. Page: 2 of: 45

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REV 00 / ICN 0	Initial issue.

AP-3.10Q.4

Rev. 06/30/1999

EXECUTIVE SUMMARY

The purpose of this analysis model report (AMR) was to support the biosphere component of TSPA by developing disruptive event biosphere dose conversion factors (BDCFs). Disruptive Event BDCFs, when combined with the concentration of activity deposited on the soil surface by volcanic eruption, will allow calculations of radiation doses. Calculation of activity deposition is outside the scope of this AMR. This AMR presents the analysis and documents the results in terms of BDCF for the receptor of interest considered for reasonable representation and for the bounding representation.

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ACRONYMS AND ABBREVIATIONS

Acronyms

AMR	Analysis Model Report
BDCF	Biosphere Dose Conversion Factor
CRWMS M&O	Civilian Radioactive Waste Management System Management and Operating Contractor
CEDE	Committed Effective Dose Equivalent
OCRWM	Office of Civilian Radioactive Waste Management
LHS	Latin Hypercube Sampling
MC	Monte Carlo (Sampling)
SR	Site Recommendation
STD	Standard Deviation
TBV	To Be Verified
TEDE	Total Effective Dose Equivalent
TSPA	Total System Performance Assessment

Abbreviations

Ac	Actinium
Am	Americium
Bq	Becquerel
C	Carbon
Ci	Curie
Cs	Cesium
Fr	Francium

I	Iodine
Mo	Molybdenum
Nb	Niobium
Ni	Nickel
Np	Neptunium
Pa	Protactinium
pCi	picocurie
Pu	Plutonium
Ra	Radium
rem	historically derived from Roentgen Equivalent Man, unit of dose
Sr	Strontium
Sv	Sievert
Tc	Technetium
Th	Thorium
U	Uranium
Y	Yttrium

1. PURPOSE

Biosphere is one of the component process models supporting the Total System Performance Assessment (TSPA) used to predict the long-term behavior of the potential repository at Yucca Mountain. The biosphere model considers the movement of radionuclides in the accessible environment, exposure of humans to these radionuclides, and the resulting doses. The biosphere model allows assessment of doses following internal and external exposure to radionuclides present in environmental media, such as water, soil, air, and food. Internal exposure pathways under consideration include ingestion and inhalation of radionuclides; external exposure pathway considers external irradiation from contaminated soil.

A substantial part of the biosphere modeling for the TSPA is carried out by the computer code GENII-S (Leigh et al. 1993). GENII-S has been selected for its capabilities to support modeling of environmental transport and to perform multi-pathway dose calculations. GENII-S uses a comprehensive set of environmental pathway models and associated computer programs to estimate potential radiation doses to humans from radionuclides in the environment.

The purpose of this analysis model report (AMR) was to support the Biosphere component of TSPA by developing disruptive event biosphere dose conversion factors (BDCFs) for application in the dosimetric segment of the biosphere model for the Tectonic Hazards assessment. This AMR presents the analysis and documents the results for both the reasonable representation and for the bounding representation.

This analysis was conducted within the applicable limits of the GENII-S code for the TSPA modeling, as described in the software qualification report (CRWMS M&O 1998). The conclusions in this report only apply to radionuclides listed in Section 6, and not the full suite of radionuclides considered in GENII-S.

Activities described in this report were conducted in accordance with the *Development Plan for Disruptive Event Biosphere Dose Conversion Factor Analysis* (CRWMS M&O 1999a).

2. QUALITY ASSURANCE

This analysis has been determined to be Quality Affecting in accordance with Civilian Radioactive Waste Management System Management and Operating Contractor (CRWMS M&O) procedure QAP-2-0, *Conduct of Activities,* because the information will be used to support Performance Assessment and other quality-affecting activities. Therefore, this analysis is subject to the requirements of the *Quality Assurance Requirements and Description* (DOE 1998) document. This analysis is covered by the Activity Evaluation for *Scientific Investigation of Radiological Doses in the Biosphere* (CRWMS M&O 1999b).

Personnel performing work on this analysis were trained and qualified according to Office of Civilian Radioactive Waste Management (OCRWM) procedures AP-2.1Q, *Indoctrination and Training of Personnel* and AP-2.2Q, *Establishment and Verification of Required Education and Experience of Personnel.* Preparation of this analysis did not require the classification of items in accordance with CRWMS M&O procedure QAP-2-3, *Classification of Permanent Items.* This analysis was not a field activity. Therefore, a determination of importance in accordance with CRWMS M&O procedure NLP-2-0, *Determination of Importance Evaluation,* was not required.

This report was written in accordance with OCRWM procedure AP-3.10Q, *Analyses and Models* and the following procedures invoked by AP-3.10Q:

AP-2.13Q, Rev. 0, ICN 1. *Technical Product Development Planning.*

AP-2.14Q, Rev. 0, ICN 0. *Review of Technical Products.*

AP-3.4Q, Rev. 1, ICN 1. *Level 3 Change Control.*

AP-3.15Q, Rev. 1, ICN 0. *Managing Technical Product Inputs.*

AP-6.1Q, Rev. 3, ICN 0. *Controlled Documents.*

AP-17.1Q, Rev. 1, ICN 1. *Record Source Responsibilities for Inclusionary Records.*

AP-SI.1Q, Rev.2, ICN 2. *Software Management.*

AP-SIII.2Q. Rev. 0, ICN 2. *Qualification of Unqualified Data and the Documentation of Rationale for Accepted Data.*

AP-SIII.3Q. Rev. 0, ICN 0. *Submittal and Incorporation of Data to the Technical Data Management System.*

AP-SIII.4Q, Rev. 0, ICN 1. *Development, Review, Online Placement, and Maintenance of Individual Reference Information Base Data Items.*

YAP-SV.1Q. Rev. 0, ICN 1. *Control of the Electronic Management of Data.*

3. COMPUTER SOFTWARE AND MODEL USAGE

As the part of the analysis, the computer code GENII-S V1.4.8.5 was used. GENII-S is a computer program used to calculate statistical and deterministic values of radiation doses to humans from exposure to radionuclides in the environment. GENII-S is an acquired software, which was qualified for use on the Yucca Mountain Project (CRWMS M&O 1998). Validation of the biosphere model used by GENII-S will be performed as a separate effort. Until the model validation is completed, the computer code is designated as TBV (TBV-3955). The software consists of executable program and auxiliary files, all of which are maintained under Configuration Management (CSCI: 30034 V1.4.8.5). GENII-S was appropriate for this application and was used within the range of validation in accordance with AP-SI.1Q, *Software Management*, as described in the software qualification report (CRWMS M&O 1998). The analysis was performed using a Gateway 2000 Personal Computer, CPU# 111161.

4. INPUTS

4.1 DATA AND PARAMETERS

Inputs to this analysis were developed in a series of AP-3.10Q analyses, as listed in Table 1 or transmitted using Input Transmittals per AP-3.14Q. Table 1 includes input identifications, sources, Q status, and the list of parameters from a given source that are used in this analysis. More detailed description of input is presented in Section 6 (see Tables 2, 3, 4, 5, 6, and 8).

4.2 CRITERIA

Twelve radionuclides were identified by the Performance Assessment Operations Organization as relevant for a direct release scenario (disruptive events) (CRWMS M&O 1999j): ^{227}Ac, ^{241}Am, ^{243}Am, ^{137}Cs, ^{231}Pa, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{90}Sr, ^{229}Th, ^{232}U, ^{233}U. The analysis was conducted for these radionuclides.

4.3 CODES AND STANDARDS

There are no applicable standards at this time. The Nuclear Regulatory Commission has proposed regulatory standard (10 CFR 63 draft) for a potential repository at Yucca Mountain (see Federal Register for February 22, 1999, 64 FR 8640). Until the final rulemaking for 10 CFR 63 is completed, the interim guidance provided by DOE (Dyer 1999) will be followed. This guidance specifies criteria applicable to this analysis. The document includes *Requirements for Performance Assessment*, which require to "Account for uncertainties and variabilities in parameter values..." (Sec. 114 (b)). Section 115, *Required Characteristics of the Reference Biosphere and Critical Group*, specifies the approach to defining a critical group, which is relevant to this analysis. Per *Performance Objectives for the Geologic Repository After Permanent Closure* (Sec. 113), individual doses to the receptor of interest due to one-year of exposure should be expressed in terms of total effective dose equivalent (TEDE), which is a sum of effective dose equivalent (EDE) and committed effective dose equivalent (CEDE) integrated over 50-year time period.

Table 1. List of Input Parameters and Their Sources.

Input No.	Document Title and Source Identification	Data Title and Data Tracking Number	Q Status Of Data	Parameter Name/ Input Description
1	CRWMS M&O 1999c. Environmental Transport Parameter Analysis. DI: ANL-MGR-MD-000007 Rev. 00. Las Vegas, Nevada. CRWMS M&O. MOL.19991115.0238	Environmental Transport Parameter Values for Dose Assessment MO9911RIB00064.000	Q	(1) Deposition velocity: particle for deposition on crops (2) Resuspension factor (3) Crop biomass for all crop types under consideration (4) Basic soil data: depth of surface soil, fraction of plant root in surface soil, fraction of plant root in deep soil, surface soil density, bulk soil density. (5) Soil ingestion rate (6) Weathering half-life (7) Translocation factor for all crop types/animal food products under consideration (8) Animal feed and water consumption rates for all animal food products under consideration (9) Dry-to-wet ratio for all crop types under consideration.
2	CRWMS M&O 1999d. Transfer Coefficient Analysis. DI: ANL-MGR-MD-000008 Rev. 00. Las Vegas, Nevada. CRWMS M&O. MOL.19991115.0237	Parameter Values for Transfer Coefficients MO9911RIB00065.000	Q	(1) Transfer parameters for elements and food types under consideration. (2) Soil-to-plant transfer scale factor and animal uptake scale factor.
3	CRWMS M&O 1999e. Input Parameter Values for External and Inhalation Radiation Exposure Analysis. DI: ANL-MGR-MD-000001 Rev. 00. Las Vegas, Nevada. CRWMS M&O. MOL.19990923.0235	Input Parameter Values for External and Inhalation Radiation Exposure Analysis MO9910B00061.000	Q	(1) Mass loading (2) Inhalation exposure time, chronic breathing rate, and soil exposure time for the receptor of interest
4	CRWMS M&O 1999f. Ingestion Exposure Pathway Parameters. Input Transmittal No. R&E-ESR-99395.T. Las Vegas, Nevada: CRWMS M&O. MOL.19991202.0101.	Ingestion Exposure Pathway Parameters MO9912SPAING06.033	TBV 3958	(1) Crop interception fraction (2) Plant growing times (3) Holdup times for plant and animal food products (4) Feed storage time (5) Animal dietary fractions
5	CRWMS M&O 1999g. Recommended Distribution-Based and Fixed (Mean) Consumption Parameters for Locally Produced Food by Type and Tap Water. Input Transmittal No. R&E-ESR-99394.T. Las Vegas, Nevada: CRWMS M&O. MOL.19991202.0102.	Recommended Distribution-based and Fixed (Mean) Consumption Parameters for Locally Produced Food by Type and Tap Water. MO9912SPACON05.001	TBV 3957	Locally grown food consumption rates for the receptor of interest

Table 1 continued.

	Document Title and Source identification	Data Title and Data Tracking Number	Q Status of Data	Parameter Name/ Input Description
6	CRWMS M&O 1999h. Dose Conversion Factor Analysis: Evaluation of GENII-S Dose Assessment Methods. DI: ANL-MGR-MD-000002 Rev. 00. Las Vegas, Nevada: CRWM M&O. MOL.19991207.0215.	Parameter Values for Internal and External Dose Conversion Factors MO9911RIB00066.000	Q	(1) Modifying factors for ingestion and inhalation (2) Dose coefficients for exposure to contaminated soil (3) Dose coefficients for air submersion.
7	CRWMS M&O 1999i. Preliminary Leaching Coefficients for GENII-S. Input Transmittal No. R&E-PA-99264.T. Albuquerque, NM: CRWMS M&O. MOL.19990915.0271.	Leaching Coefficients for GENII-S Code. SN9912T0512299.001	TBV 3956	Leaching coefficients for elements under consideration

5. ASSUMPTIONS

The parameters described in this AMR are biosphere dose conversion factors. These radionuclide-specific BDCFs represent expected dose for a defined receptor under a given exposure scenario for unit concentration of that radionuclide in soil. All assumptions listed below are used in Section 6.

5.1 SOURCE OF CONTAMINATION

Surface soil was assumed to be the source of contamination for this analysis, per the agreement obtained at the meeting on dose calculations for volcanic disruptions (Smith 1999). Biosphere dose conversion factors were calculated for unit activity concentration in surface soil (1 pCi m^{-2}) uniformly distributed throughout the surface soil layer (Smith 1999, Burck 1999). The thickness of the surface soil has been determined to be 15 cm (CRWMS M&O 1999c). The thickness of volcanic ash deposited on soil surface was determined to be insignificant, when compared with the thickness of surface soil (Burck 1999), therefore the ash-soil mixture was assumed to have properties of soil.

Once the activity concentration of a specific radionuclide per unit area of surface soil is determined, the dose from this radionuclide will be calculated by multiplying BDCF for the radionuclide under consideration by its concentration in surface soil. Calculations of radionuclide concentrations in soil (ash deposition) resulting from volcanic events are conducted within the scope of the Disruptive Events Process Model Report.

Ground water contamination is evaluated separately, therefore groundwater was assumed to be uncontaminated. BDCFs for groundwater contamination will be considered in "Non-Disruptive Event Biosphere Dose Conversion Factor Analysis" (DI: ANL-MGR-MD-000010) generated in parallel with this analysis. Doses resulting from combined groundwater contamination and volcanic eruption may be calculated, if required, by combining dose contributions from these two types of radioactivity release to the biosphere.

5.2 EXPOSURE SCENARIO

Calculations were performed for a near-field scenario, in which interest is focused on the doses an individual could receive at a particular location as a result of initial contamination or external sources (Leigh et al. 1993, p. 1-2). Various aspects of radionuclide release and transport from a volcano to the location of interest will be modeled in the AMR within the Disruptive Events PMR, titled "Igneous Consequence Modeling for the TSPA–SR" (DI: ANL-WIS-MD-000017). For calculations of BDCFs, radionuclide inventory was considered in terms of basic radionuclide concentrations in surface soil which exist after immediate volcanic transport has occurred. The radioactivity is assumed to be uniformly plowed into the surface soil layer of 15-cm in depth (Smith 1999). Preliminary calculations (Burck 1999) have indicated negligible thickness of ash at the location of interest (the average thickness was determined to be 0.008 cm), therefore no separate set of BDCFs for ash-like medium was required to support the current TSPA. The ash-soil mixture was assumed to have properties of soil (Burck 1999). Radionuclide transport by air is modeled in the "Igneous Consequence Modeling for the TSPA - SR" AMR, therefore air transport mode was not considered in this AMR.

In response to GENII-S interface (to disable GENII-S selections and options not relevant to the exposure scenarios of interest), the following assumption were made: there is no surface water (lakes, rivers) in the vicinity of Yucca Mountain, therefore surface water transport was not considered; biotic transport and waste form degradation were not included because these processes are characteristic of shallow burial of waste; it was assumed that all contaminated food is locally grown.

5.3 RECEPTOR OF INTERST

The receptor of interest for the reasonable representation is the average member of the critical group. Consumption rates for the average critical group member are based on the mean values of the corresponding distributions of the locally-produced food consumption, consistent with the description of characteristics of the reference biosphere and critical group (Dyer 1999, Sec. 115 (b)(4)). The receptor considered for the bounding representation is characterized by the behaviors and characteristics leading to higher exposures (a highly conservative case). (Although important characteristics of both receptors are based on the results of the locally grown food consumption survey, none of the survey respondents were characterized by the highest consumption rates across all food categories.)

5.4 EXPOSURE PATHWAYS

Radiation dose to an individual results from exposures to radionuclides, which are either internal or external to the body. The routes taken by radionuclides through the biosphere from the source to a person are called exposure pathways. They are determined by radionuclide transport in the environment from the source to environmental medium and to man. Doses to humans depend on radionuclide concentration in environmental media and by specific human behavioral characteristics, which affect exposure to these media. Exposure pathways fall into three principal categories: ingestion pathways, inhalation pathways, and external exposure pathways.

The following exposure pathways were considered:

- Consumption of locally produced leafy vegetables
- Consumption of other (root) locally produced vegetables
- Consumption of locally produced fruit
- Consumption of locally produced grain
- Consumption of locally produced meat (beef and pork)
- Consumption of locally produced poultry
- Consumption of locally produced milk
- Consumption of locally produced eggs
- Inadvertent soil ingestion
- Inhalation of resuspended particulate matter
- External exposure to contaminated soil

Drinking water ingestion and aquatic food ingestion, usually considered for the undisrupted performance, were not included because of the assumption that groundwater was not contaminated.

6. ANALYSIS/MODEL

The objective of this analysis was to develop biosphere specific disruptive (volcanic) event dose conversion factors for the receptors of interest (see Section 5.3). To meet this objective, a comprehensive biosphere model that describes the movement of radionuclides released to the environment to man was used. GENII-S (Leigh et al. 1993) was identified as a suitable computer code that uses a comprehensive set of environmental pathway models and associated computer programs for estimating potential radiation doses to humans from radionuclides in the environment. It combines multi-pathway environmental transport models with human exposure parameters to calculate radiation doses using methods based on recommendations of the International Commission on Radiation Protection (ICRP 1977).

GENII-S has been selected as the computer code to support biosphere modeling effort. Selection of the model and supporting software has been previously conducted and the rationale has been documented (Harris 1997). The biosphere model used in this analysis is subject to validation (TBV-3955).

GENII-S code was used to calculate BDCFs for the conditions following volcanic eruption as described in Section 5. Twelve radionuclides were identified as relevant for a direct release scenario (disruptive events) (CRWMS M&O 1999j): ^{227}Ac, ^{241}Am, ^{243}Am, ^{137}Cs, ^{231}Pa, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{90}Sr, ^{229}Th, ^{232}U, ^{233}U. Calculations for reasonable representation and for bounding representation were performed in a series of individual runs for eleven radionuclides under consideration. Radionuclide inventory was specified in terms of basic concentrations that exist after transport has occurred. The following inventory activity units were selected: pCi for activity and per m^2 for soil inventory resulting in basic concentrations in surface soil in the units of pCi per m^2. BDCFs for reasonable representation were obtained in statistical runs using Latin Hypercube sampling method, random number seed of 0.333, and 160 trials. (With Latin Hypercube sampling, a parameter's probability distribution is divided into equal probability intervals. The code then generates a parameter value for each interval according to the interval's probability distribution.) BDCFs for bounding representation were calculated in deterministic runs. BDCFs for both reasonable representation and for the bounding representation were calculated in units of rem y^{-1} pCi^{-1} m^2.

Biosphere modeling for disruptive events was site specific to the extent that was practicable. An effort was made to use site-specific values of model parameters whenever possible. Input parameters, developed in a series of AMRs, were entered by changing the content of input files and by using a menu-driven interface. Changes to input files can be summarized as follows:

- Table 2 lists the selections of environmental input parameters for both reasonable and bounding representations, which are included in a modified original DEFAULT.IN file. After modifications, the file was renamed DEFRR.IN and DEFSC.IN for reasonable representation and bounding representation, respectively.

- Tables 3 and 4 contain the developed values of food transfer coefficients and leaching factors, which were used to change GENII-S original file named FTRANS.DAT. The

resulting input files for the reasonable representation and bounding representation were named FTRANRR.DAT and FTRANSC.DAT, respectively.

- The original file containing dose coefficients for external exposure, GRDF.DAT, was replaced with the developed file GRDFNEW.DAT. Dose coefficients for external exposure to contaminated soil listed in Table 5 for radionuclides under consideration. The same values of dose coefficients were used for reasonable representation and for bounding representation.

Attachment II contains listings of the developed/modified files specified in this paragraph in the directory named "Input Files RR and BR" included on CD-ROM.

Tables 6 and 8 contain descriptions and sources of all input parameters used for reasonable and bounding representations that were entered using a menu-driven interface.

Some of the parameters/options available in GENII-S were not used because they were irrelevant to the exposure scenario of interest. Nevertheless, the names of these parameters appear in Tables 2 through 6 and in Table 8, consistently with the GENII-S input format. The nomenclature used in Tables 6 and 8 adheres to the usage in GENII-S code.

Table 2. Environmental Input Parameters for Reasonable Representation and for Bounding Representation from files DEFRR.IN and DEFSC.IN.

Parameter	Value		Reference[a]/ Comment
	Reasonable Representation	Bounding Representation	
Absolute humidity (kg/m^3)	---	---	Not used
Air dispersion conserv. flag	---	---	Not used
Deposition velocity for resuspension (m/sec)	0.001	0.1	Input source #1
Leaf resuspension factor (1/m)	8.3×10^{-11} Lognormal distribution: $9.6\times10^{-12} - 7.2\times10^{-10}$	1.4×10^{-9}	Input source #1
Crop biomass (kg/m2)			
- Leafy vegetables	2.0	1.5	Input source #1
- Root vegetables	2.0	2.0	
- Fruit	3.0	0.7	
- Grain	0.8	0.4	
- Stored feed, beef	0.8	0.8	
- Stored feed, poultry	0.8	0.8	
- Stored feed, milk	1.0	0.8	
- Stored feed, eggs	0.8	0.8	
- Fresh forage, beef	1.0	0.7	
- Fresh forage, milk	1.5	0.7	
Interception fraction for irrigation	---	---	Not used
Depth of surface soil (cm)	15	15	Input source #1
Surface soil density (kg/m2)	225	180	Input source #1
Soil density (kg/m3)	1500	1500	Input source #1
Harvest removal considered?	---	---	Not used
Soil ingested (mg/day)	50	410	Input source #1
Weathering time (day)	14	14	Input source #1
Translocation, plants			
- Leafy vegetables	1.0	1.0	Input source #1
- Root vegetables	0.1	0.1	
- Fruit	0.1	0.1	
- Grain	0.1	0.1	
Translocation, animal food			
- Stored feed, beef	0.1	0.1	Input source #1
- Stored feed, poultry	0.1	0.1	
- Stored feed, milk	0.1	0.1	
- Stored feed, eggs	0.1	0.1	
- Fresh forage, beef	1.0	1.0	
- Fresh forage, milk	1.0	1.0	
Animal consumption rate (kg/day)			
- Stored feed, beef	68	68	Input source #1
- Stored feed, poultry	0.12	0.4	
- Stored feed, milk	55	73	
- Stored feed, eggs	0.12	0.4	
- Fresh forage, beef	68	68	
- Fresh forage, milk	55	73	
Animal drinking water consumption rate(L/day)			
- Beef	---	---	Not used
- Poultry	---	---	
- Milk	---	---	
- Eggs	---	---	
Acute fresh forage by season	---	---	Not used
Shore width factors	---	---	Not used

Table 2. Continued.

Parameter	Value		Reference[a]/ Comment
	Reasonable Representation	Bounding Representation	
Swimming water ingested (L/hr)	---	---	Not used
H2O/sediment transfer (L/m2/yr)	---	---	Not used
Veg. prod. (kg/m2/yr)	---	---	Not used
Excavation (m2/m3-yr)		---	Not used
Fraction of soil brought to surface from within the waste by animal excavation	---	---	Not used
Chronic breathing (cm3/sec)	266.2	358.8	Input source #3
Acute breathing (cm3/sec)	---	---	Not used
Number of distances	---	---	Not used
JF/chi/Q/pop grid dist. (m)	---	---	Not used
Dry/wet ratio			
- Leafy vegetables	0.10	0.20	Input source #1
- Root vegetables	0.25	0.38	
- Fruit	0.18	0.24	
- Grain	0.91	0.93	
- Stored feed, beef	0.18	0.22	
- Stored feed, poultry	0.91	0.93	
- Stored feed, milk	0.18	0.22	
- Stored feed, eggs	0.91	0.93	
- Fresh forage, beef	0.20	0.22	
- Fresh forage, milk	0.20	0.22	

[a] Input source identification in Reference/Comment column (e.g. #1, #3) refers to input numbers in Table 1.

Table 3. Food Transfer Library and Bioaccumulation Library for Reasonable Representation from File FTRANRR.DAT.

Element	Z	Food Transfer Coefficients								Leaching factors 1/y
		Leafy vegetables ---	Root vegetables ---	Fruit ---	Grain ---	Beef day/kg	Poultry day/kg	Milk day/L	Eggs day/kg	
C	6	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E-04
Ni	28	2.8E-01	6.0E-02	6.0E-02	3.0E-02	5.0E-03	1.0E-03	1.6E-02	1.0E-01	1.7E-03
Sr	38	2.0E+00	1.2E+00	2.0E-01	2.0E-01	8.0E-03	8.0E-02	1.5E-03	3.0E-01	3.4E-02
Y	39	1.5E-02	6.0E-03	6.0E-03	6.0E-03	1.0E-03	1.0E-02	2.0E-05	2.0E-03	4.0E-03
Mo	42	2.5E-01	6.0E-02	6.0E-02	6.0E-02	1.0E-03	1.9E-01	1.5E-03	9.0E-01	6.7E-02
Tc	43	4.0E+01	1.5E+00	1.5E+00	7.3E-01	1.0E-04	3.0E-02	1.0E-02	3.0E+00	2.8E+00
I	53	3.4E-03	5.0E-02	5.0E-02	5.0E-02	7.0E-03	1.8E-02	1.0E-02	3.0E+00	5.9E-01
Cs	55	1.3E-01	4.9E-02	2.2E-01	2.6E-02	5.0E-02	4.4E+00	8.0E-03	4.0E-01	2.4E-04
Ra	88	8.0E-02	1.3E-02	6.1E-03	1.2E-03	9.0E-04	3.0E-02	1.3E-03	2.0E-05	1.4E-03
Ac	89	3.5E-03	3.5E-04	3.5E-04	3.5E-04	2.5E-05	4.0E-03	2.0E-05	2.0E-03	1.5E-03
Th	90	4.0E-03	3.0E-04	2.1E-04	3.4E-05	1.0E-04	4.0E-03	5.0E-06	2.0E-03	2.1E-04
Pa	91	2.5E-03	2.5E-04	2.5E-04	2.5E-04	5.0E-05	4.0E-03	5.0E-06	2.0E-03	1.1E-01
U	92	8.5E-03	1.4E-02	4.0E-03	1.3E-03	3.0E-04	1.2E+00	6.0E-04	1.0E+00	1.9E-02
Np	93	3.7E-02	1.7E-02	1.7E-02	2.7E-03	1.0E-03	4.0E-03	5.0E-06	2.0E-03	1.3E-01
Pu	94	4.0E-04	2.0E-04	1.9E-04	2.6E-05	1.0E-05	3.0E-03	1.1E-06	8.0E-03	1.2E-03
Am	95	2.0E-03	4.7E-04	4.1E-04	9.0E-05	2.0E-05	6.0E-03	2.0E-06	4.0E-03	3.6E-04

Note: The values of food transfer coefficients are documented in input source no. 2; the values of leaching factors are documented in input source no. 8 (see Table 1 for identification of input sources).

Table 4. Food Transfer Library and Bioaccumulation Library for Bounding Representation from File FTRANSC.DAT.

Element	Z	Food Transfer Coefficients								Leaching factors 1/y
		Leafy vegetables ---	Root vegetables ---	Fruit ---	Grain ---	Beef day/kg	Poultry day/kg	Milk day/L	Eggs day/kg	
C	6	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.8E-5
Ni	28	2.8E+00	6.0E-01	6.0E-01	3.0E-01	2.0E-02	4.0E-03	6.4E-02	4.0E-01	1.9E-04
Sr	38	2.0E+01	1.2E+01	2.0E+00	2.0E+00	3.2E-02	3.2E-01	6.0E-03	1.2E+00	3.6E-03
Y	39	1.5E-01	6.0E-02	6.0E-02	6.0E-02	4.0E-03	4.0E-02	8.0E-05	8.0E-03	4.0E-03
Mo	42	2.5E+00	6.0E-01	6.0E-01	6.0E-01	4.0E-03	7.6E-01	6.0E-03	3.6E+00	1.3E-02
Tc	43	4.0E+02	1.5E+01	1.5E+01	7.3E+00	4.0E-04	1.2E-01	4.0E-02	1.2E+01	4.2E-02
I	53	3.4E-02	5.0E-01	5.0E-01	5.0E-01	2.8E-02	7.2E-02	4.0E-02	1.2E+01	8.4E-03
Cs	55	1.3E+00	4.9E-01	2.2E+00	2.6E-01	2.0E-01	1.8E+01	3.2E-02	1.6E+00	6.8E-05
Ra	88	8.0E-01	1.3E-01	6.1E-02	1.2E-02	3.6E-03	1.2E-01	5.2E-03	8.0E-05	3.2E-05
Ac	89	3.5E-02	3.5E-03	3.5E-03	3.5E-03	1.0E-04	1.6E-02	8.0E-05	8.0E-03	1.5E-03
Th	90	4.0E-02	3.0E-03	2.1E-03	3.4E-04	4.0E-04	1.6E-02	2.0E-05	8.0E-03	4.5E-06
Pa	91	2.5E-02	2.5E-03	2.5E-03	2.5E-03	2.0E-04	1.6E-02	2.0E-05	8.0E-03	1.1E-01
U	92	8.5E-02	1.4E-01	4.0E-02	1.3E-02	1.2E-03	4.8E+00	2.4E-03	4.0E+00	3.1E-04
Np	93	3.7E-01	1.7E-01	1.7E-01	2.7E-02	4.0E-03	1.6E-02	2.0E-05	8.0E-03	1.7E-03
Pu	94	4.0E-03	2.0E-03	1.9E-03	2.6E-04	4.0E-05	1.2E-02	4.4E-06	3.2E-02	1.9E-05
Am	95	2.0E-02	4.7E-03	4.1E-03	9.0E-04	8.0E-05	2.4E-02	8.0E-06	1.6E-02	2.3E-06

Note: The values of food transfer coefficients are documented in input source no. 2; the values of leaching factors are documented in input source no. 8 (see Table 1 for identification of input sources).

Table 5. Dose Coefficients (for external exposure) for Reasonable Representation and for Bounding Representation from File GRDFNEW.DAT.

Radionuclide	Exposure to Contaminated Soil Sv/y per Bq/m3
Primary Radionuclides	
Ac-227	8.26E-14
Am-241	7.38E-12
Am-243	2.40E-11
C-14	2.27E-15
Cs-137 (Ba-137m)	5.39E-10
I-129	2.19E-12
Mo-93	9.97E-14
Ni-63	0.00E+00
Np-237	1.31E-11
Pa-231	3.03E-11
Pu-238	2.54E-14
Pu-239	4.79E-14
Pu-240	2.47E-14
Sr-90	1.17E-13
Tc-99	2.11E-14
Th-229	5.36E-11
U-232	1.50E-13
U-233	2.28E-13
U-234	6.75E-14
U-236	3.60E-14
U-238	1.74E-14
Decay Products	
Th-228	1.32E-12
Ra-224	8.62E-12
Pb-212	1.14E-10
Bi-212	1.27E-09
Th-234	1.73E-11
Pa-234	1.70E-09
Pa-233	1.63E-10
Ra-225	1.86E-12
Ac-225	1.94E-10
Np-239	1.23E-10
Th-227	8.36E-11
Ra-223	2.36E-10
Fr-223	3.19E-11
Nb-93m	1.76E-14
Y-90	3.78E-12

Note: The values of dose coefficients are documented in input source no. 6 (see Table 1 for identification of input sources). The file contains dose coefficients for both undisrupted performance and direct release.

6.1 REASONABLE REPRESENTATION

Reasonable representation case considered a reasonable, conservative estimate of the BDCFs. This case used a statistical approach with many parameters described by a distribution. Behaviors and characteristics of the receptor of interest, the average member of the critical group, were described by a set of discrete values: mean consumption rates of locally grown food, and best estimates for relevant inhalation and external exposure parameters. Parametric distributions were subsequently sampled to arrive at stochastic representation of BDCFs.

Input values for the reasonable representation runs were developed in a series of AP-3.10Q analyses listed in Section 4. Input values, entered using GENII-S menu-driven interface, are listed in Table 6. The values/selections in the tables are listed in the way they are entered in GENII-S. Parameters related to irrigation, such as irrigation rate and irrigation time were set to zero under the assumption of no radionuclide contamination present in water (see Section 5.1 for discussion). Summary input files for reasonable representation are included in Attachment II in the directory named "Summary Input Files RR". These input files were generated by GENII-S; to provide a comprehensive list of input values, parameters, and selections. However, GENII-S does not use these files for computational purposes. GENII-S working files that are applied by the computer code for computational purposes are listed in Attachment II in the directory named "Working Files RR". Working files for the reasonable representation are grouped in sets of six files with the same root name and the following extensions: bak, flg, inp, out, pti, and vec.

Statistical output generated for reasonable representation case (mean, standard deviation, minimum, and maximum) is summarized in Table 7. The additional output information on BDCF statistics is included in Attachment II in the directory named "Summary Output RR". Files in this directory were generated by capturing screen images displayed by GENII-S. The output information includes minimum and maximum values, means, variances and percentiles. The full set of statistical run results for 160 trials for radionuclides of interest can be found in Attachment II in the directory named "Statistical Output Files RR".

Table 6. GENII-S Menu-Accessible Input Parameters; Statistical Run, Reasonable Representation.

Menu(s)	Option/ - Parameter, Unit	Selection	Values			Distribution	Reference[a]/ Comments
			Minimum	Best Estimate	Maximum		
PRE-GENII							
Edit Flags and Options	Scenario Options						
	- Near-Field Scenario	Y	NA	NA	NA	NA	Assumptions
	- Population Dose	N	NA	NA	NA	NA	
	- Acute Release	N	NA	NA	NA	NA	
	Transport Options						
	- Air Transport	N	NA	NA	NA	NA	Assumptions
	- Surface Water Transport	N	NA	NA	NA	NA	
	- Biotic Transport	N	NA	NA	NA	NA	
	- Waste From Degradation	N	NA	NA	NA	NA	
	Exposure Pathway Options						
	- External Finite Plume	N	NA	NA	NA	NA	Assumptions
	- External Infinite Plume	N	NA	NA	NA	NA	
	- External Ground Exposure	Y	NA	NA	NA	NA	
	- External Recreational Exposure	N	NA	NA	NA	NA	
	- Inhalation Uptake	Y	NA	NA	NA	NA	
	- Drinking Water Ingestion	N	NA	NA	NA	NA	
	- Aquatic Food Ingestion	N	NA	NA	NA	NA	
	- Terrestrial Food Ingestion	Y	NA	NA	NA	NA	
	- Animal Product Ingestion	Y	NA	NA	NA	NA	
	- Inadvertent Soil Ingestion	Y	NA	NA	NA	NA	
	Deterministic Output Options						
	- Both Committed and Cumulative	N	NA	NA	NA	NA	Assumptions
	- EDE by Nuclide	N	NA	NA	NA	NA	
	- EDE by Pathway	N	NA	NA	NA	NA	
	Run Options						
	- Inventory Unit Index (1-5)	1, pCi	NA	NA	NA	NA	Assumptions/ Unit selection
	- Soil Inventory Unit Index (1-3)	1, per m^2	NA	NA	NA	NA	
	- Inventory Input Option (1-3)	2	NA	NA	NA	NA	
	- Det Run/Stat Run/Both (1/2/3)	2	NA	NA	NA	NA	
	- Nuclide Intake Duration, yr	1	NA	NA	NA	NA	
Select Nuclides	Radionuclide selection	Y/N	-	-	-	-	Input source #7

Table 6. Continued

Menu(s)	Option/ - Parameter, Unit	Selection	Values			Distribution	Reference[a]/ Comments
			Minimum	Best Estimate	Maximum		
PRE-GENII (continued)							
Select Statistical Output	- Statistical Committed Dose Summary	Y	NA[b]	NA	NA	NA	
	- Statistical Committed Nuclide Dose	N	NA	NA	NA	NA	
	- Statistical Committed Pathway Dose	N	NA	NA	NA	NA	
	- Statistical Committed Organ Dose	N	NA	NA	NA	NA	
	- Statistical Cumulative Pathway Dose	N	NA	NA	NA	NA	
	- Statistical Cumulative Organ Dose	N	NA	NA	NA	NA	
	- Statistical External Dose Summary	N	NA	NA	NA	NA	
MAIN EDITING MENU							
Titles And Run Controls	- Model Name		NA	NA	NA	NA	
	- Title (2 lines)		NA	NA	NA	NA	
	- Latin Hypercube (LHS) or Monte Carlo (MC) Sampling	LHS	NA	NA	NA	NA	
	- The Number of Trials (<=500)	160	NA	NA	NA	NA	
	- A Random Seed (0.0<=Seed<=1.0)	0.333	NA	NA	NA	NA	
Fixed Data Input Variable Distribution	Population/Soil/Scenario Data						
	- Total Population	1	NA	NA	NA	—	Not used
	- Population Scale Factor	NA	--	1	--	Fixed	Not used
	- Soil/Plant Transfer Scale Factor, (-)	NA	0.0275	--	36.4	Lognormal	Input source #2
	- Animal Uptake Scale Factor, (-)	NA	0.117	--	8.51	Lognormal	Input source #2
	- Human Dose Factor Scale Factor, (-)	NA	--	1	--	Fixed	Input source #6
	- Dose Commitment Period, yr	NA	NA	50	NA	NA	Assumption
	- Surface Soil Depth, cm	NA	--	15	--	Fixed	Input source #1
	- Surface Soil Density, kg/m^2	NA	--	225	--	Fixed	Input source #1
	- Deep Soil Density, kg/m^3	NA	--	1500	--	Fixed	Input source #1
	- Roots in Upper Soil, fraction	NA	--	1	--	Fixed	Input source #1
	- Roots in Deep Soil, fraction	NA	--	0	--	Fixed	Input source #1
	- Air Release Time Before Intake, yr	NA	NA	0	NA	NA	Not used
	- H2O Release Time Before Intake, yr	NA	NA	0	NA	NA	Not used
	Biotic Trans./Near Field Data						
	Not used	—	—	—	—	—	—

Table 6. Continued.

Menu(s)	Option/ - Parameter, Unit	Selection	Values			Distribution	Reference[a]/ Comments
			Minimum	Best Estimate	Maximum		
MAIN EDITING MENU (continued)							
Fixed Data Input Variable Distribution	External/Inhalation Exposure (cont.)						
	- Chronic Plume Exposure Time, hr	NA	--	0	--	Fixed	Not used
	- Acute Plume Exposure Time, hr/phr	NA	--	0	--	Fixed	Not used
	- Inhalation Exposure Time, hr/yr	NA	---	3,918.5	---	Fixed	Input source #3
	- Resuspension Model Flag (0-2)	1	NA	NA	NA	NA	Mass loading
	- Mass Loading, g/m^3	NA	7.4×10^{-7}	8.7×10^{-6}	6.4×10^{-5}	Lognormal	Input source #3
	- Transit Time to Rec. Site, hr	NA	--	0	--	Fixed	|
	- Swimming Exposure Time, hr	NA	--	0	--	Fixed	|
	- Boating Exposure Time, hr	NA	--	0	--	Fixed	| Parameters
	- Shoreline Exposure Time, hr	NA	--	0	--	Fixed	| not used
	- Type of Shoreline Index (1-4)	0	NA	NA	NA	NA	|
	- H2O/Sediment Transfer1/m^2/yr	NA	--	0	--	Fixed	|
	- Soil Exposure Time, hr	NA	---	827	---	Fixed	Input source #3
	- Home Irrigation Flag (0/1 = N/Y)	0	NA	NA	NA	NA	|
	- Irrigation Water Index (1-2)	1	NA	NA	NA	NA	| Water not
	- Home Irrigation Rate, in/yr	NA	52	69.5	87	Uniform	| contaminated
	- Home Irrigation Duration, mo/yr	NA	--	12	--	Fixed	|
	Ingestion Exposure						
	- Food Production Option	0	NA	NA	NA	NA	Not used
	- Food-Weighted Chi/Q, kg-s/m^3	0	--	0	--	Fixed	Not used
	- Crop Resuspension Factor, 1/m	NA	9.6×10^{-12}	8.3×10^{-11}	7.2×10^{-10}	Lognormal	Input source #1
	- Crop Deposition Velocity, m/s	NA	--	0.001	--	Fixed	Input source #1
	- Crop Interception Fraction	NA	0.044	0.259	0.474	Normal	Input source #4
	- Exported Food Dose (0/1 = N/Y)	0	NA	NA	NA	NA	Not used
	- Soil Ingestion Rate, mg/day	NA	--	50	--	Fixed	Input source #1
	- Swim H2O Ingestion Rate, l/h	NA	--	0	--	Fixed	Not used
	- Population Ingesting Aquatic Food	0	NA	NA	NA	NA	Not used
	- Bioaccumulation Flag (0/1 = N/Y)	0	NA	NA	NA	NA	Not used
	- Population Drinking Contaminated Water	0	NA	NA	NA	NA	|
	- Drink Water Source Index (0-3)	0	NA	NA	NA	NA	| Drinking water
	- Drink Water Treated (0/1 = N/Y)	0	NA	NA	NA	NA	| not
	- Drink Water Holdup Time, days	NA	--	0	--	Fixed	| contaminated
	- Drink Water Consumption, l/y	NA	--	752.85	--	Fixed	|

Table 6. Continued.

Menu(s)	Option/ - Parameter, Unit	Selection	Values			Distribution	Reference[a]/ Comments
			Minimum	Best Estimate	Maximum		
MAIN EDITING MENU (continued)							
Array Data Input (cont.) Variable Distribution	Aquatic Food Ingestion Not used	—	—	—	—	—	—
	Terrestrial Food Ingestion						
	- Use (0/1 = F/T)						
	Leafy Vegetables	1	NA	NA	NA	NA	Input source #5
	Root Vegetables	1	NA	NA	NA	NA	Input source #5
	Fruit	1	NA	NA	NA	NA	Input source #5
	Grain	1	NA	NA	NA	NA	Input source #5
	- Growing Time, days						
	Leafy Vegetables	NA	45	64.5	75	Triangular	Input source #4
	Root Vegetables	NA	70	(84)[c]	98	Uniform	Input source #4
	Fruit	NA	88	(136)	184	Uniform	Input source #4
	Grain	NA	75	(159)	244	Uniform	Input source #4
	- Water Source Flag (0-2)						
	Leafy Vegetables	0	NA	NA	NA	NA	|
	Root Vegetables	0	NA	NA	NA	NA	| Water not
	Fruit	0	NA	NA	NA	NA	| contaminated
	Grain	0	NA	NA	NA	NA	|
	- Irrigation Rate, in/yr						
	Leafy Vegetables	NA	28.17	42.11	80.37	Triangular	| Input source #4
	Root Vegetables	NA	47.34	(49.46)	51.58	Uniform	|
	Fruit	NA	30.00	(37.69)	45.37	Uniform	| Water not
	Grain	NA	55.85	(68.11)	80.37	Uniform	| contaminated
	- Irrigation Time, mo/yr						
	Leafy Vegetables	NA	2.0	3.2	4.9	Triangular	| Input source #4
	Root Vegetables	NA	3.2	(3.9)	4.6	Uniform	|
	Fruit	NA	2.9	(4.5)	6.0	Uniform	| Water not
	Grain	NA	4.9	(6.5)	8.0	Uniform	| contaminated
	- Crop Yield, kg/m^2						
	Leafy Vegetables	NA	0.59	1.82	4.11	Triangular	Input source #4
	Root Vegetables	NA	1.73	4.33	5.87	Triangular	Input source #4
	Fruit	NA	1.57	(1.91)	2.25	Uniform	Input source #4
	Grain	NA	0.33	(0.56)	0.78	Uniform	Input source #4

Table 6. Continued.

Menu(s)	Option/ - Parameter, Unit	Selection	Values			Distribution	Reference[a]/ Comments
			Minimum	Best Estimate	Maximum		
MAIN EDITING MENU (continued)							
Array Data Input (cont.) Variable Distribution	Terrestrial Food Ingestion (cont.)						
	- Production, kg/yr						
	Leafy Vegetables	NA	--	0	--	Fixed	|
	Root Vegetables	NA	--	0	--	Fixed	| Parameter
	Fruit	NA	--	0	--	Fixed	| not used
	Grain	NA	--	0	--	Fixed	|
	- Holdup, days						
	Leafy Vegetables	NA	--	1	--	Fixed	Input source #4
	Root Vegetables	NA	--	14	--	Fixed	Input source #4
	Fruit	NA	--	14	--	Fixed	Input source #4
	Grain	NA	--	14	--	Fixed	Input source #4
	- Consumption Rate, kg/yr						
	Leafy Vegetables	NA	--	15.14	--	Fixed	Input source #5
	Root Vegetables	NA	--	7.81	--	Fixed	Input source #5
	Fruit	NA	--	15.57	--	Fixed	Input source #5
	Grain	NA	--	0.48	--	Fixed	Input source #5
	Animal Product Consumption						
	- Use (0/1 = F/T)						
	Beef	1	NA	NA	NA	NA	Input source #5
	Poultry	1	NA	NA	NA	NA	Input source #5
	Milk	1	NA	NA	NA	NA	Input source #5
	Eggs	1	NA	NA	NA	NA	Input source #5
	• Consumption Rate, kg/yr						
	Beef	NA	--	2.93	--	Fixed	Input source #5
	Poultry	NA	--	0.80	--	Fixed	Input source #5
	Milk	NA	--	4.14	--	Fixed	Input source #5
	Eggs	NA	--	6.68	--	Fixed	Input source #5
	• Holdup, days						
	Beef	NA	--	20	--	Fixed	Input source #4
	Poultry	NA	--	1	--	Fixed	Input source #4
	Milk	NA	--	1	--	Fixed	Input source #4
	Eggs	NA	--	1	--	Fixed	Input source #4

Table 6. Continued.

Menu(s)	Option/ - Parameter, Unit	Selection	Values			Distribution	Reference[a]/ Comments
			Minimum	Best Estimate	Maximum		
MAIN EDITING MENU (continued)							
Array Data Input (cont.) Variable Distribution	Animal Product Consumption						
	- Production, kg/yr						
	Beef	NA	--	0	--	Fixed	Parameter not used
	Poultry	NA	--	0	--	Fixed	
	Milk	NA	--	0	--	Fixed	
	Eggs	NA	--	0	--	Fixed	
	- Contaminated Water Fraction						
	Beef	NA	--	0	--	Fixed	Water not contaminated
	Poultry (corn)	NA	--	0	--	Fixed	
	Milk	NA	--	0	--	Fixed	
	Eggs (corn)	NA	--	0	--	Fixed	
	Animal Products (Stored Feed Data)						
	- Dietary Fraction						
	Beef	NA	--	0	--	Fixed	Input source #4
	Poultry (corn)	NA	--	1	--	Fixed	Input source #4
	Milk	NA	--	0	--	Fixed	Input source #4
	Eggs (corn)	NA	--	1	--	Fixed	Input source #4
	- Growing Time, days						
	Beef	NA	--	0	--	Fixed	Input source #4
	Poultry (corn)	NA	--	75	--	Fixed	Input source #4
	Milk	NA	--	0	--	Fixed	Input source #4
	Eggs (corn)	NA	--	75	--	Fixed	Input source #4
	- Water Source Flag						
	Beef	0	NA	NA	NA	NA	Water not contaminated
	Poultry (corn)	0	NA	NA	NA	NA	
	Milk	0	NA	NA	NA	NA	
	Eggs (corn)	0	NA	NA	NA	NA	
	- Irrigation Rate, in/yr						
	Beef	NA	--	0	--	Fixed	Input source #4
	Poultry (corn)	NA	--	80.37	--	Fixed	
	Milk	NA	--	0	--	Fixed	Water not contaminated
	Eggs (corn)	NA	--	80.37	--	Fixed	
	- Irrigation Time, mo/yr						
	Beef	NA	--	0	--	Fixed	Input source #4
	Poultry (corn)	NA	--	4.9	--	Fixed	
	Milk	NA	--	0	--	Fixed	Water not contaminated
	Eggs (corn)	NA	--	4.9	--	Fixed	

Table 6. Continued.

Menu(s)	Option/ - Parameter, Unit	Selection	Values			Distribution	Reference[a]/ Comments
			Minimum	Best Estimate	Maximum		
MAIN EDITING MENU (continued)							
Array Data Input (cont.) Variable Distribution	Animal Products (Stored Feed Data) cont.						
	- Feed Yield, kg/m^2						
	Beef	NA	--	0	--	Fixed	Input source #4
	Poultry (corn)	NA	0.59	(0.69)	0.78	Uniform	Input source #4
	Milk	NA	--	0	--	Fixed	Input source #4
	Eggs (corn)	NA	0.59	(0.69)	0.78	Uniform	Input source #4
	- Storage, days						
	Beef	NA	--	0	--	Fixed	Input source #4
	Poultry (corn)	NA	--	14	--	Fixed	Input source #4
	Milk	NA	--	0	--	Fixed	Input source #4
	Eggs (corn)	NA	--	14	--	Fixed	Input source #4
	Animal Products (Fresh Forage Data)						
	- Dietary Fraction						
	Beef (alfalfa)	NA	--	1	--	Fixed	Input source #4
	Milk (alfalfa)	NA	--	1	--	Fixed	Input source #4
	- Grow Time, days						
	Beef (alfalfa)	NA	46	47	135	Triangular	Input source #4
	Milk (alfalfa)	NA	46	47	135	Triangular	Input source #4
	- H2O Source Flag						
	Beef (alfalfa)	0	NA	NA	NA	NA	| Water not
	Milk (alfalfa)	0	NA	NA	NA	NA	| contaminated
	- Irrigation Rate, in/yr						
	Beef (alfalfa)	NA	--	94.66	--	Fixed	| Water not
	Milk (alfalfa)	NA	--	94.66	--	Fixed	| contaminated
	- Irrigation Time, mo/yr						
	Beef (alfalfa)	NA	--	12	--	Fixed	| Water not
	Milk (alfalfa)	NA	--	12	--	Fixed	| contaminated
	- Feed Yield, kg/m^2						
	Beef (alfalfa)	NA	0.25	(0.7)	1.15	Uniform	Input source #4
	Milk (alfalfa)	NA	0.25	(0.7)	1.15	Uniform	Input source #4
	- Storage, days						
	Beef (alfalfa)	NA	--	0	--	Fixed	Input source #4
	Milk (alfalfa)	NA	--	0	--	Fixed	Input source #4

Table 6. Continued.

Menu(s)	Option/ - Parameter, Unit	Selection	Values			Distribution	Reference[a]/ Comments
			Minimum	Best Estimate	Maximum		
MAIN EDITING MENU (continued)							
Array Data Input (cont.) Variable Distribution	Inventory – Basic Concentrations						
	- Air, pCi/m^3	NA	--	0	--	Fixed	
	- Surface Soil, pCi/m^2	NA	--	1	--	Fixed	
	- Deep Soil, pCi/kg	NA	--	0	--	Fixed	Assumption
	- Ground Water, pCi/l	NA	--	0	--	Fxed	
	- Surface Water, pCi/l	NA	--	0	--	Fixed	

[a] Input source identification in Reference/Comment column (e.g. #1, #3) refers to input numbers in Table 1.

[b] NA as an entry means that a given selection/option/value does not appear in GENII-S.

[c] If data for best estimate value of uniform distribution was not provided by the input source, the average value was used (number in parentheses).

Table 7. Statistical Output Information for BDCFs for Reasonable Representation for the Receptor of Interest.

Radionuclide	Biosphere Dose Conversion Factors, rem y^{-1} pCi^{-1} m^2			
	Arithmetic Mean	Arithmetic STD	Minimum	Maximum
Sr-90	7.792E-09	1.196E-08	1.772E-10	1.059E-07
Cs-137	1.809E-09	9.175E-10	1.266E-09	9.853E-09
Ac-227	2.990E-09	1.405E-09	1.371E-09	1.147E-08
Th-229	9.437E-10	3.848E-10	4.803E-10	3.081E-09
Pa-231	1.592E-09	6.715E-10	9.913E-10	6.346E-09
U-232	8.070E-10	8.770E-10	1.458E-10	7.437E-09
U-233	1.768E-10	1.935E-10	3.235E-11	1.641E-09
Pu-238	3.620E-10	7.276E-11	2.746E-10	7.728E-10
Pu-239	4.019E-10	8.074E-11	3.049E-10	8.581E-10
Pu-240	4.012E-10	8.061E-11	3.043E-10	8.565E-10
Am-241	5.375E-10	2.308E-10	3.309E-10	2.174E-09
Am-243	5.748E-10	2.303E-10	3.687E-10	2.208E-09

6.2 BOUNDING REPRESENTATION

The bounding representation considered a high bounding estimate of the BDCFs. This case used a deterministic approach with parameters described by single values. The resulting BDCFs for radionuclides under consideration were subsequently expressed by single values. Input parameters were developed in a series of AP3.10Q analyses listed in Section 4. Selection of the parametric values for the bounding (highly conservative) case is documented in the appropriate AMRs.

Similar to the reasonable representation, parameters related to irrigation, such as irrigation rate and irrigation time were set to zero under the assumption of no radionuclide contamination present in water (see Section 5.1 for discussion). Menu–accessible input parameters for deterministic runs are listed in Table 8. Summary input files for bounding representation are included in Attachment II in the directory named "Summary Input Files BR. These input files were generated by GENII-S, to provide a comprehensive list of input values, parameters, and selections but not used by the computer code for computational purposes. GENII-S working files that are applied by the computer code for computational purposes are listed in Attachment II in the directory named "Working Files BR. Working files for the bounding representation are grouped in sets of six files with the same root name and the following extensions: bak, flg, inp, out, pti, and vec. Root name includes radionuclide and case identification.

The results of BDCF calculations for bounding representation are summarized in Table 9. Output files for bounding representation are included in Attachment II in the directory named "Working Files BR. These are the files with the extension ".out".

Table 8. GENII-S Menu-Accessible Input Parameters; Deterministic Run, Bounding Representation.

Menu(s)	Option/ - Parameter, Unit	Selection	Value	Reference[a]/ Comments
PRE-GENII				
Edit Flags and Options	Scenario Options			
	- Near-Field Scenario	Y	NA	Assumptions
	- Population Dose	N	NA	
	- Acute Release	N	NA	
	Transport Options			
	- Air Transport	N	NA	Assumptions
	- Surface Water Transport	N	NA	
	- Biotic Transport	N	NA	
	- Waste From Degradation	N	NA	
	Exposure Pathway Options			
	- External Finite Plume	N	NA	Assumptions
	- External Infinite Plume	N	NA	
	- External Ground Exposure	Y	NA	
	- External Recreational Exposure	N	NA	
	- Inhalation Uptake	Y	NA	
	- Drinking Water Ingestion	N	NA	
	- Aquatic Food Ingestion	N	NA	
	- Terrestrial Food Ingestion	Y	NA	
	- Animal Product Ingestion	Y	NA	
	- Inadvertent Soil Ingestion	Y	NA	
	Deterministic Output Options			
	- Both Committed and Cumulative	N	NA	Assumptions
	- EDE by Nuclide	N	NA	
	- EDE by Pathway	N	NA	
	Run Options			
	- Inventory Unit Index (1-5)	1, pCi	NA	Assumptions/ Unit selection
	- Soil Inventory Unit Index (1-3)	1, per m^2	NA	
	- Inventory Input Option (1-3)	2	NA	
	- Det Run/Stat Run/Both (1/2/3)	1	NA	
	- Nuclide Intake Duration, yr	1	NA	
Select Nuclides	Radionuclide selection	Y/N	-	Input source #7
Titles And Run Controls	- Model Name		NA	
	- Title (2 lines)		NA	
	- Latin Hypercube (LHS) or Monte Carlo (MC) Sampling	NA	NA	Parameters not used
	- The Number of Trials (<=500)	0	NA	
	- A Random Seed (0.0<=Seed<=1.0)	NA	NA	
Fixed Data Input	Population/Soil/Scenario Data			
	- Total Population	1	NA	Not used
	- Population Scale Factor	NA	1	Not used
	- Dose Commitment Period, yr	NA	50	Assumption
	- Surface Soil Depth, cm	NA	15	Input source #1
	- Surface Soil Density, kg/m^2	NA	180	Input source #1
	- Deep Soil Density, kg/m^3	NA	1500	Input source #1
	- Roots in Upper Soil, fraction	NA	1	Input source #1
	- Roots in Deep Soil, fraction	NA	0	Input source #1
	- Air Release Time Before Intake, yr	NA	0	Not used
	- H2O Release Time Before Intake, yr	NA	0	Not used

Table 8. Continued

Menu(s)	Option/ - Parameter, Unit	Selection	Value	Reference[a]/ Comments
MAIN EDITING MENU				
Fixed Data Input	Biotic Trans./Near Field Data Not used	—	—	—
	External/Inhalation Exposure			
	- Chronic Plume Exposure Time, hr	NA	0	Param. not used
	- Acute Plume Exposure Time, hr/phr	NA	0	Param. not used
	- Inhalation Exposure Time, hr/yr	NA	6353.5	Input source #3
	- Resuspension Model Flag (0-2)	1	NA	Mass loading
	- Mass Loading, g/m^3	NA	6.410^{-5}	Input source #3
	- Transit Time to Rec. Site, hr	NA	0	|
	- Swimming Exposure Time, hr	NA	0	|
	- Boating Exposure Time, hr	NA	0	| Parameters
	- Shoreline Exposure Time, hr	NA	0	| not used
	- Type of Shoreline Index (1-4)	0	0	|
	- H2O/Sediment Transfer1/m^2/yr	NA	0	|
	- Soil Exposure Time, hr	NA	3947	Input source #3
	- Home Irrigation Flag (0/1 = N/Y)	0	NA	| Water not
	- Irrigation Water Index (1-2)	0	NA	| contaminated
	- Home Irrigation Rate, in/yr	NA	109	| Input source #3
	- Home Irrigation Duration, mo/yr	NA	12	|
	Ingestion Exposure			
	- Food Production Option	0	NA	Not used
	- Food-Weighted Chi/Q, kg-s/m^3	0	NA	Not used
	- Crop Resuspension Factor, 1/m	NA	1.4×10^{-9}	Input source #1
	- Crop Deposition Velocity, m/s	NA	0.001	Input source #1
	- Crop Interception Fraction	NA	0.474	Input source #4
	- Exported Food Dose (0/1 = N/Y)	0	NA	Not used
	- Soil Ingestion Rate, mg/day	NA	410	Input source #1
	- Swim H2O Ingestion Rate, l/h	NA	0	Not used
	- Population Ingesting Aquatic Food	0	NA	Not used
	- Bioaccumulation Flag (0/1 = N/Y)	0	NA	Not used
	- Population Drinking Contaminated Water	0	NA	| Drinking water
	- Drink Water Source Index (0-3)	0	NA	| not
	- Drink Water Treated (0/1 = N/Y)	0	NA	| contaminated
	- Drink Water Holdup Time, days	NA	0	|
	- Drink Water Consumption, l/y	NA	1487.45	| Input source #5
	Aquatic Food Ingestion Not used	—	—	—

Table 8. Continued.

Menu(s)	Option/ - Parameter, Unit	Selection	Value	Reference[a]/ Comments
MAIN EDITING MENU (continued)				
Array Data Input	Terrestrial Food Ingestion			
	- Use (0/1 = F/T)			
	Leafy Vegetables	1	NA	Input source #5
	Root Vegetables	1	NA	Input source #5
	Fruit	1	NA	Input source #5
	Grain	1	NA	Input source #5
	- Growing Time, days			
	Leafy Vegetables	NA	75	Input source #4
	Root Vegetables	NA	98	Input source #4
	Fruit	NA	184	Input source #4
	Grain	NA	244	Input source #4
	- H2O Source Flag (0-2)			
	Leafy Vegetables	0	NA	|
	Root Vegetables	0	NA	| Water not
	Fruit	0	NA	| contaminated
	Grain	0	NA	|
	- Irrigation Rate, in/yr			
	Leafy Vegetables	NA	80.37	| Water not
	Root Vegetables	NA	51.58	| contaminated
	Fruit	NA	45.37	| Input source #4
	Grain	NA	80.37	|
	- Irrigation Time, mo/yr			
	Leafy Vegetables	NA	2.0	| Water not
	Root Vegetables	NA	3.2	| contaminated
	Fruit	NA	2.9	|
	Grain	NA	4.9	| Input source #4
	- Crop Yield, kg/m^2			
	Leafy Vegetables	NA	0.59	Input source #4
	Root Vegetables	NA	1.73	Input source #4
	Fruit	NA	1.57	Input source #4
	Grain	NA	0.33	Input source #4
	- Production, kg/yr			
	Leafy Vegetables	NA	0	|
	Root Vegetables	NA	0	| Parameter
	Fruit	NA	0	| not used
	Grain	NA	0	|
	- Holdup, days			
	Leafy Vegetables	NA	1	Input source #4
	Root Vegetables	NA	14	Input source #4
	Fruit	NA	14	Input source #4
	Grain	NA	14	Input source #4
	- Consumption Rate, kg/yr			
	Leafy Vegetables	NA	59.68	Input source #5
	Root Vegetables	NA	29.86	Input source #5
	Fruit	NA	97.69	Input source #5
	Grain	NA	12.33	Input source #5

Table 8. Continued.

Menu(s)	Option/ - Parameter, Unit	Selection	Value	Reference[a]/ Comments
MAIN EDITING MENU (continued)				
Array Data Input (cont.)	Animal Product Consumption			
	- Use (0/1 = F/T)			
	Beef	1	NA	Input source #5
	Poultry (corn)	1	NA	Input source #5
	Milk	1	NA	Input source #5
	Eggs (corn)	1	NA	Input source #5
	- Consumption Rate, kg/yr			
	Beef	NA	53.11	Input source #5
	Poultry	NA	10.50	Input source #5
	Milk	NA	100.36	Input source #5
	Eggs	NA	33.34	Input source #5
	- Holdup, days			
	Beef	NA	20	Input source #4
	Poultry	NA	1	Input source #4
	Milk	NA	1	Input source #4
	Eggs	NA	1	Input source #4
	- Production, kg/yr			
	Beef	NA	0	|
	Poultry (corn)	NA	0	| Parameter
	Milk	NA	0	| not used
	Eggs (corn)	NA	0	|
	- Contaminated Water Fraction			
	Beef	NA	0	|
	Poultry (corn)	NA	0	| Water not
	Milk	NA	0	| contaminated
	Eggs (corn)	NA	0	|
	Animal Products (Stored Feed Data)			
	- Dietary Fraction			
	Beef	NA	0	Input source #4
	Poultry (corn)	NA	1	Input source #4
	Milk	NA	0	Input source #4
	Eggs (corn)	NA	1	Input source #4
	- Growing Time, days			
	Beef	NA	0	Input source #4
	Poultry (corn)	NA	75	Input source #4
	Milk	NA	0	Input source #4
	Eggs (corn)	NA	75	Input source #4
	- Water Source Flag			
	Beef	0	NA	|
	Poultry (corn)	0	NA	| Water not
	Milk	0	NA	| contaminated
	Eggs (corn)	0	NA	|
	- Irrigation Rate, in/yr			
	Beef	NA	0	| Water not
	Poultry (corn)	NA	80.37	| contaminated
	Milk	NA	0	|
	Eggs (corn)	NA	80.37	| Input source #4
	- Irrigation Time, mo/yr			
	Beef	NA	0	|| Water not
	Poultry (corn)	NA	4.9	| contaminated
	Milk	NA	0	|
	Eggs (corn)	NA	4.9	| Input source #4

Table 8. Continued.

Menu(s)	Option/ - Parameter, Unit	Selection	Value	Reference[a]/ Comments
MAIN EDITING MENU (continued)				
Array Data Input (cont.)	Animal Products (Stored Feed Data) cont.			
	- Feed Yield, kg/m^2			
	Beef	NA	0	Input source #4
	Poultry (corn)	NA	0.59	Input source #4
	Milk	NA	0	Input source #4
	Eggs (corn)	NA	0.59	Input source #4
	- Storage, days			
	Beef	NA	0	Input source #4
	Poultry (corn)	NA	14	Input source #4
	Milk	NA	0	Input source #4
	Eggs (corn)	NA	14	Input source #4
	Animal Products (Fresh Forage Data)			
	- Diet Fraction			
	Beef (alfalfa)	NA	1	Input source #4
	Milk (alfalfa)	NA	1	Input source #4
	- Grow Time, days			
	Beef (alfalfa)	NA	135	Input source #4
	Milk (alfalfa)	NA	135	Input source #4
	- H2O Source Flag			
	Beef (alfalfa)	0	NA	| Water not
	Milk (alfalfa)	0	NA	| contaminated
	- Irrigation Rate, in/yr			
	Beef (alfalfa)	NA	94.66	| Water not
	Milk (alfalfa)	NA	94.66	| contaminated
	- Irrigation Time, mo/yr			
	Beef (alfalfa)	NA	12	| Water not
	Milk (alfalfa)	NA	12	| contaminated
	- Feed Yield, kg/m^2			
	Beef (alfalfa)	NA	0.25	Input source #4
	Milk (alfalfa)	NA	0.25	Input source #4
	- Feed Storage, days			
	Beef (alfalfa)	NA	0	Input source #4
	Milk (alfalfa)	NA	0	Input source #4
	Inventory – Basic Concentrations			
	- Air, pCi/m^3	NA	0	
	- Surface Soil, pCi/m^2	NA	1	
	- Deep Soil, pCi/kg	NA	0	Assumptions
	- Ground Water, pCi/l	NA	0	
	- Surface Water, pCi/l	NA	0	

[a] Input source identification in Reference/Comment column (e.g. #1, #3) refers to input numbers in Table 1.

Table 9. BDCFs for Bounding Representation.

Radionuclide	BDCF (rem y^{-1} pCi^{-1} m^2)
Sr-90	8.4E-07
Cs-137	1.1E-07
Ac-227	1.9E-07
Th-229	5.2E-08
Pa-231	1.2E-07
U-232	5.6E-08
U-233	1.2E-08
Pu-238	3.1E-08
Pu-239	3.5E-08
Pu-240	3.5E-08
Am-241	4.1E-08
Am-243	4.1E-08

7. CONCLUSIONS

The objective of this analysis was to calculate biosphere dose conversion factors for disruptive volcanic events for reasonable representation and for bounding representation for the receptors of interest. Reasonable representation BDCFs are summarized in Table 7. Bounding representation BDCFs are summarized in Table 9.

The results of this analysis apply to radionuclides specified in preliminary screening analysis (CRWMS M&O 1999j), which is subject to potential modifications. Upon receipt of the final results of radionuclide screening, this report may need to be revised. Biosphere model used by GENII-S is not validated at this time. The model has been designated as TBV, however no impact of this TBV is anticipated at this point. Other TBVs indicated in this analysis are due to unconfirmed nature of the data, which are being developed in the AMRs that are not approved at this point. There may be a potential impact of some of these TBVs, resulting in the need for a revision of this AMR.

Consideration of uncertainties associated with disruptive event BDCFs, which are the subject of this analysis, will be discussed in the related "Disruptive Event Biosphere Dose Conversion Factor Sensitivity Analysis" AMR (DI: ANL-MGR-MD-000004).

8. INPUTS AND REFERENCES

8.1 INPUTS

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8.2 REFERENCES

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8.3 REGULATIONS AND PROCEDURES

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ATTACHMENTS

Attachment	Title
I	Document Input Reference Sheets
II	GENII-S Input and Output Files

ATTACHMENT I
DOCUMENT INPUT REFERENCE SHEETS

(5 pages)

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
DOCUMENT INPUT REFERENCE SHEET

1. Document Identifier No./Rev.:	Change:	Title:
ANL-MGR-MD-000003 REV 00	NA	Disruptive Event Biosphere Dose Conversion Factor Analysis

	Input Document: 2. Technical Product Input Source Title and Identifier(s) with Version	3. Section	4. Input Status	5. Section Used in	6. Input Description	7. TBV/TBD Priority	8. TBV Due To: Unqual.	From Uncontrolled Source	Un-confirmed
1	Leigh, C.D.; Thompson, B.M.; Campbell, J.E.; Longsine, D.E.; Kennedy, R.A.; and Napier, B.A. 1993. *User's Guide for GENII-S: A Code for Statistical and Deterministic Simulations of Radiation Doses to Humans from Radionuclides in the Environment.* SAND91-0561. Albuquerque, New Mexico: Sandia National Laboratories. TIC: 231133.	Entire	N/A Reference	4,5,6	GENII-S Users Manual	N/A	N/A	N/A	N/A
2	CRWMS M&O 1999. *Environmental Transport Parameter Analysis.* ANL-MGR-MD-000007 Rev 0. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19991115.0238.	Entire	N/A Reference	6	Particle deposition velocity; Resuspension factor; Crop biomass; Surface soil depth; Fraction of plant root in surface soil; Fraction of plant root in deep soil; Surface soil density; Bulk soil density.	N/A	N/A	N/A	N/A
3	CRWMS M&O 1999. *Transfer Coefficient Analysis.* ANL-MGR-MD-000008 Rev. 0. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19991115.0237.	Entire	N/A Reference	6	Transfer coefficients; Soil-to-plant transfer scale factor; Animal uptake scale factor.	N/A	N/A	N/A	N/A
4	CRWMS M&O 1999. *Input Parameter Values for External and Inhalation Radiation Exposure Analysis.* ANL-MGR-MD-000001 Rev 0. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19990923.0235.	Entire	N/A Reference	6	Mass loading; Inhalation exposure time; Chronic breathing rate; Soil exposure time.	N/A	N/A	N/A	N/A
5	CRWMS M&O 1999. *Dose Conversion Factor Analysis: Evaluation of GENII-S Dose Assessment Methods.* ANL-MGR-MD-000002 Rev. 0. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19991207.0215.	Entire	N/A Reference	6	Dose coefficients for exposure to 15-cm layer of contaminated soil; Dose coefficients for air submersion.	N/A	N/A	N/A	N/A
6	SN9912T0512299.001. *Leaching Coefficients for GENII-S Code.* Submittal date: 12/06/99.	Entire	TBV-3956	6	Preliminary leaching coefficients for GENII-S. Reason for TBV – leaching coefficients are developed in AMR which is not approved at this time.	1	x	N/A	x

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Input Document							8. TBV Due To		
	2. Technical Product Input Source Title and Identifier(s) with Version	3. Section	4. Input Status	5. Section Used in	6. Input Description	7. TBV/TBD Priority	Unqual.	From Uncontrolled Source	Un-confirmed
7	Burck, P. 1999. "Response to Disruptive Event BDCF Input Data/Information Request." Memorandum from P. Burck (SNL) to J.F. Schmitt, June 1, 1999, with attachment. ACC: MOL.19991001.0157.	Entire	TBV-3702	5	Assumptions for disruptive event scenario. Reason for TBV – assumptions are derived from the results of AMR, which is not approved at this time.	1	N/A	N/A	x
8	Smith, A.J. 1999. "Checker Comments on AMR 'Disruptive Event Biosphere Dose Conversion Factor Analysis'." Interoffice correspondence from A.J. Smith (CRWMS M&O) to M. Wasiolek, October 14, 1999, LV.PA.AJS.10/99-106, with enclosures. ACC: MOL.19991103.0223.	Entire	TBV-3705	5	Assumptions for disruptive event scenario. Reason for TBV – assumptions are derived from the results of AMR, which is not approved at this time.	1	N/A	N/A	x
9	MO9910RIB00061.000. Input Parameter Values for External and Inhalation Radiation Exposure Analysis. Submittal date: 10/07/99. MOL.19991110.0266.	Entire	N/A Qualified	6	Mass loading; inhalation exposure time; chronic breathing rate; soil exposure time.	N/A	N/A	N/A	N/A
10	MO9911RIB00065.000. Parameter Values for Transfer Coefficients. Submittal date: 11/12/99.	Entire	N/A Qualified	6	Transfer coefficients; soil-to-plant transfer scale factor; animal uptake scale factor.	N/A	N/A	N/A	N/A
11	MO9911RIB00064.000. Environmental Transport Parameter Values for Dose Assessment. Submittal date: 11/12/99.	Entire	N/A Qualified	6	Particle deposition velocity; Resuspension factor; Crop biomass; Surface soil depth; Fraction of plant root in surface soil; Fraction of plant root in deep soil; Surface soil density; Bulk soil density.	N/A	N/A	N/A	N/A
12	MO9911RIB00066.000. Parameter Values for Internal and External Dose Conversion Factors. Submittal date: 11/12/99.	Entire	N/A Qualified	6	Dose coefficients for exposure to 15-cm layer of contaminated soil; Dose coefficients for air submersion	N/A	N/A	N/A	N/A
13	CRWMS M&O 1999. *Status of Radionuclide Screening for Total System Performance Assessment - Site Recommendation (TSPA-SR).* R&E-PA-99217.Tc Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19991115.0133.	Entire	N/A Referen-ce/Criteri on	6	Radionuclides to be included in analysis	N/A	N/A	N/A	N/A

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Input Document							8. TBV Due To		
	2. Technical Product Input Source Title and Identifier(s) with Version	3. Section	4. Input Status	5. Section Used in	6. Input Description	7. TBV/TBD Priority	Unqual.	From Uncontrolled Source	Un-confirmed
14	CRWMS M&O 1999. *Ingestion Exposure Pathway Parameters.* R&E-ESR-99395.T. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19991202.0101.	Entire	N/A Reference	6	Crop interception fraction; plant growing times; holdup times for plant and animal food products	N/A	N/A	N/A	N/A
15	CRWMS M&O 1999. *Recommended Distribution-based and Fixed (Mean) Consumption Parameters for Locally Produced Food by Type and Tap Water.* R&E-ESR-99394.T. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19991202.0102.	Entire	N/A Reference	6	Average and maximum food consumption rates for the receptor of interest.	N/A	N/A	N/A	N/A
16	Sandia National Laboratories. *GENII-S 1.485 Environmental Radiation Dosimetry Software System.* 1999. V1.485. PC. 30034 V1.4.8.5.	Entire	TBV-3955	6	Computer code used in analysis. Acquired software, qualified for use on the Project; Reason for TBV - biosphere model used by the code is not validated.	N/A	N/A	N/A	N/A
17	International Commission on Radiological Protection 1977. *Recommendations of the International Commission on Radiological Protection.* ICRP Number 26. New York, New York: Pergamon Press. TIC: 221568.	Entire	N/A Reference	N/A	N/A	N/A	N/A	N/A	N/A
18	Dyer, J.R. 1999. "Revised Interim Guidance Pending Issuance of New U.S. Nuclear Regulatory Commission (NRC) Regulations (Revision 01, July 22, 1999), for Yucca Mountain, Nevada." Letter from J.R. Dyer (DOE) to Dr. D.R. Wilkins (CRWMS M&O), September 3, 1999, OL&RC:SB-1714, with enclosure, "Interim Guidance Pending Issuance of New NRC Regulations for Yucca Mountain (Revision 01)." ACC: MOL.19990910.0079.	Sec. 113, 114, 115	N/A Reference	N/A	N/A	N/A	N/A	N/A	N/A
19	Harris 1997. "Recommendation of Models to be Used in the Biosphere Modeling Effort." Correspondence from Michael W. Harris (CRWMS M&O) to Wendy R. Dixon (U.S. DOE), July 8, 1997, LV.ESR.CHT.07/97-125, with attachment. ACC: MOL.19971124.0033 (letter) and MOL.19971124.0034 (attachment).	Entire	NA Reference	6	Justification for computer code selection	N/A	N/A	N/A	N/A

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ANL-MGR-MD-000003 REV 00	NA	Disruptive Event Biosphere Dose Conversion Factor Analysis

Input Document							8. TBV Due To		
	2. Technical Product Input Source Title and Identifier(s) with Version	3. Section	4. Input Status	5. Section Used in	6. Input Description	7. TBV/TBD Priority	Unqual.	From Uncontrolled Source	Un-confirmed
20	CRWMS M&O 1999. *Preliminary Leaching Coefficients for GENII-S.* Input Transmittal R&E-PA-99264.T. Albuquerque, New Mexico: CRWMS M&O. ACC: MOL.19990915.0271.	Entire	NA Reference	6	Leaching coefficients for GENII-S code	N/A	N/A	N/A	N/A
21	MO9912SPAING06.033. Ingestion Exposure Pathway Parameters. Submittal date: 12/22/1999.	Entire	TBV-3958	6	Crop interception fraction; plant growing times; holdup times for plant and animal food products. Reason for TBV – data are developed in the AMR, which is not approved at this time.	1	x	N/A	x
22	MO9912SPACON05.001. Recommended Distribution-based and Fixed (Mean) Consumption Parameters for Locally Produced Food by Type and Tap Water. Submittal date: 12/13/1999.	Entire	TBV-3957	6	Average and maximum food consumption rates for the receptor of interest. Reason for TBV – data are developed in the AMR, which is not approved at this time.	1	x	N/A	x

ATTACHMENT II
LIST OF GENII-S INPUT AND OUTPUT FILES

(4 pages and CD-ROM)

LIST OF FILES PROVIDED ON CD-ROM

Modified GENII-S Input Files
Directory Name: Input Files RR and CR

- DEFRR.IN – modified default file (DEFAULT.IN) for reasonable representation
- DEFSC.IN – modified default file (DEFAULT.IN) for bounding representation
- FTRANRR.DAT – modified transfer coefficient (FTRANS.DAT) file for reasonable representation
- FTRANSC.DAT – modified transfer coefficient (FTRANS.DAT) file for bounding representation
- GRDFNEW.DAT – modified external dose coefficient file (GRDF.DAT)

GENII-S – generated Summary Input Files for Reasonable Representation
Directory Name: Summary Input Files RR

- R4IAC227.TXT – summary input file for ^{227}Ac
- R4IAM241.TXT – summary input file for ^{241}Am
- R4IAM243.TXT – summary input file for ^{243}Am
- R4ICS137.TXT – summary input file for ^{137}Cs
- R4IPA231.TXT – summary input file for ^{238}Pu
- R4IPU238.TXT– summary input file for ^{238}Pu
- R4IPU239.TXT– summary input file for ^{239}Pu
- R4IPU240.TXT– summary input file for ^{240}Pu
- R4ISR90.TXT– summary input file for ^{90}Sr
- R4ITH229.TXT– summary input file for ^{229}Th
- R4IU232.TXT – summary input file for ^{232}U
- R4IU233.TXT – summary input file for ^{233}U

GENII-S – generated Summary Input Files for Bounding Representation
Directory Name: Summary Input Files BR

- S4IAC227.TXT – summary input file for ^{227}Ac
- S4IAM241.TXT – summary input file for ^{241}Am
- S4IAM243.TXT – summary input file for ^{243}Am
- S4ICS137.TXT – summary input file for ^{137}Cs
- S4IPA231.TXT – summary input file for ^{238}Pu
- S4IPU238.TXT– summary input file for ^{238}Pu
- S4IPU239.TXT– summary input file for ^{239}Pu
- S4IPU240.TXT– summary input file for ^{240}Pu
- S4ISR90.TXT– summary input file for ^{90}Sr
- S4ITH229.TXT– summary input file for ^{229}Th
- S4IU232.TXT – summary input file for ^{232}U
- S4IU233.TXT – summary input file for ^{233}U

Complete Sets of Working Files for Reasonable Representation
Directory Name: Working Files RR

Eleven sets of working files for radionuclides of interest are included. Each set consists of six files with the root name of RRnnnnn.xxx, where nnnnn identifies radionuclide, and xxx can be one of the following six extensions: bak, flg, inp, out, pti, vec.

Complete Sets of Working Files for Bounding Representation
Directory Name: Working Files BR

Eleven sets of working files for radionuclides of interest are included. Each set consists of six files with the root name of SCnnnnn.xxx, where nnnnn identifies radionuclide, and xxx can be one of the following six extensions: bak, flg, inp, out, pti, vec.

Summary Statistical Output for Reasonable Representation
Directory name: Summary Output RR

- PS4AC227.TXT – summary output file for ^{227}Ac
- PS4AM241.TXT – summary output file for ^{241}Am
- PS4AM243.TXT – summary output file for ^{243}Am
- PS4CS137.TXT – summary output file for ^{137}Cs
- PS4PA231.TXT – summary output file for ^{238}Pu
- PS4PU238.TXT– summary output file for ^{238}Pu
- PS4PU239.TXT– summary output file for ^{239}Pu
- PS4PU240.TXT– summary output file for ^{240}Pu
- PS4SR90.TXT– summary output file for ^{90}Sr
- PS4TH229.TXT– summary output file for ^{229}Th
- PS4U232.TXT– summary output file for ^{232}U
- PS4U233TXT– summary output file for ^{233}U

Complete Output Files for Reasonable Representation (Results of Statistical Runs)
Directory name: Statistical Output Files RR

- R4OAC227O.TXT – output file for ^{227}Ac
- R4OM241O.TXT – output file for ^{241}Am
- R4OAM243O.TXT – output file for ^{243}Am
- R4OCS137O.TXT – output file for ^{137}Cs
- R4OPA231O.TXT – output file for ^{238}Pu
- R4OPU238O.TXT– output file for ^{238}Pu
- R4OPU239O.TXT– output file for ^{239}Pu
- R4OPU240O.TXT– output file for ^{240}Pu
- R4OSR90O.TXT– output file for ^{90}Sr
- R4OTH229O.TXT– output file for ^{229}Th
- R4OU232.TXT – output file for ^{232}U

- R4OU233.TXT – output file for ^{233}U