VIABILITY ASSESSMENT REVIEW: DILUTION OF RADIONUCLIDES IN SOIL KESA

CONCERNS:

No major concerns were identified in the Viability Assessment (VA) for this KESA. Additional information on areas of review and technical comments are provided to document the scope of review and to provide information on issues that may prove to be useful in the future.

IMPORTANCE:

Dilution of radionuclides in soil from surface processes is important to PA calculations because calculated external gamma and inhalation doses (following volcanic event) are significantly reduced when dilution is included in TPA calculations. Surface processes include plowing and leaching from surface to lower soil layers. The external gamma dose rate is significantly reduced for radionuclides underneath a soil layer greater than 15 cm thickness due to shielding. Because a farming exposure scenario includes plowing of soil and all soil contamination based exposure scenarios include water infiltration, accounting for dilution from plowing and leaching adds realism to TSPA calculations.

STATUS OF RESOLUTION:

The following technical comments were noted to be discussed as part of the continuing issue resolution process.

1. DOE has not provided information in their documentation (CRWMS M&O, 1998) on those parameters that are used in the GENII-S code (Leigh et al. 1993) that affect leaching of radionuclides from soil to lower layers away from human exposure pathways (i.e., plant uptake and consumption). Thus, it is not possible to determine to what extent losses of radionuclides from soil due to leaching during the exposure year are accounted for in DOEs TSPA modeling. The factor of interest is called the leaching factor, which is calculated from soil distribution coefficients (Kd), precipitation rate, evapotranspiration rate, irrigation rate, and soil volumetric water content.

2. The TSPA-VA does not describe the use of any models to account for the fate of radionuclides deposited in ash blankets from igneous activity over periods beyond the year of an event. Currently, the TPA code includes the ASHRMOVO module which is used for that purpose. It appears, therefore, that this aspect of the current DOE approach to calculation of doses from igneous activity is more conservative than the current NRC approach (e.g., dilution is not accounted for in DOE approach). It is also worth noting that the improved approach to calculation of the expected annual dose in TPA involves calculation of igneous activity doses over time beyond the year of the volcanic event and thus the capability to model ash plumes over time is important to adopting the favored approach to calculation of expected annual dose. While DOE may choose to perform their calculations using a different approach than NRC or a more conservative approach, it may be prudent to ensure DOE is aware of these differences as they continue to refine their hazard analyses for igneous activity and update the biosphere model as they have indicated in the License Application Plan (U.S. Department of Energy, 1998b).

ADDITIONAL BACKGROUND:

The review was focused on chapters of the DOE TSPA-VA, Volume 3 (U.S. Department of Energy, 1998a) that pertain to dilution of radionuclides in soil including Section 3.8—Development of TSPA Components for VA: Biosphere, Section 4.4.2—Effects of Disruptive Events: Igneous Activity, Section 5.8 Sensitivity Analysis for Components: Biosphere, Section 6.4—Principal Factors Affecting Postclosure Performance: Biosphere Uptake, Section 6.5.1.11—Assessment of Potential Activities to Increase Confidence in the Total System Performance Assessment Based on the Results of TSPA VA: Biosphere Transport and Uptake. Supporting documentation in the VA technical basis document was also reviewed including Chapter 9: Biosphere (CRWMS M&O, 1998) that contains a detailed list of input parameters for DCF calculations. The input parameter choices relevant to soil dilution were compared with current parameter selections for TPA Version 3.2.

REFERENCES:

CRWMS M&O. 1998. *Chapter 9, Total System Performance Assessment -Viability Assessment (TSPA-VA) Analyses Technical Basis Document: Biosphere.* B00000000-01717-4301-00009 REV 00. Las Vegas, NV: Civilian Radioactive Waste Management System Management & Operating Contractor.

Leigh, C.D., B.M. Thompson, J.E. Campbell, D.E. Longsine, R.A. Kennedy, B.A. Napier. 1993. *User's Guide for GENII-S: A Code for Statistical and Deterministic Simulation of Radiation Doses to Humans from Radionuclides in the Environment.* SAND 91-0561. Albuquerque, NM: Sandia National Laboratories.

U.S. Department of Energy. 1998a. *Viability Assessment of a Repository at Yucca Mountain, Volume 3: Total System Performance Assessment.* DOE/RW-0508. Las Vegas, NV: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

U.S. Department of Energy. 1998b. *Viability Assessment of a Repository at Yucca Mountain, Volume 4: License Application Plan and Costs.* DOE/RW-0508. Las Vegas, NV: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

VIABILITY ASSESSMENT REVIEW: LOCATION AND LIFESTYLE OF CRITICAL GROUP KESA

CONCERNS:

No major concerns were identified in the Viability Assessment (VA) for this KESA. Additional information on areas of review and technical comments are provided to document the scope of review and to provide information on issues that may prove to be useful in the future.

IMPORTANCE:

Forthcoming EPA and NRC regulations applicable to the potential repository site at Yucca Mountain are expected to implement the critical group concept recommended by a National Academy of Sciences committee in 1995 (National Research Council, 1995). Lifestyle and location of the critical group provide the basis for calculating the dose conversion factors (DCFs) which are input parameters for PA dose modeling.

The dose conversion factors used in PA dose calculations (that convert water and soil radionuclide concentrations to dose) are based on assumptions about the location and lifestyle of the critical group. DCFs proportionally affect PA dose results and therefore assumptions about the critical group affect the magnitude of the calculated dose. Past uncertainty analysis of the DCFs indicate that the range spans about an order of magnitude and approximate a truncated log-normal distribution. DOE uncertainty estimates are consistent with these results. This variation suggests assumptions and supporting data for DCF calculations can have a significant impact on calculated doses. While no quantitative importance analyses have been conducted to date by CNWRA to quantify the importance of this KESA relative to others, DOE analyses suggest the DCFs that result from this KESA are of moderate importance to post closure performance (using a scale of low, moderate, high, see VA volume 3, table 6-1) (U.S. Department of Energy, 1998). Moderate importance means uncertainty in the principal factor (i.e., DCF) contributes to a factor of 5 to 50 increase or decrease in peak dose from the expected value. Note table 2-2 of the VA, Volume 4, shows that the biosphere is of low importance. This is an internal inconsistency and as indicated in the footnote for this table, the range should fall in the moderate importance category (U.S. Department of Energy, 1998).

STATUS OF RESOLUTION:

Overall, the DOE approach in TSPA-VA to calculating DCFs is very similar to the NRC approach used in the TPA code and appears consistent with requirements for reference biosphere and critical group in draft 10 CFR Part 63. DOE is using the same biosphere/pathway/dose models (GENII-S)(Leigh et al., 1993) as NRC to calculate an annual dose to the average member of a 20 km farming group in Amargosa Valley. Most of the DOE input parameters are the same as used by NRC/CNWRA. The use of site-specific survey data for local demographics is an improvement over NRC/CNWRA modeling.

The following technical comments were noted to be discussed as part of the continuing issue resolution process, and incorporated as appropriate into Revision 2 of the Total System Performance Assessment Issue (TSPAI) Issue Resolution Status Report (IRSR).

1. More information is needed on how DOE has implemented the approach of using DCF distributions in their TSPA modeling. The VA indicates stochastic calculations in GENII-S (Leigh et al., 1993) are run to generate radionuclide-specific DCF distributions that are then sampled for each iteration of the

TSPA. DOE indicates the DCFs are "completely correlated" for the sampling so that if a large value is selected for one radionuclide then large values for all radionuclides are selected (CRWMS M&O, 1998). In the past, the NRC/CNWRA considered sampling DCF distributions for the TPA in a manner consistent with the general approach taken by DOE but abandoned the concept based on statistical and conceptual concerns. One problem was the potential introduction of bias from double sampling (first in the stochastic calculation of the DCF, then again when DCFs are sampled for each iteration of the TSPA). Another concern was that double sampling would de-couple the DCFs from their original sampling vectors such that all re-sampled DCFs for a given TSPA iteration would not be based on the same suite of input parameters (e.g., the irrigation rate for the selected ^{241}Am DCF is not the same as the irrigation rate for the selected ^{237}Np DCF). Thus, conceptually, the biosphere and critical group characteristics would be incongruent among radionuclides in a given iteration of the code. The DOE statement that the DCFs were correlated by the magnitude of the DCF is questionable because the various factors that contribute to the magnitude of DCFs vary among radionuclides, thus the parameter selections that cause an increase in the ^{99}Tc DCF will not necessarily increase the ^{129}I DCF. The effect of this correlation is expected to increase the range of the dose distribution but may not affect the mean dose.

2. The comparison of critical group and biosphere parameters showed good agreement between DOE and NRC. These input parameter choices were compared with current parameter selections for TPA Version 3.2 (attachment A) and a sample of DCF calculations were confirmed by running the GENII-S (Leigh et al., 1993) code (attachment B). However, it should be noted that the range used for mass loading for the inhalation model (2.4E-6, 1.54E-4) is less conservative than the range selected by NRC/CNWRA staff for use in TPA 3.2 (1.0E-4, 1.0E-2) for igneous activity. The DOE documentation is unclear as to whether this mass loading is used for soil and ash inclusively. These values appear reasonable for soil, but are nonconservative for ash. This is an important, and very uncertain parameter for use in calculating inhalation dose from igneous activity. This lack of conservatism may be offset by DOE using a more conservative approach to calculating doses from ash blankets (i.e., no or incomplete accounting of dilution effects). Refer to the VA review results summary for the dilution of radionuclides in soil KESA for more information on dilution issues.

ADDITIONAL BACKGROUND:

The review was focused on chapters of the DOE TSPA-VA, Volume 3 (U.S. Department of Energy, 1998) that directly pertain to DCF calculation including Chapter 3.8—Development of TSPA Components for VA: Biosphere, Chapter 5.8—Sensitivity Analysis for Components: Biosphere, Chapter 6.4—Principal Factors Affecting Postclosure Performance: Biosphere Uptake, Chapter 6.5.1.11—Assessment of Potential Activities to Increase Confidence in the Total System Performance Assessment Based on the Results of TSPA VA: Biosphere Transport and Uptake. Supporting documentation in the VA technical basis document was also reviewed including Chapter 9: Biosphere (CRWMS M&O, 1998) that contains a detailed list of input parameters for the DCF calculations.

REFERENCES:

CRWMS M&O. 1998. *Chapter 9, Total System Performance Assessment - Viability Assessment (TSPA-VA) Analyses Technical Basis Document: Biosphere*. B00000000-01717-4301-00009 REV 00. Las Vegas, NV: Civilian Radioactive Waste Management System Management & Operating Contractor.

Leigh, C.D., B.M. Thompson, J.E. Campbell, D.E. Longsine, R.A. Kennedy, B.A. Napier. 1993. *User's Guide for GENII-S: A Code for Statistical and Deterministic Simulation of Radiation Doses to Humans from Radionuclides in the Environment.* SAND 91-0561. Albuquerque, NM: Sandia National Laboratories.

National Research Council. 1995. *Technical Bases for Yucca Mountain Standards.* Washington, DC: National Research Council: Committee on Technical Bases for Yucca Mountain Standards.

U.S. Department of Energy. 1998. *Viability Assessment of a Repository at Yucca Mountain: Total System Performance Assessment.* DOE/RW-0508. Las Vegas, NV: U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

ATTACHMENT A

COMPARISON OF BIOSPHERE INPUT PARAMETER VALUES/ASSUMPTIONS PROVIDED BY DOE IN TSPA-VA TECHNICAL BASIS DOCUMENT WITH TPA 3.2 VALUES/ASSUMPTIONS (REV 1, 1/25/99)

Parameter	DOE Best Estimate*	TPA 3.2 Value	TPA 3.2 Revision
Population/Soil/Scenario			
Population Scale Factor	1.0	1.0	
Soil/Plant Transfer Scale Factor	0.117—8.51	1.0	
Animal Uptake Scale Factor	0.117—8.51	1.0	
Human Dose Factor Scale Factor	1.0	1.0	
Surface Soil Plow Depth (cm)	15	15	
Surface Areal Soil Density (kg/m^2)	225	225	
Deep Areal Soil Density (kg/m^3)	1,500	1,500	
Roots in Upper Soil (fraction)	1.0	1.0	
Roots in Deep Soil (fraction)	0.0	0.0	
External/Inhalation Exposure			
Chronic Plume Exposure (hr)	not provided	3,384 (farmer) 2,184 (resident)	
Inhalation Exposure (hr/yr)	3,869 (no resident)	4,200 (farmer) 2,184 (resident)	
Mass Load (g/m^3)	1.93E-5 1.93E-5	Range:[1.0E-2, 1.0E-4]	Key Parameter for volcano scenario with large uncertainty - TPA value value based on CNWRA/NRC consensus, DOE value is comparatively low but is within range of values reported for soil (no literature values for ash have been identified and therefore must be estimated).
Soil Exposure Duration (hr)	1,578 (no resident)	1,800 (farmer) 364 (resident)	
Home Irrigation Rate (in./yr)	71 61—66	58 (current) 41 (pluvial)	
Home Irrigation Duration (mo/yr)	12 12	9 (current) 12 (pluvial)	
Ingestion Exposure			
Crop Resuspension Factor (m^{-1})	1.0E-5 1.0E-5	2.0E-7 (ash) 4.4E-10 (soil)	
Crop Deposition Velocity (m/s)	0.001	0.001	

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COMPARISON OF BIOSPHERE INPUT PARAMETER VALUES/ASSUMPTIONS PROVIDED BY DOE IN TSPA-VA TECHNICAL BASIS DOCUMENT WITH TPA 3.2 VALUES/ASSUMPTIONS (REV 1, 1/25/99)

Parameter	DOE Best Estimate*	TPA 3.2 Value	TPA 3.2 Revision
Crop Interception (fraction)	0.40	0.40	
Soil Ingestion Rate (mg/day)	410	50	Difference requires further investigation (do not know sensitivity)
Drink Water Holdup Duration (days)	0	0	
Drink Water Consumption (L/yr)	683.8	730	
Terrestrial Food Ingestion			
Leafy Vegetables—Grow Duration (days)	67	80	Sensitivity indicates difference is not important
Other Vegetables—Grow Duration (days)	84	85	
Fruit—Grow Duration (days)	119	80	Sensitivity indicates difference is not important
Grain—Grow Duration (days)	132.5	75	Sensitivity indicates difference is not important
Leafy Vegetables—Irrigation Rate (in./yr)	36 35—36	60 (current) 43 (pluvial)	DOE estimate appears more realistic - TPA revision possible
Other Vegetables-Irrigation Rate (in./yr)	41 39—40	60 (current) 43 (pluvial)	DOE estimate appears more realistic - TPA revision possible
Fruit—Irrigation Rate (in./yr)	36 33—35	60 (current) 43 (pluvial)	DOE estimate appears more realistic - TPA revision possible
Grain—Irrigation Rate (in./yr)	51 47.5—49	60 (current) 43 (pluvial)	
Leafy Vegetables—Irrigation Duration (mo/yr)	3 3	3.0 (current) 6.0 (pluvial)	
Other Vegetables—Irrigation Duration (mo/yr)	3.9 3.9	5.0 (current) 6.0 (pluvial)	
Fruit—Irrigation Duration (mo/yr)	4.0 4.0	2.5 (current) 6.0 (pluvial)	
Grain—Irrigation Duration (mo/yr)	5.55 5.55	5.0 (current) 5.0 (pluvial)	
Leafy Vegetables—Yield (kg/m^2)	2.2	2	
Other Vegetable—Yield (kg/m^2)	3.8	4	
Fruit—Yield (kg/m^2)	1.9	3	

COMPARISON OF BIOSPHERE INPUT PARAMETER VALUES/ASSUMPTIONS PROVIDED BY DOE IN TSPA-VA TECHNICAL BASIS DOCUMENT WITH TPA 3.2 VALUES/ASSUMPTIONS (REV 1, 1/25/99)

Parameter	DOE Best Estimate*	TPA 3.2 Value	TPA 3.2 Revision
Grain—Yield (kg/m^2)	0.62	0.54	
Leafy Vegetables—Holdup (days)	1	1	
Other Vegetables—Holdup (days)	14	14	
Fruit—Holdup (days)	14	14	
Grain—Holdup (days)	14	14	
Leafy Vegetables—Consumption Rate (kg/yr)	8.01	6	
Other Vegetables—Consumption Rate (kg/yr)	4.20	26	DOE value based on local survey data, TPA revision justifiable
Fruit—Consumption Rate (kg/yr)	8.53	23	DOE value based on local survey data, TPA revision justifiable
Grain—Consumption Rate (kg/yr)	0.17	34	DOE value based on local survey data, TPA revision justifiable
Animal Product Consumption			
Beef—Consumption Rate (kg/yr)	2.75	29.5	
Poultry—Consumption Rate (kg/yr)	0.49	0	
Milk—Consumption Rate (kg/yr)	4.42	100	DOE value based on local survey data, TPA revision justifiable
Eggs—Consumption Rate (kg/yr)	4.03	3	
Beef—Holdup (days)	20	20	
Poultry—Holdup (days)	1	0	DOE includes poultry, TPA does not, TPA revision justifiable to include poultry based on survey data
Milk—Holdup (days)	1	1	
Eggs—Holdup (days)	1	1	
Beef—Contaminated Water (fraction)	1	1	
Poultry—Contaminated Water (fraction)	1	0	
Milk—Contaminated Water (fraction)	1	1	
Eggs—Contaminated Water (Fraction)	1	1	

COMPARISON OF BIOSPHERE INPUT PARAMETER VALUES/ASSUMPTIONS PROVIDED BY DOE IN TSPA-VA TECHNICAL BASIS DOCUMENT WITH TPA 3.2 VALUES/ASSUMPTIONS (REV 1, 1/25/99)

Parameter	DOE Best Estimate*	TPA 3.2 Value	TPA 3.2 Revision
Fresh Forage Data			
Beef Forage—Dietary Fraction	1.0	0.56	DOE value is conservative, TPA value based on regional data, thus no revision required
Milk Cow Forage—Dietary Fraction	1.0	0.56	DOE value is conservative, TPA value based on regional data, thus no revision required
Beef Forage—Grow Duration (days)	57.5	46	Sensitivity indicates parameter not important, no revision required
Milk Forage—Grow Duration (days)	57.5	46	Sensitivity indicates parameter not important, no revision required
Beef Forage—Irrigation Rate (in./yr)	73.5 66.5—69.5	60 (current) 43 (pluvial)	DOE estimate appears more realistic - TPA revision possible
Milk Forage—Irrigation Rate (in./yr)	73.5 66.5—69.5	60 (current) 43 (pluvial)	DOE estimate appears more realistic - TPA revision possible
Beef Forage—Irrigation Duration (mo/yr)	10.5 10.5	5.5 (current) 7 (pluvial)	Requires more information from DOE to determine basis for DOE value
Milk Forage—Irrigation Duration (mo/yr)	10.5 10.5	5.5 (current) 7 (pluvial)	Requires more information from DOE to determine basis for DOE value
Beef Forage—Yield (kg/m^3)	0.93	1.23	
Milk Forage—Yield (kg/m^3)	0.93	1.23	
Beef Forage—Storage Duration (days)	0	20	
Milk Forage—Storage Duration (days)	0	1	
Stored Feed			
Hen—Drinking Water Dietary Fraction	1	1	
Hen—Fraction of Contaminated Feed	1	1	
Hen—Drinking Water Source	Contaminated Groundwater	Contaminated Groundwater	
Hen Feed—Storage Duration (days)	14	14	
Hen Feed—Grow Duration (days)	75	75	

COMPARISON OF BIOSPHERE INPUT PARAMETER VALUES/ASSUMPTIONS PROVIDED BY DOE IN TSPA-VA TECHNICAL BASIS DOCUMENT WITH TPA 3.2 VALUES/ASSUMPTIONS (REV 1, 1/25/99)

Parameter	DOE Best Estimate*	TPA 3.2 Value	TPA 3.2 Revision
Hen Feed—Irrigation Rate (in./yr)	66 64—65	60 (current) 43 (pluvial)	
Hen Feed—Irrigation Duration (mo/yr)	4.9	5	
Hen Feed—Yield (kg/m^2)	0.62	0.54	
Miscellaneous			
Absolute Humidity (kg/m^3)	not provided	0.008	Info from DOE on default parameters needed
Leaf Surface Resuspension Factor (m^{-1})	not provided	1.0E-9	Info from DOE on default parameters needed
Biomass (wet kg/m^2)			
Leafy Vegetables	not provided	2	Info from DOE on default parameters needed
Other Vegetables	"	2	
Fruit	"	3	
Grain	"	0.8	
Beef Feed—Stored	"	0.8	
Poultry Feed—Stored	"	0.8	
Milk Feed—Stored	"	1	
Laying Hen Feed—Stored	"	0.8	
Beef Forage—Fresh	"	1	
Milk Forage—Fresh	"	1.5	
Weathering Half Time (days)	not provided	14	Info from DOE on default parameters needed
Translocation Fractions			
Leafy Vegetables	not provided	1.0	Info from DOE on default parameters needed
Other Vegetables	"	0.1	
Fruit	"	0.1	
Grain	"	0.1	

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COMPARISON OF BIOSPHERE INPUT PARAMETER VALUES/ASSUMPTIONS PROVIDED BY DOE IN TSPA-VA TECHNICAL BASIS DOCUMENT WITH TPA 3.2 VALUES/ASSUMPTIONS (REV 1, 1/25/99)

Parameter	DOE Best Estimate*	TPA 3.2 Value	TPA 3.2 Revision
Translocation—Animal			
Beef Feed—Stored	not provided	0.1	Info from DOE on default parameters needed
Poultry Feed—Stored	"	0.1	
Milk Feed—Stored	"	0.1	
Laying Hen Feed—Stored	"	0.1	
Beef Forage—Fresh	"	1.0	
Milk Forage—Fresh	"	1.0	
Animal Water Consumption Rates (kg/day)			
Beef Cow	50	60	Additional DOE bases needed
Poultry	0.3	0.3	
Milk Cow	60	100	Additional DOE bases needed
Laying Hen (eggs)	0.3	0.3	
Animal Consumption Rates (wet weight — kg/day)			
Beef Feed—Stored	68.0	33	(DOE assumes 0% of stored feed so value =0)
Poultry Feed—Stored	0.12	0.08	
Milk Feed—Stored	55.0	73	(DOE assumes 0% of stored feed so value = 0)
Laying Hen Feed—Stored	0.12	0.11	
Beef Forage—Fresh	68.0	33	
Milk Forage—Fresh	55.0	73	Basis for DOE needed
Chronic Breathing Rate (cm^3/sec)	not provided	270	Info from DOE on default parameters needed
Acute Breathing Rate (cm^3/sec)	not provided	330	Info from DOE on default parameters needed
Dry/Wet Ratio			
Leafy Vegetables	not provided	0.20	Info from DOE on default parameters needed
Other Vegetables	"	0.25	
Fruit	"	0.18	
Grain	"	0.91	
Beef—Stored Feed	"	0.22	
Poultry—Stored Feed	"	0.22	
Milk Cow—Stored Feed	"	0.22	
Hen (Eggs)—Stored Feed	"	0.91	
Beef Cattle—Fresh Forage	"	0.22	
Milk Cow—Fresh Forage	"	0.22	

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COMPARISON OF BIOSPHERE INPUT PARAMETER VALUES/ASSUMPTIONS PROVIDED BY DOE IN TSPA-VA TECHNICAL BASIS DOCUMENT WITH TPA 3.2 VALUES/ASSUMPTIONS (REV 1, 1/25/99)

Parameter	DOE Best Estimate*	TPA 3.2 Value	TPA 3.2 Revision
Organ Weighting Factors	not provided	See 10 CFR 20.1003	Info from DOE on default parameters needed
Leaching Factor			
Total Annual Precipitation (cm/yr)	not provided	15 (current) 37.5 (pluvial)	Info from DOE on leach model parameters needed
Total Annual Irrigation Rate (cm/yr)	not provided	152 (current) 108 (pluvial)	Info from DOE on leach model parameters needed
Total Annual Evapotranspiration (cm/yr)	not provided	80 (current) 48 (pluvial)	Info from DOE on leach model parameters needed
Soil Volumetric Water Content (ml/cm^3)	not provided	0.35	Info from DOE on leach model parameters needed
Soil Partition Coefficients (K_d) (L/kg)	not provided	Various	Info from DOE on leach model parameters needed

*DOE uses parameter distributions for 3 types of receptors (subsistence farmer, resident farmer, Amargosa Valley population). For purposes of comparison the value reported in the above table is the expected value/mean/mode for the Amargosa Valley population receptor. The rationale for this selection is that the Amargosa receptor habits are based on local survey data which represents the best available information for defining receptor behavior persuant to draft Part 63 requirements. The distribution range and type used by DOE may have considerable influence on the mean DCF calculated, however, such information is not provided in the above table.

Note: Differences between DOE and TPA value that are considered notable are signified by inclusion of text in the "TPA 3.2 Revision" column.

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ATTACHMENT B

Table B. Comparison of DOE average Amargosa Valley resident, current precipitation, groundwater pathway BDCF results for VA with confirmatory calculation results based on DOE input parameters.

Radionuclide	DOE VA Mean BDCF	Confirmatory Calculation Result	DOE VA Median BDCF	Confirmatory Calculation Result
^{237}Np	6.57E+00	6.49E+00	5.24E+00	5.31E+00
^{129}I	4.79E-01	3.02E-01*	3.13E-01	2.50E-01
^{239}Pu	4.41E+00	4.43E+00	3.50E+00	3.61E+00
^{99}Tc	3.14E-03	2.96E-03	2.37E-03	2.40E-03

*difference may be due to radionuclide-specific modeling assumptions that were not documented in the VA and therefore not included in the confirmatory calculations

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