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UniStar
NUCLEAR ENERGY

10 CFR 50.4
10 CFR 52.79

November 12, 2010

UN#10-278

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3,
RAI 266, Accidental Release of Radioactive Liquid Effluents in Ground and Surface Waters

References:
1) Surinder Arora (NRC) to Robert Poche (UniStar Nuclear Energy), "FINAL RAI 266 CHPB 5098" email dated October 7, 2010

2) UniStar Nuclear Energy Letter UN#10-277, from Greg Gibson to Document Control Desk, U.S. NRC, Submittal of Response to RAI 265, Groundwater, and RAI 266, Accidental Release of Radioactive Liquid Effluents in Ground and Surface Waters, dated November 8, 2010

The purpose of this letter is to respond to the request for additional information (RAI) identified in the NRC e-mail correspondence to UniStar Nuclear Energy, dated October 7, 2010 (Reference 1). This RAI addresses Accidental Release of Radioactive Liquid Effluents in Ground and Surface Waters, as discussed in Section 2.4.13 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Combined License Application (COLA), Revision 6.

Reference 2 provided a November 12, 2010 schedule for the response for RAI 266, Question 02.04.13-6. The enclosure provides our response to RAI 266, Question 02.04.13-6,

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and includes revised COLA content. A Licensing Basis Document Change Request has been initiated to incorporate these changes into a future revision of the COLA.

Our response does not include any new regulatory commitments. This letter does not contain any sensitive or proprietary information.

If there are any questions regarding this transmittal, please contact me at (410) 470-4205, or Mr. Wayne A. Massie at (410) 470-5503.

*I declare under penalty of perjury that the foregoing is true and correct.*

Executed on November 12, 2010

Greg Gibson

Enclosure: Response to NRC Request for Additional Information RAI 266, Question 02.04.13-6, Accidental Release of Radioactive Liquid Effluents in Ground and Surface Waters, Calvert Cliffs Nuclear Power Plant, Unit 3

cc: Surinder Arora, NRC Project Manager, U.S. EPR Projects Branch
Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosure)
Loren Plisco, Deputy Regional Administrator, NRC Region II (w/o enclosure)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2
U.S. NRC Region I Office

GTG/RDS/mdf

# Enclosure

## Response to NRC Request for Additional Information RAI 266, Question 02.04.13-6, Accidental Release of Radioactive Liquid Effluents in Ground and Surface Waters, Calvert Cliffs Nuclear Power Plant, Unit 3

**RAI 266**

**Question 02.04.13-6**

Supplemental question to the response to RAI 104, Question 02.04.13-4

In RAI 104, Question 02.04.13-4, the staff asked the applicant to provide technical information supporting the conclusion that the postulated ground water exposure pathway applies a conservative approach in analyzing the postulated failure of a radioactive waste tank containing radioactive materials. The applicant submitted a response on June 30, 2010 addressing the issues identified in the RAI. In addition to updating the ground water model, the applicant also included in its response the results of an updated evaluation assessing the radiological impact of a failed radioactive waste tank. Based on a review of this response, CHPB and RHEB staff have identified the following items for the applicant to address and resolve in FSAR Tier 2, Section 2.4.13.

a. Table 2.4-206 – Results for Chesapeake Bay

The dose result of 9.5 mrem was confirmed independently using the information presented in this table and FSAR Tier 2, Section 2.4.13.1.4.7, and assumed radionuclide concentrations based on U.S. EPR, FSAR Section 11.1, Table 11.1-2. However, the basis of the stated consumption rates for fish (5.4 kg/yr) and mollusk/crustacean (0.9 kg/yr) are not attributed to specific references. The applicant should identify the references in the text for the assumed consumption rates. Also, the staff is questioning the use of RESRAD code data and their basis for the stated consumption rates. The RESRAD code was developed for the purpose of evaluating sites after the decommissioning of nuclear facilities. Regarding the consumption rates of fish, mollusk and crustacean, see guidance and supporting information on consumption rates listed in Tables E-4 and E-5 of Regulatory Guide 1.109. The concerns with the RESRAD data is that they may not be sufficiently conservative in assessing the impacts of a radwaste tank failure. The objective is to use a common set of data and references in applying fish, mollusk, and crustacean consumption rates. This would result in having to recalculate all dose results presented in Table 2.4-206 and other dose results as warranted.

The staff is questioning the use of freshwater site bioaccumulation factors in assessing the transfer of radioactivity from water to fish/crustacean/mollusk in a saltwater environment. Note that the dose assessments applied in the CCNPP-3 ER and FSAR Tier 2, Section 11.2 for radwaste liquid effluent releases are based on parameters that characterize a saltwater site. The applicant is requested to update its assessment using bioaccumulation factors for a saltwater site. For guidance and supporting information, see Table A-1 of Regulatory Guide 1.109, or GENII Computer codes, Appendix D, Tables D.11 to D.13. The objective is to use a common set of data and references in applying bioaccumulation factors for salt and freshwater site conditions. This would result in having to recalculate all dose results presented in Table 2.4-206 and other dose results as warranted.

b. Table 2.4-211 – Results for Branch 2

The dose result of 23 mrem was confirmed independently using the information presented in this table and FSAR Tier 2, Section 2.4.13.1.4.7, and assumed radionuclide concentrations based on U.S. EPR, FSAR Section 11.1, Table 11.1-2. However, the basis of the stated consumption rates fish (5.4 kg/yr) and mollusk/crustacean (0.9 kg/yr) are not attributed to

specific references. The applicant should identify the references in the text for the assumed consumption rates.

The staff is also questioning the use of RESRAD code data and their basis for the stated consumption rates. The RESRAD code was developed for the purpose of evaluating sites after the decommissioning of nuclear facilities. Regarding the consumption rates of fish, mollusk and crustacean, see guidance and supporting information on consumption rates in Tables E-4 and E-5 of Regulatory Guide 1.109. The concerns with the RESRAD data is that they may not be sufficiently conservative in assessing the impacts of a radwaste tank failure. The objective is to use of a common set of data and references in applying fish, mollusk, and crustacean consumption rates. This would result in having to recalculate all dose results presented in Table 2.4-211 and other dose results as warranted.

**Response**

**Part a**

For the direct pathway to Chesapeake Bay, the annual dose resulting from the ingestion of fish, mollusks, and crustaceans has been recalculated using the average adult individual consumption rates listed in Table E-4 of Regulatory Guide 1.109 (6.9 kg/yr for fish and 1.0 kg/yr for seafood) and using saltwater bioaccumulation factors for fish, mollusks, and crustaceans based on GENII Version 2 Software Design Document, Appendix D, Tables D.11 to D.13. The consumption rate for seafood has been split into two parts (0.5 kg/yr for mollusks and 0.5 kg/yr for crustaceans). The recalculated dose for this pathway is 12.42 mrem/yr.

COLA Tier 2 FSAR Table 2.4-206 (added in the response to RAI 104, Question 02.04.13-4[1]) is being updated to reflect the new dose calculations. Also, FSAR Section 2.4.13.1.4.7 is being updated to reflect the new dose calculations and to include the references cited above.

**Part b**

For the pathway through Fill to Branch 2, the annual dose resulting from the ingestion of fish, mollusks, and crustaceans has been recalculated using the average adult individual consumption rates listed in Table E-4 of Regulatory Guide 1.109 (6.9 kg/yr for fish and 1.0 kg/yr for seafood) and using saltwater bioaccumulation factors for fish, mollusks, and crustaceans based on GENII Version 2 Software Design Document, Appendix D, Tables D.11 to D.13. The consumption rate for seafood has been split into two parts (0.5 kg/yr for mollusks and 0.5 kg/yr for crustaceans). The recalculated dose for this pathway is 73.98 mrem/yr.

FSAR Table 2.4-211 (added in the response to RAI 104, Question 02.04.13-4[1]) is being updated to reflect the new dose calculations. Also, FSAR Section 2.4.13.1.4.7 is updated to reflect the new dose calculations and to include the references cited above.

It is noted that a third pathway, Upper Chesapeake Unit to Branch 2, also evaluates annual dose from the ingestion of seafood. The annual dose resulting from the ingestion of fish, mollusks, and crustaceans for this pathway has also been recalculated using the average adult individual consumption rates listed in Table E-4 of Regulatory Guide 1.109 (6.9 kg/yr for fish and

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1 G. Gibson (UniStar Nuclear Energy) to Document Control Desk ((NRC), "Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI No.104,Question 02.04.13-4, Liquid Radioactive Release," letter UN#10-153, dated June 17, 2010.

1.0 kg/yr for seafood) and using saltwater bioaccumulation factors for fish, mollusks, and crustaceans based on GENII Version 2 Software Design Document, Appendix D, Tables D.11 to D.13. The consumption rate for seafood has been split into two parts (0.5 kg/yr for mollusks and 0.5 kg/yr for crustaceans). The recalculated dose for this pathway is 32.58 mrem/yr.

FSAR Table 2.4-207 (added in the response to RAI 104, Question 02.04.13-4[1]) is being updated to reflect the new dose calculations. Also, FSAR Section 2.4.13.1.4.7 is being updated to reflect the new dose calculations and to include the references cited above.

**COLA Impact**

FSAR Section 2.4.13.1.4.7 is being updated as follows:

**2.4.13.1.4.7 Advection, Radioactive Decay, Retardation, Adsorption, Hydrodynamic Dispersion, and Biological Uptake and Potential Consumption of Fish, Crustaceans, and Mollusks**

From the boundaries of the CCNPP Unit 3 site, all discharge, both surface water and groundwater, eventually reaches the Chesapeake Bay. Neither surface water nor groundwater discharge from the CCNPP Unit 3 site is used as a drinking water source. In the case that compliance with the ECLs is not demonstrated at the boundary of the restricted area, biological uptake and the corresponding potential for human exposure by ingestion is examined to ensure that ECL exceedance at the boundary will not lead to adverse human exposure. In this case, radionuclide concentrations predicted to be discharging into Chesapeake Bay were also evaluated for biological uptake and human ingestion of fish, crustaceans, and mollusks harvested from this area. The concentrations predicted to be discharging in surface streams, or discharging from groundwater for the Chesapeake Bay pathway, were considered as the exposure concentration for Chesapeake Bay biota, without accounting for any additional dilution in the Bay. These undiluted concentrations were used to estimate the biological uptake using the fish-water and mollusk-crustacean uptake ratios given in ~~Table D-5 of ANL, 2001 and in Eckerman, 1988~~ Tables D.11, D.12, and D.13 of PNNL, 2004.

The dose via each consumption pathway (mollusk/crustacean and fish) was determined using assumptions for fraction of food contaminated for mollusks/crustaceans (50 percent) and fish (25 percent), and standard default assumptions for annual consumption (~~5.4~~ 6.9 kg/year fish and ~~0.9~~ 1.0 kg/year ~~crustacean/mollusk~~ seafood from NRC Regulatory Guide 1.109, taken as 50% mollusks and 50% crustaceans) and converted to a dose in millirem based on dose conversion factors from ~~Table D.1 of ANL, 2001 and in~~ Eckerman, 1988. The rationale for using non-default values for the percent of contaminated fish, crustaceans, and mollusks is based on the likelihood that fishermen would fish outside of the area of contamination for at least 25% of the time and that fish, themselves are wide-ranging and would spend time both in and outside of the area of potential discharge, while for crustaceans and mollusks the assumption is that harvesting would be 50% outside the contaminated area due to the narrow width of the contamination plume entering the Bay (Section 2.4.13.1.4.10). The resultant dose for each compound by each intake exposure pathway was summed and a total exposure was determined.

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FSAR Section 2.4.13.1.4.12 is being updated as follows:

### 2.4.13.1.4.12 Transport Considering Advection, Radioactive Decay, Adsorption, Dispersion, and Biological Uptake and Potential Consumption of Fish, Crustaceans, and Mollusks

The activity concentrations resulting from the transport analysis were used to evaluate potential biological uptake and human ingestion of fish, crustaceans, and mollusks harvested in the immediate vicinity of groundwater discharge in Chesapeake Bay or in the vicinity of the point where Branch 2 flows into Chesapeake Bay using the method discussed in Section 2.4.13.1.4.7. The concentrations predicted to be discharging in surface streams, or discharging from groundwater for the Chesapeake Bay pathway, were considered as the exposure concentration for Chesapeake Bay biota, without accounting for any additional dilution in the Bay. This analysis was performed for the pathways having tritium (H-3) and Iodine (I-131) concentrations in excess of their ECLs at the points of discharge into Chesapeake Bay: the pathways to Branch 2 and the direct pathway through the Upper Chesapeake unit to the Bay. The predicted radionuclide concentrations (Tables 2.4-206, 2.4-207 and 2.4-211) were considered directly available for biological uptake, and a fish-water and mollusk-crustacean uptake ratio was applied from ~~Table D-5 of Eckerman (1988)~~ PNNL (2004). The results of these calculations and the evaluations are presented in Tables 2.4-206, 2.4-207 and 2.4-211. The total ingestion exposure for the direct Chesapeake Bay pathway is ~~9.50~~ 12.42 millirem per year. For the pathways to Branch 2, the total ingestion exposure is ~~21.17~~ 32.58 millirem per year for transport through the Upper Chesapeake unit and is ~~23.02~~ 73.98 millirem per year for transport through the fill material. These exposures are ~~well~~ below the allowable exposure level to individual members of the public of 100 millirem per year required in 10 CFR 20.1301. In addition, these estimates are very conservative because do not account for dilution due to the mixing of ground or surface water discharges into Chesapeake Bay, which may be expected to reduce the total ingestion exposure levels by at least one to two orders of magnitude.

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FSAR Section 2.4.13.1.5 is being updated as follows:

### 2.4.13.1.5 Compliance with 10 CFR Part 20

. . .

Nonetheless, an evaluation of the annual human radiological dose received from the ingestion of Chesapeake Bay biota potentially contaminated from direct discharge to the Bay was performed for the pathway through the Upper Chesapeake unit to Chesapeake Bay and for the pathways to Branch 2. The results of this evaluation indicate the total ingestion exposure is ~~21.17~~ 32.58 millirem per year for the pathway through the Upper Chesapeake unit to Branch 2, is ~~9.50~~ 12.42 millirem per year for transport through the Upper Chesapeake unit to Chesapeake Bay, and is ~~23.02~~ 73.98 millirem per year for alternative transport through the fill material to Branch 2. In all cases, the exposure is ~~well~~ below the allowable total exposure level to individual members of the public of 100 millirem per year required in 10 CFR 20.1301. As discussed above, the estimated exposures are conservative because they do not account for dilution due to the mixing of ground or surface water discharges into Chesapeake Bay.

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FSAR Section 2.4.13.3 is being updated as follows:

### 2.4.13.3 References

~~**ANL, 2001**. Users Manual for RESRAD Version 6, ANL/EAD-4, Yu, C., Zielen, A.J., Cheng, J.-J, LePoire, D.J. , Gnanapragasam, E., Kamboj, S., Arnish, J. Walo III, A, Williams, W.A., and Peterson, H., Argonne National Laboratory, July 2001.~~

**PNNL, 2004**. GENII Version 2 Software Design Document, PNNL-14584, Pacific Northwest National Laboratory, November 2004.

FSAR Tables 2.4-206, 2.4-207 and 2.4-211 (added in the response to RAI 104, Question 02.04.13-4[1]) are being updated as follows:

## Table 2.4-206 - {Transport Analysis for Pathway to Chesapeake Bay (1)}

(Page 1 of 2)

| Parent Radio-nuclide | Progeny in Chain | ECL[a] (µCi/cm³) | Half-life[b] $t_{1/2}$ (years) | Reactor Coolant Activity[c] (µCi/cm³) | Advection & Radioactive Decay[d] | | +Retardation[e] | | +Dilution[f] | | +Dispersion[g] | | Final Activity[c] (µCi/cm³) | Final Activity / ECL | Bio-Accumulation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Ground Water Activity (µCi/cm³) | Ground Water Activity / ECL | Ground Water Activity (µCi/cm³) | Ground Water Activity / ECL | Surface Water Activity (µCi/cm³) | Surface Water Activity / ECL | Surface Water Activity (µCi/cm³) | Surface Water Activity / ECL | | | Total Dose - Aquatic Ingestion (mrem/year) |
| H-3 | | 1.00E-03 | 12.348 | 1.0E+00 | 9.50E-01 | 9.50E+02 | 9.50E-01 | 9.50E+02 | 9.50E-01 | 9.50E+02 | 5.35E-03 | 5.35E+00 | 5.35E-03 | 5.35E+00 | ~~6.16E-01~~ 7.62E-01 |
| Na-24 | | 5.00E-05 | 0.002 | 3.7E-02 | 2.0E-162 | 3.93E-158 | | | | | | | 1.96E-162 | 3.93E-158 | ~~3.26E-157~~ 7.60E-159 |
| Cr-51 | | 5.00E-04 | 0.076 | 2.0E-03 | 4.8E-07 | 9.68E-04 | | | | | | | 4.84E-07 | 9.68E-04 | ~~8.34E-02~~ 1.02E-01 |
| Mn-54 | | 3.00E-05 | 0.857 | 1.0E-03 | 4.8E-04 | 1.60E+01 | 1.36E-20 | 4.53E-16 | | | | | 1.36E-20 | 4.53E-16 | ~~1.54E-12~~ 8.98E-14 |
| Fe-55 | | 1.00E-04 | 2.700 | 7.6E-04 | 6.0E-04 | 6.01E+00 | 6.96E-222 | 6.96E-218 | | | | | 6.96E-222 | 6.96E-218 | ~~7.22E-216~~ 5.88E-215 |
| Fe-59 | | 1.00E-05 | 0.122 | 1.9E-04 | 1.1E-06 | 1.07E-01 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Co-58 | | 2.00E-05 | 0.194 | 2.9E-03 | 1.1E-04 | 5.58E+00 | 9.23E-93 | 4.62E-88 | | | | | 9.23E-93 | 4.62E-88 | ~~1.64E-86~~ 4.70E-86 |
| Co-60 | | 3.00E-06 | 5.284 | 3.4E-04 | 3.0E-04 | 1.01E+02 | 1.77E-07 | 5.91E-02 | 1.77E-07 | 5.91E-02 | 9.41E-11 | 3.14E-05 | 9.41E-11 | 3.14E-05 | ~~1.25E-03~~ 3.61E-03 |
| Zn-65 | | 5.00E-06 | 0.668 | 3.2E-04 | 1.2E-04 | 2.49E+01 | 3.11E-33 | 6.21E-28 | | | | | 3.11E-33 | 6.21E-28 | ~~2.62E-25~~ 9.73E-25 |
| Br-83 | | 9.00E-04 | 0.000 | 3.2E-02 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Kr-83m | NaN | 0.000 | 0.0E+00 | 0.0E+00 | | | | | | | | 0.00E+00 | | - |
| Br-84 | | 4.00E-04 | 0.000 | 1.7E-02 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Br-85 | | NaN | 0.000 | 2.0E-03 | 0.0E+00 | | | | | | | | 0.00E+00 | | - |
| | Kr-85 | NaN | 0.001 | 0.0E+00 | 0.0E+00 | | | | | | | | 0.00E+00 | | - |
| Rb-88 | | 4.00E-04 | 0.000 | 1.0E+00 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Rb-89 | | 9.00E-04 | 0.000 | 4.7E-02 | 0.0E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Sr-89 | 8.00E-06 | 0.138 | 6.3E-04 | 6.6E-06 | 8.31E-01 | 5.65E-75 | 7.06E-70 | | | | | 5.65E-75 | 7.06E-70 | ~~6.59E-69~~ 8.96E-70 |
| Sr-90 | | 5.00E-07 | 29.120 | 3.3E-05 | 3.2E-05 | 6.46E+01 | 1.52E-05 | 3.04E+01 | 1.52E-05 | 3.04E+01 | 2.48E-09 | 4.97E-03 | 2.48E-09 | 4.97E-03 | ~~4.46E-02~~ 6.07E-03 |
| | Y-90 | 7.00E-06 | 0.007 | 7.7E-06 | 3.2E-05 | 4.61E+00 | 1.52E-05 | 2.17E+00 | 1.52E-05 | 2.17E+00 | 2.48E-09 | 3.55E-04 | 2.48E-09 | 3.55E-04 | ~~1.31E-02~~ 1.43E-02 |
| Sr-91 | | 2.00E-05 | 0.001 | 1.0E-03 | 1.1E-256 | 5.49E-252 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Y-91m | 2.00E-03 | 0.000 | 5.2E-04 | 7.0E-257 | 3.48E-254 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Y-91 | 8.00E-06 | 0.160 | 8.1E-05 | 1.7E-06 | 2.14E-01 | 4.05E-66 | 5.07E-61 | | | | | 4.05E-66 | 5.07E-61 | ~~1.89E-59~~ 2.06E-59 |
| Sr-92 | | 4.00E-05 | 0.000 | 1.7E-04 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Y-92 | 4.00E-05 | 0.000 | 1.4E-04 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Y-93 | | 2.00E-05 | 0.001 | 6.5E-05 | 7.5E-243 | 3.75E-238 | | | | | | | 7.50E-243 | 3.75E-238 | ~~1.67E-236~~ 1.82E-236 |
| Zr-95 | | 2.00E-05 | 0.175 | 9.3E-05 | 2.5E-06 | 1.26E-01 | 2.53E-06 | 1.26E-01 | 2.53E-06 | 1.26E-01 | 2.04E-08 | 1.02E-03 | 2.04E-08 | 1.02E-03 | ~~3.15E-02~~ 8.59E-03 |
| | Nb-95m | 3.00E-05 | 0.010 | 0.0E+00 | 1.9E-08 | 6.23E-04 | 1.87E-08 | 6.23E-04 | 1.87E-08 | 6.23E-04 | | | 1.87E-08 | 6.23E-04 | ~~1.94E-02~~ 8.50E-03 |
| | Nb-95 | 3.00E-05 | 0.096 | 9.3E-05 | 5.5E-06 | 1.82E-01 | 5.45E-06 | 1.82E-01 | 5.45E-06 | 1.82E-01 | | | 5.45E-06 | 1.82E-01 | ~~6.31E+00~~ 2.77E+00 |
| Mo-99 | | 2.00E-05 | 0.008 | 1.1E-01 | 4.1E-38 | 2.06E-33 | | | | | | | 4.12E-38 | 2.06E-33 | ~~3.73E-33~~ 1.64E-32 |
| | Tc-99m | 1.00E-03 | 0.001 | 4.6E-02 | 4.0E-38 | 3.97E-35 | | | | | | | 3.97E-38 | 3.97E-35 | ~~7.23E-35~~ 1.46E-34 |
| Ru-103 | | 3.00E-05 | 0.108 | 7.7E-05 | 2.2E-07 | 7.23E-03 | | | | | | | 2.17E-07 | 7.23E-03 | ~~9.82E-02~~ 3.59E-01 |
| | Rh-103m | 6.00E-03 | 0.000 | 6.8E-05 | 2.2E-07 | 3.61E-05 | | | | | | | 2.16E-07 | 3.61E-05 | ~~3.73E-04~~ 1.69E-04 |
| Ru-106 | | 3.00E-06 | 1.008 | 2.7E-05 | 1.4E-05 | 4.81E+00 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Rh-106 | NaN | 0.000 | 2.7E-05 | 1.4E-05 | | 0.00E+00 | | | | | | 0.00E+00 | | ~~0.00E+00~~ |
| Ag-110m | | 6.00E-06 | 0.684 | 2.0E-07 | 7.9E-08 | 1.32E-02 | 7.95E-08 | 1.32E-02 | 7.95E-08 | 1.32E-02 | 4.71E-10 | 7.85E-05 | 4.71E-10 | 7.85E-05 | ~~1.80E-03~~ 3.81E-03 |
| | Ag-110 | NaN | 0.000 | 0.0E+00 | 1.1E-09 | | 1.06E-09 | | 1.06E-09 | | | | 1.06E-09 | | ~~0.00E+00~~ |

## Table 2.4-206 - {Transport Analysis for Pathway to Chesapeake Bay (1)}

(Page 2 of 2)

| Parent Radio-nuclide | Progeny in Chain | ECL[a] (µCi/cm³) | Half-life[b] $t_{1/2}$ (years) | Reactor Coolant Activity[c] (µCi/cm³) | Advection & Radioactive Decay[d] | | +Retardation[e] | | +Dilution[f] | | +Dispersion[g] | | Final Activity[c] (µCi/cm³) | Final Activity / ECL | Bio-Accumulation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Ground Water Activity (µCi/cm³) | Ground Water Activity / ECL | Ground Water Activity (µCi/cm³) | Ground Water Activity / ECL | Surface Water Activity (µCi/cm³) | Surface Water Activity / ECL | Surface Water Activity (µCi/cm³) | Surface Water Activity / ECL | | | Total Dose - Aquatic Ingestion (mrem/year) |
| Te-127m | | 9.00E-06 | 0.298 | 4.4E-04 | 5.3E-05 | **5.89E+00** | 5.30E-05 | **5.89E+00** | 5.30E-05 | **5.89E+00** | 3.51E-07 | **3.90E-02** | 3.51E-07 | 3.90E-02 | ~~1.66E+00~~ 6.45E+00 |
| | Te-127 | 1.00E-04 | 0.001 | 0.0E+00 | 5.2E-05 | **5.19E-01** | 5.19E-05 | **5.19E-01** | 5.19E-05 | **5.19E-01** | 3.43E-07 | 3.43E-03 | 3.43E-07 | 3.43E-03 | ~~1.36E-01~~ 5.28E-01 |
| I-129 | | 2.00E-07 | 15700000 | 4.6E-08 | 4.6E-08 | **2.30E-01** | 4.60E-08 | **2.30E-01** | 4.60E-08 | **2.30E-01** | 2.58E-10 | 1.29E-03 | 2.58E-10 | 1.29E-03 | ~~4.01E-03~~ 3.01E-03 |
| I-130 | | 2.00E-05 | 0.001 | 5.0E-02 | 1.6E-196 | 7.75E-192 | | | | | | | 1.55E-196 | 7.75E-192 | ~~4.13E-191~~ 3.10E-191 |
| Te-129m | | 7.00E-06 | 0.092 | 1.5E-03 | 1.6E-06 | **2.24E-01** | 1.57E-06 | **2.24E-01** | 1.57E-06 | **2.24E-01** | 3.54E-08 | 5.06E-03 | 3.54E-08 | 5.06E-03 | ~~2.17E-01~~ 8.43E-01 |
| | Te-129 | 4.00E-04 | 0.000 | 2.4E-03 | 1.0E-06 | 2.55E-03 | 1.02E-06 | 2.55E-03 | 1.02E-06 | 2.55E-03 | | | 1.02E-06 | 2.55E-03 | ~~1.18E-01~~ 4.57E-01 |
| Te-131m | | 8.00E-06 | 0.003 | 3.7E-03 | 2.7E-83 | 3.37E-78 | | | | | | | 2.70E-83 | 3.37E-78 | ~~1.41E-76~~ 5.46E-76 |
| | Te-131 | 8.00E-05 | 0.000 | 2.6E-03 | 6.1E-84 | 7.59E-80 | | | | | | | 6.07E-84 | 7.59E-80 | ~~3.14E-78~~ 1.22E-77 |
| | I-131 | 1.00E-06 | 0.022 | 7.4E-01 | 2.6E-13 | 2.57E-07 | | | | | | | 2.57E-13 | 2.57E-07 | ~~7.71E-07~~ 5.79E-07 |
| Te-132 | | 9.00E-06 | 0.009 | 4.1E-02 | 7.4E-33 | 8.23E-28 | | | | | | | 7.40E-33 | 8.23E-28 | ~~3.99E-26~~ 1.55E-25 |
| | I-132 | 1.00E-04 | 0.000 | 3.7E-01 | 7.6E-33 | 7.63E-29 | | | | | | | 7.63E-33 | 7.63E-29 | ~~2.89E-28~~ 2.17E-28 |
| I-133 | | 7.00E-06 | 0.002 | 1.3E+00 | 3.4E-116 | 4.85E-111 | | | | | | | 3.40E-116 | 4.85E-111 | ~~1.98E-110~~ 1.49E-110 |
| | Xe-133m | NaN | 0.006 | 0.0E+00 | 4.1E-48 | | | | | | | | 4.08E-48 | | |
| | Xe-133 | NaN | 0.014 | 0.0E+00 | 2.1E-20 | | | | | | | | 2.09E-20 | | |
| Te-134 | | 3.00E-04 | 0.000 | 6.7E-03 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | I-134 | 4.00E-04 | 0.000 | 2.4E-01 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| I-135 | | 3.00E-05 | 0.001 | 7.9E-01 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Xe-135m | NaN | 0.000 | 0.0E+00 | 0.0E+00 | | | | | | | | 0.00E+00 | | |
| | Xe-135 | NaN | 0.001 | 0.0E+00 | 7.0E-265 | | | | | | | | 7.00E-265 | | |
| Cs-134 | | 9.00E-07 | 2.062 | 1.7E-01 | 1.3E-01 | **1.39E+05** | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Cs-136 | | 6.00E-06 | 0.036 | 5.3E-02 | 1.2E-09 | 1.99E-04 | | | | | | | 1.20E-09 | 1.99E-04 | ~~3.69E-02~~ 2.52E-03 |
| Cs-137 | | 1.00E-06 | 30 | 1.1E-01 | 1.1E-01 | **1.08E+05** | 3.94E-33 | 3.94E-27 | | | | | 3.94E-33 | 3.94E-27 | ~~5.40E-25~~ 3.69E-26 |
| | Ba-137m | NaN | 0.000 | 1.0E-01 | 1.0E-01 | | 3.72E-33 | | | | | | 3.72E-33 | | ~~0.00E+00~~ |
| Cs-138 | | 4.00E-04 | 0.000 | 2.2E-01 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Ba-140 | | 8.00E-06 | 0.035 | 6.2E-04 | 8.5E-12 | 1.06E-06 | | | | | | | 8.50E-12 | 1.06E-06 | ~~7.68E-06~~ 1.81E-06 |
| | La-140 | 9.00E-06 | 0.005 | 1.6E-04 | 9.8E-12 | 1.09E-06 | | | | | | | 9.79E-12 | 1.09E-06 | ~~4.05E-05~~ 8.41E-06 |
| Ce-141 | | 3.00E-05 | 0.089 | 8.9E-05 | 7.4E-08 | 2.46E-03 | | | | | | | 7.37E-08 | 2.46E-03 | ~~1.05E-01~~ 9.02E-02 |
| Ce-143 | | 2.00E-05 | 0.004 | 7.6E-05 | 1.1E-77 | 5.34E-73 | | | | | | | 1.07E-77 | 5.34E-73 | ~~2.38E-71~~ 2.05E-71 |
| | Pr-143 | 2.00E-05 | 0.037 | 8.8E-05 | 4.0E-12 | 1.98E-07 | | | | | | | 3.96E-12 | 1.98E-07 | ~~1.09E-05~~ 1.25E-05 |
| Ce-144 | | 3.00E-06 | 0.778 | 6.9E-05 | 3.1E-05 | **1.02E+01** | 5.11E-161 | 1.70E-155 | | | | | 5.11E-161 | 1.70E-155 | ~~5.29E-154~~ 4.55E-154 |
| | Pr-144m | NaN | 0.000 | 0.0E+00 | 5.5E-07 | | 9.09E-163 | | | | | | 9.09E-163 | | ~~0.00E+00~~ |
| | Pr-144 | 6.00E-04 | 0.000 | 6.9E-05 | 3.1E-05 | **5.11E-02** | 5.11E-161 | 8.52E-158 | | | | | 5.11E-161 | 8.52E-158 | ~~0.00E+00~~ |
| W-187 | | 3.00E-05 | 0.003 | 1.8E-03 | 4.6E-104 | 1.54E-99 | | | | | | | 4.62E-104 | 1.54E-99 | ~~2.07E-97~~ 5.70E-99 |
| Np-239 | | 2.00E-05 | 0.006 | 8.7E-04 | 2.533E-46 | 1.27E-41 | 2.53E-46 | 1.27E-41 | 2.53E-46 | 1.27E-41 | | | 2.53E-46 | 1.27E-41 | ~~1.82E-40~~ 3.60E-39 |
| | Pu-239 | 2.00E-08 | 24,065 | 0.0E+00 | 2.331E-10 | **1.17E-02** | 2.33E-10 | **1.17E-02** | 2.33E-10 | **1.17E-02** | 1.31E-12 | 6.55E-05 | 1.31E-12 | 6.55E-05 | ~~3.96E-04~~ 1.18E-02 |
| Highlighted values exceed one percent of the ECL. | | | | | | | | | | | | | **Sum =** | **5.60** | ~~**9.50**~~ **12.42** |

## Table 2.4-207 - {Transport Analysis for Pathway to Branch 2}

(Page 1 of 2)

| Parent Radio-nuclide | Progeny in Chain | ECL[a] (µCi/cm³) | Half-life[b] $t_{1/2}$ (years) | Reactor Coolant Activity[c] (µCi/cm³) | Advection & Radioactive Decay[d] | | +Retardation[e] | | +Dilution[f] | | +Dispersion[g] | | Final Activity[c] (µCi/cm³) | Final Activity / ECL | Bio-Accumulation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Ground Water Activity (µCi/cm³) | Ground Water Activity / ECL | Ground Water Activity (µCi/cm³) | Ground Water Activity / ECL | Surface Water Activity (µCi/cm³) | Surface Water Activity / ECL | Surface Water Activity (µCi/cm³) | Surface Water Activity / ECL | | | Total Dose - Aquatic Ingestion (mrem/year) |
| H-3 | | 1.00E-03 | 12.348 | 1.0E+00 | 9.84E-01 | 9.84E+02 | 9.84E-01 | 9.84E+02 | 9.19E-02 | 9.19E+01 | 1.53E-03 | 1.53E+00 | 1.53E-03 | 1.53E+00 | ~~1.76E-01~~ 2.17E-01 |
| Na-24 | | 5.00E-05 | 0.002 | 3.7E-02 | 4.0E-54 | 8.00E-50 | | | | | | | 4.00E-54 | 8.00E-50 | ~~6.65E-49~~ 1.55E-50 |
| Cr-51 | | 5.00E-04 | 0.076 | 2.0E-03 | 1.3E-04 | 2.69E-01 | 1.34E-04 | 2.69E-01 | 1.26E-05 | 2.51E-02 | 2.96E-07 | 5.92E-04 | 2.96E-07 | 5.92E-04 | ~~5.10E-02~~ 6.26E-02 |
| Mn-54 | | 3.00E-05 | 0.857 | 1.0E-03 | 7.9E-04 | 2.62E+01 | 3.40E-09 | 1.13E-04 | | | | | 3.40E-09 | 1.13E-04 | ~~3.86E-01~~ 2.25E-02 |
| Fe-55 | | 1.00E-04 | 2.700 | 7.6E-04 | 7.0E-04 | 7.04E+00 | 1.54E-74 | 1.54E-70 | | | | | 1.54E-74 | 1.54E-70 | ~~1.59E-68~~ 1.30E-67 |
| Fe-59 | | 1.00E-05 | 0.122 | 1.9E-04 | 3.5E-05 | 3.54E+00 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Co-58 | | 2.00E-05 | 0.194 | 2.9E-03 | 1.0E-03 | 5.04E+01 | 2.78E-32 | 1.39E-27 | | | | | 2.78E-32 | 1.39E-27 | ~~4.94E-26~~ 1.42E-25 |
| Co-60 | | 3.00E-06 | 5.284 | 3.4E-04 | 3.3E-04 | 1.09E+02 | 2.93E-05 | 9.77E+00 | 2.74E-06 | 9.12E-01 | 9.76E-10 | 3.25E-04 | 9.76E-10 | 3.25E-04 | ~~1.30E-02~~ 3.74E-02 |
| Zn-65 | | 5.00E-06 | 0.668 | 3.2E-04 | 2.4E-04 | 4.71E+01 | 1.25E-13 | 2.51E-08 | | | | | 1.25E-13 | 2.51E-08 | ~~1.06E-05~~ 3.93E-05 |
| Br-83 | | 9.00E-04 | 0.000 | 3.2E-02 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Kr-83m | NaN | 0.000 | 0.0E+00 | 0.0E+00 | | | | | | | | 0.00E+00 | | |
| Br-84 | | 4.00E-04 | 0.000 | 1.7E-02 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Br-85 | | NaN | 0.000 | 2.0E-03 | 0.0E+00 | | | | | | | | 0.00E+00 | | |
| | Kr-85 | NaN | 0.001 | 0.0E+00 | 4.5E-179 | | | | | | | | 4.52E-179 | | |
| Rb-88 | | 4.00E-04 | 0.000 | 1.0E+00 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Rb-89 | | 9.00E-04 | 0.000 | 4.7E-02 | 0.0E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Sr-89 | 8.00E-06 | 0.138 | 6.3E-04 | 1.5E-04 | 1.82E+01 | 5.86E-27 | 7.33E-22 | | | | | 5.86E-27 | 7.33E-22 | ~~6.84E-21~~ 9.30E-22 |
| Sr-90 | | 5.00E-07 | 29.120 | 3.3E-05 | 3.3E-05 | 6.55E+01 | 2.57E-05 | 5.13E+01 | 2.40E-06 | 4.79E+00 | 1.13E-09 | 2.26E-03 | 1.13E-09 | 2.26E-03 | ~~2.03E-02~~ 2.76E-03 |
| | Y-90 | 7.00E-06 | 0.007 | 7.7E-06 | 3.3E-05 | 4.68E+00 | 2.57E-05 | 3.67E+00 | 2.40E-06 | 3.42E-01 | 1.13E-09 | 1.61E-04 | 1.13E-09 | 1.61E-04 | ~~5.96E-03~~ 6.50E-03 |
| Sr-91 | | 2.00E-05 | 0.001 | 1.0E-03 | 9.6E-86 | 4.81E-81 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Y-91m | 2.00E-03 | 0.000 | 5.2E-04 | 6.1E-86 | 3.04E-83 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Y-91 | 8.00E-06 | 0.160 | 8.1E-05 | 2.5E-05 | 3.07E+00 | 1.14E-24 | 1.43E-19 | | | | | 1.14E-24 | 1.43E-19 | ~~5.33E-18~~ 5.81E-18 |
| Sr-92 | | 4.00E-05 | 0.000 | 1.7E-04 | 3.9E-292 | 9.86E-288 | | | | | | | 3.94E-292 | 9.86E-288 | ~~9.98E-287~~ 1.36E-287 |
| | Y-92 | 4.00E-05 | 0.000 | 1.4E-04 | 2.4E-223 | 6.08E-219 | | | | | | | 2.43E-223 | 6.08E-219 | ~~2.27E-217~~ 2.48E-217 |
| Y-93 | | 2.00E-05 | 0.001 | 6.5E-05 | 4.6E-82 | 2.32E-77 | | | | | | | 4.64E-82 | 2.32E-77 | ~~1.04E-75~~ 1.13E-75 |
| Zr-95 | | 2.00E-05 | 0.175 | 9.3E-05 | 2.9E-05 | 1.44E+00 | 2.89E-05 | 1.44E+00 | 2.70E-06 | 1.35E-01 | 5.00E-08 | 2.50E-03 | 5.00E-08 | 2.50E-03 | ~~7.70E-02~~ 2.10E-02 |
| | Nb-95m | 3.00E-05 | 0.010 | 0.0E+00 | 2.1E-07 | 7.13E-03 | 2.14E-07 | 7.13E-03 | 2.00E-08 | 6.65E-04 | | | 2.00E-08 | 6.65E-04 | ~~2.07E-02~~ 9.07E-03 |
| | Nb-95 | 3.00E-05 | 0.096 | 9.3E-05 | 5.1E-05 | 1.69E+00 | 5.06E-05 | 1.69E+00 | 4.73E-06 | 1.58E-01 | | | 4.73E-06 | 1.58E-01 | ~~5.47E+00~~ 2.40E+00 |
| Mo-99 | | 2.00E-05 | 0.008 | 1.1E-01 | 1.7E-13 | 8.51E-09 | | | | | | | 1.70E-13 | 8.51E-09 | ~~1.54E-08~~ 6.77E-08 |
| | Tc-99m | 1.00E-03 | 0.001 | 4.6E-02 | 1.6E-13 | 1.64E-10 | | | | | | | 1.64E-13 | 1.64E-10 | ~~2.98E-10~~ 6.04E-10 |
| Ru-103 | | 3.00E-05 | 0.108 | 7.7E-05 | 1.1E-05 | 3.82E-01 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Rh-103m | 6.00E-03 | 0.000 | 6.8E-05 | 1.1E-05 | 1.91E-03 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Ru-106 | | 3.00E-06 | 1.008 | 2.7E-05 | 2.2E-05 | 7.35E+00 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Rh-106 | NaN | 0.000 | 2.7E-05 | 2.2E-05 | | 0.00E+00 | | | | | | 0.00E+00 | | ~~0.00E+00~~ |
| Ag-110m | | 6.00E-06 | 0.684 | 2.0E-07 | 1.5E-07 | 2.47E-02 | 1.48E-07 | 2.47E-02 | 1.38E-08 | 2.31E-03 | | | 1.38E-08 | 2.31E-03 | ~~5.28E-02~~ 1.12E-01 |
| | Ag-110 | NaN | 0.000 | 0.0E+00 | 2.0E-09 | | 1.97E-09 | | 1.84E-10 | | | | 1.84E-10 | | ~~0.00E+00~~ |

## Table 2.4-207 - {Transport Analysis for Pathway to Branch 2}

(Page 2 of 2)

| Parent Radio-nuclide | Progeny in Chain | ECL[a] (µCi/cm³) | Half-life[b] $t_{1/2}$ (years) | Reactor Coolant Activity[c] (µCi/cm³) | Advection & Radioactive Decay[d] | | +Retardation[e] | | +Dilution[f] | | +Dispersion[g] | | Final Activity[c] (µCi/cm³) | Final Activity / ECL | Bio-Accumulation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Ground Water Activity (µCi/cm³) | Ground Water Activity / ECL | Ground Water Activity (µCi/cm³) | Ground Water Activity / ECL | Surface Water Activity (µCi/cm³) | Surface Water Activity / ECL | Surface Water Activity (µCi/cm³) | Surface Water Activity / ECL | | | Total Dose - Aquatic Ingestion (mrem/year) |
| Te-127m | | 9.00E-06 | 0.298 | 4.4E-04 | 2.2E-04 | **2.46E+01** | 2.22E-04 | **2.46E+01** | 2.07E-05 | **2.30E+00** | 3.63E-07 | **4.04E-02** | 3.63E-07 | 4.04E-02 | ~~1.72E+00~~ 6.67E+00 |
| | Te-127 | 1.00E-04 | 0.001 | 0.0E+00 | 2.2E-04 | **2.17E+00** | 2.17E-04 | **2.17E+00** | 2.03E-05 | **2.03E-01** | 3.55E-07 | 3.55E-03 | 3.55E-07 | 3.55E-03 | ~~1.41E-01~~ 5.46E-01 |
| I-129 | | 2.00E-07 | 15700000 | 4.6E-08 | 4.6E-08 | **2.30E-01** | 4.60E-08 | **2.30E-01** | 4.30E-09 | **2.15E-02** | 7.13E-11 | 3.56E-04 | 7.13E-11 | 3.56E-04 | ~~1.11E-03~~ 8.31E-04 |
| I-130 | | 2.00E-05 | 0.001 | 5.0E-02 | 4.3E-65 | 2.15E-60 | | | | | | | 4.30E-65 | 2.15E-60 | ~~1.15E-59~~ 8.60E-60 |
| Te-129m | | 7.00E-06 | 0.092 | 1.5E-03 | 1.6E-04 | **2.31E+01** | 1.62E-04 | **2.31E+01** | 1.51E-05 | **2.16E+00** | 3.28E-07 | **4.68E-02** | 3.28E-07 | 4.68E-02 | ~~2.01E+00~~ 7.80E+00 |
| | Te-129 | 4.00E-04 | 0.000 | 2.4E-03 | 1.1E-04 | **2.64E-01** | 1.05E-04 | **2.64E-01** | 9.85E-06 | **2.46E-02** | 2.13E-07 | 5.33E-04 | 2.13E-07 | 5.33E-04 | ~~2.47E-02~~ 9.56E-02 |
| Te-131m | | 8.00E-06 | 0.003 | 3.7E-03 | 3.8E-29 | 4.81E-24 | 3.85E-29 | 4.81E-24 | 3.59E-30 | 4.49E-25 | | | 3.59E-30 | 4.49E-25 | ~~1.88E-23~~ 7.28E-23 |
| | Te-131 | 8.00E-05 | 0.000 | 2.6E-03 | 8.7E-30 | 1.08E-25 | 8.66E-30 | 1.08E-25 | 8.09E-31 | 1.01E-26 | | | 8.09E-31 | 1.01E-26 | ~~4.19E-25~~ 1.63E-24 |
| | I-131 | 1.00E-06 | 0.022 | 7.4E-01 | 6.8E-05 | **6.76E+01** | 6.76E-05 | **6.76E+01** | 6.31E-06 | **6.31E+00** | | | 6.31E-06 | 6.31E+00 | ~~1.02E+01~~ 1.42E+01 |
| Te-132 | | 9.00E-06 | 0.009 | 4.1E-02 | 4.4E-12 | 4.91E-07 | | | | | | | 4.41E-12 | 4.91E-07 | ~~2.38E-05~~ 9.23E-05 |
| | I-132 | 1.00E-04 | 0.000 | 3.7E-01 | 4.5E-12 | 4.55E-08 | | | | | | | 4.55E-12 | 4.55E-08 | ~~1.72E-07~~ 1.29E-07 |
| I-133 | | 7.00E-06 | 0.002 | 1.3E+00 | 4.3E-38 | 6.21E-33 | | | | | | | 4.35E-38 | 6.21E-33 | ~~2.53E-32~~ 1.90E-32 |
| | Xe-133m | NaN | 0.006 | 0.0E+00 | 3.5E-17 | | | | | | | | 3.54E-17 | | - |
| | Xe-133 | NaN | 0.014 | 0.0E+00 | 1.7E-07 | | | | | | | | 1.69E-07 | | - |
| Te-134 | | 3.00E-04 | 0.000 | 6.7E-03 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | I-134 | 4.00E-04 | 0.000 | 2.4E-01 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| I-135 | | 3.00E-05 | 0.001 | 7.9E-01 | 9.4E-119 | 3.12E-114 | | | | | | | 9.37E-119 | 3.12E-114 | ~~1.19E-113~~ 8.91E-114 |
| | Xe-135m | NaN | 0.000 | 0.0E+00 | 1.5E-119 | | | | | | | | 1.50E-119 | | - |
| | Xe-135 | NaN | 0.001 | 0.0E+00 | 3.7E-86 | | | | | | | | 3.74E-86 | | - |
| Cs-134 | | 9.00E-07 | 2.062 | 1.7E-01 | 1.5E-01 | **1.71E+05** | 7.30E-150 | 8.11E-144 | | | | | 7.30E-150 | 8.11E-144 | ~~1.47E-141~~ 1.00E-142 |
| Cs-136 | | 6.00E-06 | 0.036 | 5.3E-02 | 1.8E-04 | **2.93E+01** | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Cs-137 | | 1.00E-06 | 30 | 1.1E-01 | 1.1E-01 | **1.09E+05** | 7.01E-12 | 7.01E-06 | | | | | 7.01E-12 | 7.01E-06 | ~~9.62E-04~~ 6.57E-05 |
| | Ba-137m | NaN | 0.000 | 1.0E-01 | 1.0E-01 | | 6.63E-12 | | | | | | 6.63E-12 | | ~~0.00E+00~~ |
| Cs-138 | | 4.00E-04 | 0.000 | 2.2E-01 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Ba-140 | | 8.00E-06 | 0.035 | 6.2E-04 | 1.8E-06 | **2.19E-01** | 1.75E-06 | **2.19E-01** | 1.63E-07 | **2.04E-02** | 1.05E-08 | 1.31E-03 | 1.05E-08 | 1.31E-03 | ~~9.48E-03~~ 2.24E-03 |
| | La-140 | 9.00E-06 | 0.005 | 1.6E-04 | 2.0E-06 | **2.24E-01** | 2.02E-06 | **2.24E-01** | 1.88E-07 | **2.09E-02** | | | 1.88E-07 | 2.09E-02 | ~~7.79E-01~~ 1.62E-01 |
| Ce-141 | | 3.00E-05 | 0.089 | 8.9E-05 | 8.9E-06 | **2.97E-01** | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Ce-143 | | 2.00E-05 | 0.004 | 7.6E-05 | 1.8E-28 | 9.10E-24 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Pr-143 | 2.00E-05 | 0.037 | 8.8E-05 | 3.9E-07 | **1.94E-02** | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Ce-144 | | 3.00E-06 | 0.778 | 6.9E-05 | 5.3E-05 | **1.77E+01** | 1.65E-55 | 5.49E-50 | | | | | 1.65E-55 | 5.49E-50 | ~~1.70E-48~~ 1.47E-48 |
| | Pr-144m | NaN | 0.000 | 0.0E+00 | 9.4E-07 | | 2.93E-57 | | | | | | 2.93E-57 | | ~~0.00E+00~~ |
| | Pr-144 | 6.00E-04 | 0.000 | 6.9E-05 | 5.3E-05 | **8.84E-02** | 1.65E-55 | 2.74E-52 | | | | | 1.65E-55 | 2.74E-52 | ~~0.00E+00~~ |
| W-187 | | 3.00E-05 | 0.003 | 1.8E-03 | 4.4E-36 | 1.46E-31 | | | | | | | 4.37E-36 | 1.46E-31 | ~~1.96E-29~~ 5.40E-31 |
| Np-239 | | 2.00E-05 | 0.006 | 8.7E-04 | 1.406E-17 | 7.03E-13 | 1.41E-17 | 7.03E-13 | 1.31E-18 | 6.57E-14 | | | 1.31E-18 | 6.57E-14 | ~~9.45E-13~~ 1.87E-11 |
| | Pu-239 | 2.00E-08 | 24,065 | 0.0E+00 | 2.331E-10 | **1.17E-02** | 2.33E-10 | **1.17E-02** | 2.18E-11 | 1.09E-03 | | | 2.18E-11 | 1.09E-03 | ~~6.58E-03~~ 1.96E-01 |
| Highlighted values exceed one percent of the ECL. | | | | | | | | | | | | | **Sum =** | **8.12** | ~~**21.17**~~ **32.58** |

## Table 2.4-211 - {Transport Analysis for Pathway to Branch 2 through Fill}

(Page 1 of 2)

| Parent Radio-nuclide | Progeny in Chain | ECL[a] (µCi/cm³) | Half-life[b] $t_{1/2}$ (years) | Reactor Coolant Activity[c] (µCi/cm³) | Advection & Radioactive Decay[d] | | +Retardation[e] | | +Dilution[f] | | +Dispersion[g] | | Final Activity[c] (µCi/cm³) | Final Activity / ECL | Bio-Accumulation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Ground Water Activity (µCi/cm³) | Ground Water Activity / ECL | Ground Water Activity (µCi/cm³) | Ground Water Activity / ECL | Surface Water Activity (µCi/cm³) | Surface Water Activity / ECL | Surface Water Activity (µCi/cm³) | Surface Water Activity / ECL | | | Total Dose - Aquatic Ingestion (mrem/year) |
| H-3 | | 1.00E-03 | 12.348 | 1.0E+00 | 9.82E-01 | 9.82E+02 | 9.82E-01 | 9.82E+02 | 3.49E-02 | 3.49E+01 | 3.56E-03 | 3.56E+00 | 3.56E-03 | 3.56E+00 | ~~4.10E-01~~ 5.07E-01 |
| Na-24 | | 5.00E-05 | 0.002 | 3.7E-02 | 1.5E-57 | 3.02E-53 | | | | | | | 1.51E-57 | 3.02E-53 | ~~2.51E-52~~ 5.84E-54 |
| Cr-51 | | 5.00E-04 | 0.076 | 2.0E-03 | 1.1E-04 | 2.25E-01 | 1.13E-04 | 2.25E-01 | 3.99E-06 | 7.99E-03 | | | 3.99E-06 | 7.99E-03 | ~~6.88E-01~~ 8.44E-01 |
| Mn-54 | | 3.00E-05 | 0.857 | 1.0E-03 | 7.8E-04 | 2.58E+01 | 2.25E-08 | 7.50E-04 | | | | | 2.25E-08 | 7.50E-04 | ~~2.56E+00~~ 1.49E-01 |
| Fe-55 | | 1.00E-04 | 2.700 | 7.6E-04 | 7.0E-04 | 7.01E+00 | 7.01E-04 | 7.01E+00 | 2.49E-05 | 2.49E-01 | 2.55E-06 | 2.55E-02 | 2.55E-06 | 2.55E-02 | ~~2.64E+00~~ 2.15E+01 |
| Fe-59 | | 1.00E-05 | 0.122 | 1.9E-04 | 3.2E-05 | 3.17E+00 | 3.17E-05 | 3.17E+00 | 1.12E-06 | 1.12E-01 | 1.39E-07 | 1.39E-02 | 1.39E-07 | 1.39E-02 | ~~1.60E+00~~ 1.30E+01 |
| Co-58 | | 2.00E-05 | 0.194 | 2.9E-03 | 9.4E-04 | 4.70E+01 | 1.74E-26 | 8.70E-22 | | | | | 1.74E-26 | 8.70E-22 | ~~3.08E-20~~ 8.86E-20 |
| Co-60 | | 3.00E-06 | 5.284 | 3.4E-04 | 3.3E-04 | 1.09E+02 | 4.78E-05 | 1.59E+01 | 1.70E-06 | 5.66E-01 | 4.55E-09 | 1.52E-03 | 4.55E-09 | 1.52E-03 | ~~6.07E-02~~ 1.74E-01 |
| Zn-65 | | 5.00E-06 | 0.668 | 3.2E-04 | 2.3E-04 | 4.62E+01 | 1.42E-10 | 2.84E-05 | | | | | 1.42E-10 | 2.84E-05 | ~~1.20E-02~~ 4.45E-02 |
| Br-83 | | 9.00E-04 | 0.000 | 3.2E-02 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Kr-83m | NaN | 0.000 | 0.0E+00 | 0.0E+00 | | | | | | | | 0.00E+00 | | - |
| Br-84 | | 4.00E-04 | 0.000 | 1.7E-02 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Br-85 | | NaN | 0.000 | 2.0E-03 | 0.0E+00 | | | | | | | | 0.00E+00 | | - |
| | Kr-85 | NaN | 0.001 | 0.0E+00 | 1.6E-190 | | | | | | | | 1.63E-190 | | - |
| Rb-88 | | 4.00E-04 | 0.000 | 1.0E+00 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Rb-89 | | 9.00E-04 | 0.000 | 4.7E-02 | 0.0E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Sr-89 | 8.00E-06 | 0.138 | 6.3E-04 | 1.3E-04 | 1.65E+01 | 1.78E-36 | 2.22E-31 | | | | | 1.78E-36 | 2.22E-31 | ~~2.07E-30~~ 2.82E-31 |
| Sr-90 | | 5.00E-07 | 29.120 | 3.3E-05 | 3.3E-05 | 6.55E+01 | 2.31E-05 | 4.62E+01 | 8.21E-07 | 1.64E+00 | 1.81E-09 | 3.61E-03 | 1.81E-09 | 3.61E-03 | ~~3.24E-02~~ 4.41E-03 |
| | Y-90 | 7.00E-06 | 0.007 | 7.7E-06 | 3.3E-05 | 4.68E+00 | 2.31E-05 | 3.30E+00 | 8.21E-07 | 1.17E-01 | 1.81E-09 | 2.58E-04 | 1.81E-09 | 2.58E-04 | ~~9.54E-03~~ 1.04E-02 |
| Sr-91 | | 2.00E-05 | 0.001 | 1.0E-03 | 3.8E-91 | 1.90E-86 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Y-91m | 2.00E-03 | 0.000 | 5.2E-04 | 2.4E-91 | 1.20E-88 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Y-91 | 8.00E-06 | 0.160 | 8.1E-05 | 2.3E-05 | 2.82E+00 | 6.93E-33 | 8.66E-28 | | | | | 6.93E-33 | 8.66E-28 | ~~3.23E-26~~ 3.52E-26 |
| Sr-92 | | 4.00E-05 | 0.000 | 1.7E-04 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Y-92 | 4.00E-05 | 0.000 | 1.4E-04 | 8.5E-238 | 2.12E-233 | | | | | | | 8.48E-238 | 2.12E-233 | ~~7.93E-232~~ 8.64E-232 |
| Y-93 | | 2.00E-05 | 0.001 | 6.5E-05 | 3.8E-87 | 1.92E-82 | | | | | | | 3.84E-87 | 1.92E-82 | ~~8.56E-81~~ 9.33E-81 |
| Zr-95 | | 2.00E-05 | 0.175 | 9.3E-05 | 2.7E-05 | 1.34E+00 | 2.68E-05 | 1.34E+00 | 9.50E-07 | 4.75E-02 | 1.09E-07 | 5.45E-03 | 1.09E-07 | 5.45E-03 | ~~1.68E-01~~ 4.58E-02 |
| | Nb-95m | 3.00E-05 | 0.010 | 0.0E+00 | 2.0E-07 | 6.60E-03 | 1.98E-07 | 6.60E-03 | 7.03E-09 | 2.34E-04 | | | 7.03E-09 | 2.34E-04 | ~~7.28E-03~~ 3.19E-03 |
| | Nb-95 | 3.00E-05 | 0.096 | 9.3E-05 | 4.8E-05 | 1.59E+00 | 4.76E-05 | 1.59E+00 | 1.69E-06 | 5.64E-02 | | | 1.69E-06 | 5.64E-02 | ~~1.96E+00~~ 8.59E-01 |
| Mo-99 | | 2.00E-05 | 0.008 | 1.1E-01 | 2.8E-14 | 1.42E-09 | | | | | | | 2.84E-14 | 1.42E-09 | ~~2.57E-09~~ 1.13E-08 |
| | Tc-99m | 1.00E-03 | 0.001 | 4.6E-02 | 2.7E-14 | 2.73E-11 | | | | | | | 2.73E-14 | 2.73E-11 | ~~4.97E-11~~ 1.01E-10 |
| Ru-103 | | 3.00E-05 | 0.108 | 7.7E-05 | 1.0E-05 | 3.37E-01 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Rh-103m | 6.00E-03 | 0.000 | 6.8E-05 | 1.0E-05 | 1.68E-03 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Ru-106 | | 3.00E-06 | 1.008 | 2.7E-05 | 2.2E-05 | 7.25E+00 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Rh-106 | NaN | 0.000 | 2.7E-05 | 2.2E-05 | | 0.00E+00 | | | | | | 0.00E+00 | | ~~0.00E+00~~ |
| Ag-110m | | 6.00E-06 | 0.684 | 2.0E-07 | 1.5E-07 | 2.42E-02 | 1.45E-07 | 2.42E-02 | 5.16E-09 | 8.60E-04 | | | 5.16E-09 | 8.60E-04 | ~~1.97E-02~~ 4.18E-02 |
| | Ag-110 | NaN | 0.000 | 0.0E+00 | 1.9E-09 | | 1.93E-09 | | 6.86E-11 | | | | 6.86E-11 | | ~~0.00E+00~~ |

## Table 2.4-211 - {Transport Analysis for Pathway to Branch 2 through Fill}

(Page 2 of 2)

| Parent Radio-nuclide | Progeny in Chain | ECL[a] (µCi/cm³) | Half-life[b] $t_{1/2}$ (years) | Reactor Coolant Activity[c] (µCi/cm³) | Advection & Radioactive Decay[d] | | +Retardation[e] | | +Dilution[f] | | +Dispersion[g] | | Final Activity[c] (µCi/cm³) | Final Activity / ECL | Bio-Accumulation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Ground Water Activity (µCi/cm³) | Ground Water Activity / ECL | Ground Water Activity (µCi/cm³) | Ground Water Activity / ECL | Surface Water Activity (µCi/cm³) | Surface Water Activity / ECL | Surface Water Activity (µCi/cm³) | Surface Water Activity / ECL | | | Total Dose - Aquatic Ingestion (mrem/year) |
| Te-127m | | 9.00E-06 | 0.298 | 4.4E-04 | 2.1E-04 | **2.35E+01** | 2.12E-04 | **2.35E+01** | 7.52E-06 | **8.35E-01** | 8.13E-07 | **9.03E-02** | 8.13E-07 | 9.03E-02 | ~~3.85E+00~~ 1.49E+01 |
| | Te-127 | 1.00E-04 | 0.001 | 0.0E+00 | 2.1E-04 | **2.07E+00** | 2.07E-04 | **2.07E+00** | 7.36E-06 | **7.36E-02** | 7.93E-07 | 7.93E-03 | 7.93E-07 | 7.93E-03 | ~~3.15E-01~~ 1.22E+00 |
| I-129 | | 2.00E-07 | 15700000 | 4.6E-08 | 4.6E-08 | **2.30E-01** | 4.60E-08 | **2.30E-01** | 1.63E-09 | 8.16E-03 | | | 1.63E-09 | 8.16E-03 | ~~2.54E-02~~ 1.90E-02 |
| I-130 | | 2.00E-05 | 0.001 | 5.0E-02 | 3.0E-69 | 1.51E-64 | | | | | | | 3.01E-69 | 1.51E-64 | ~~8.02E-64~~ 6.02E-64 |
| Te-129m | | 7.00E-06 | 0.092 | 1.5E-03 | 1.4E-04 | **2.00E+01** | 1.40E-04 | **2.00E+01** | 4.97E-06 | **7.09E-01** | 6.77E-07 | **9.67E-02** | 6.77E-07 | 9.67E-02 | ~~4.15E+00~~ 1.61E+01 |
| | Te-129 | 4.00E-04 | 0.000 | 2.4E-03 | 9.1E-05 | **2.28E-01** | 9.11E-05 | **2.28E-01** | 3.23E-06 | 8.08E-03 | | | 3.23E-06 | 8.08E-03 | ~~3.74E-01~~ 1.45E+00 |
| Te-131m | | 8.00E-06 | 0.003 | 3.7E-03 | 7.5E-31 | 9.34E-26 | 7.47E-31 | 9.34E-26 | 2.65E-32 | 3.32E-27 | | | 2.65E-32 | 3.32E-27 | ~~1.39E-25~~ 5.37E-25 |
| | Te-131 | 8.00E-05 | 0.000 | 2.6E-03 | 1.7E-31 | 2.10E-27 | 1.68E-31 | 2.10E-27 | 5.97E-33 | 7.46E-29 | | | 5.97E-33 | 7.46E-29 | ~~3.09E-27~~ 1.20E-26 |
| | I-131 | 1.00E-06 | 0.022 | 7.4E-01 | 3.7E-05 | **3.66E+01** | 3.66E-05 | **3.66E+01** | 1.30E-06 | **1.30E+00** | | | 1.30E-06 | 1.30E+00 | ~~3.90E+00~~ 2.93E+00 |
| Te-132 | | 9.00E-06 | 0.009 | 4.1E-02 | 9.7E-13 | 1.08E-07 | | | | | | | 9.73E-13 | 1.08E-07 | ~~5.25E-06~~ 2.03E-05 |
| | I-132 | 1.00E-04 | 0.000 | 3.7E-01 | 1.0E-12 | 1.00E-08 | | | | | | | 1.00E-12 | 1.00E-08 | ~~3.80E-08~~ 2.85E-08 |
| I-133 | | 7.00E-06 | 0.002 | 1.3E+00 | 1.5E-40 | 2.11E-35 | | | | | | | 1.48E-40 | 2.11E-35 | ~~8.61E-35~~ 6.47E-35 |
| | Xe-133m | NaN | 0.006 | 0.0E+00 | 3.7E-18 | | | | | | | | 3.73E-18 | | - |
| | Xe-133 | NaN | 0.014 | 0.0E+00 | 6.6E-08 | | | | | | | | 6.59E-08 | | - |
| Te-134 | | 3.00E-04 | 0.000 | 6.7E-03 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | I-134 | 4.00E-04 | 0.000 | 2.4E-01 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| I-135 | | 3.00E-05 | 0.001 | 7.9E-01 | 1.6E-126 | 5.32E-122 | | | | | | | 1.60E-126 | 5.32E-122 | ~~2.02E-121~~ 1.52E-121 |
| | Xe-135m | NaN | 0.000 | 0.0E+00 | 2.6E-127 | | | | | | | | 2.56E-127 | | - |
| | Xe-135 | NaN | 0.001 | 0.0E+00 | 8.4E-92 | | | | | | | | 8.38E-92 | | - |
| Cs-134 | | 9.00E-07 | 2.062 | 1.7E-01 | 1.5E-01 | **1.70E+05** | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Cs-136 | | 6.00E-06 | 0.036 | 5.3E-02 | 1.2E-04 | **2.01E+01** | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Cs-137 | | 1.00E-06 | 30 | 1.1E-01 | 1.1E-01 | **1.09E+05** | 1.74E-49 | 1.74E-43 | | | | | 1.74E-49 | 1.74E-43 | ~~2.38E-41~~ 1.63E-42 |
| | Ba-137m | NaN | 0.000 | 1.0E-01 | 1.0E-01 | | 1.64E-49 | | | | | | 1.64E-49 | | ~~0.00E+00~~ |
| Cs-138 | | 4.00E-04 | 0.000 | 2.2E-01 | 0.0E+00 | 0.00E+00 | | | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Ba-140 | | 8.00E-06 | 0.035 | 6.2E-04 | 1.2E-06 | **1.49E-01** | 1.19E-06 | **1.49E-01** | 4.22E-08 | 5.28E-03 | | | 4.22E-08 | 5.28E-03 | ~~3.81E-02~~ 8.99E-03 |
| | La-140 | 9.00E-06 | 0.005 | 1.6E-04 | 1.4E-06 | **1.52E-01** | 1.37E-06 | **1.52E-01** | 4.86E-08 | 5.40E-03 | | | 4.86E-08 | 5.40E-03 | ~~2.01E-01~~ 4.17E-02 |
| Ce-141 | | 3.00E-05 | 0.089 | 8.9E-05 | 7.7E-06 | **2.55E-01** | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Ce-143 | | 2.00E-05 | 0.004 | 7.6E-05 | 5.1E-30 | 2.53E-25 | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| | Pr-143 | 2.00E-05 | 0.037 | 8.8E-05 | 2.7E-07 | **1.35E-02** | 0.00E+00 | 0.00E+00 | | | | | 0.00E+00 | 0.00E+00 | ~~0.00E+00~~ 0.00E+00 |
| Ce-144 | | 3.00E-06 | 0.778 | 6.9E-05 | 5.2E-05 | **1.74E+01** | 6.73E-122 | 2.24E-116 | | | | | 6.73E-122 | 2.24E-116 | ~~6.97E-115~~ 6.00E-115 |
| | Pr-144m | NaN | 0.000 | 0.0E+00 | 9.3E-07 | | 1.20E-123 | | | | | | 1.20E-123 | | ~~0.00E+00~~ |
| | Pr-144 | 6.00E-04 | 0.000 | 6.9E-05 | 5.2E-05 | **8.69E-02** | 6.73E-122 | 1.12E-118 | | | | | 6.73E-122 | 1.12E-118 | ~~0.00E+00~~ |
| W-187 | | 3.00E-05 | 0.003 | 1.8E-03 | 3.1E-38 | 1.03E-33 | | | | | | | 3.10E-38 | 1.03E-33 | ~~1.39E-31~~ 3.83E-33 |
| Np-239 | | 2.00E-05 | 0.006 | 8.7E-04 | 1.736E-18 | 8.68E-14 | 1.74E-18 | 8.68E-14 | 6.16E-20 | 3.08E-15 | | | 6.16E-20 | 3.08E-15 | ~~4.43E-14~~ 8.75E-13 |
| | Pu-239 | 2.00E-08 | 24,065 | 0.0E+00 | 2.331E-10 | **1.17E-02** | 2.33E-10 | **1.17E-02** | 8.27E-12 | 4.14E-04 | | | 8.27E-12 | 4.14E-04 | ~~2.50E-03~~ 7.46E-02 |
| Highlighted values exceed one percent of the ECL. | | | | | | | | | | | | | **Sum =** | **5.20** | ~~**23.02**~~ **73.98** |