

March 26, 2002

10 CFR 50.36a

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

DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT
2001 ANNUAL RADIOACTIVE EFFLUENT RELEASE AND WASTE DISPOSAL
REPORT

Enclosed is the 2001 Annual Radioactive Effluent Release and Waste Disposal Report for the Palisades Plant which is submitted in accordance with 10 CFR 50.36a(a)(2) and Palisades Technical Specification 5.6.3.

This report provides a summary of the quantities of radioactive liquid and gaseous effluent releases and solid radioactive waste processed during the period of January 1, 2001, through December 31, 2001.

SUMMARY OF COMMITMENTS

This letter contains no new commitments and no revisions to existing commitments.

Laurie Lahti

Laurie A. Lahti
Manager, Licensing

CC Administrator, Region III, USNRC
Project Manager, NRR, USNRC
NRC Resident Inspector - Palisades

Enclosure

ENCLOSURE

**NUCLEAR MANAGEMENT COMPANY, LLC
PALISADES PLANT
DOCKET 50-255**

**2001 ANNUAL RADIOACTIVE EFFLUENT RELEASE
AND WASTE DISPOSAL REPORT**

March 2002

4 pages follow

PALISADES NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE AND WASTE DISPOSAL REPORT

JANUARY - DECEMBER 2001

This report provides information relating to radioactive effluent releases and solid radioactive waste shipments at the Palisades Nuclear Plant during the period of January 1, 2001 through December 31, 2001. The report is required by 10 CFR 50.36a(a)(2) and Plant Technical Specification 5.6.3. The report format is detailed in the Offsite Dose Calculation Manual (ODCM), Appendix A.

Plant Operating History

Palisades was taken off line on March 30, 2001 for a refueling outage. The Plant returned to service on May 10, 2001, and remained in service until June 20, 2001, when it was taken off line to repair Primary Coolant System (PCS) leakage. The Plant remained off line for the remainder of 2001 to replace control rod drive mechanism seal housings.

1. Supplemental Information

A. Batch Releases

Information relating to batch release of gaseous and liquid effluents is provided in Attachment 1.

B. Abnormal releases

None

C. Lower Limits of Detection (LLD's) for gaseous and liquid effluents are provided in Attachment 5.

D. Results of the 2001 Radiochemistry Cross Check Program with Analytics are shown in Attachment 6. All results were in agreement for all isotopes on all three detectors. There were a total of 271 measurements made.

E. Radioactive Effluent Monitoring Instrumentation

No radioactive effluent monitoring instrument channels were inoperable for more than 30 days during this reporting period.

2. Gaseous Effluents

Attachment 2 lists and summarizes all gaseous radioactive effluents released during the reporting period. The unidentified beta was 3.74E-05% of the total release.

Gaseous effluents (noble gasses) and resultant beta and gamma doses released during 2001 were 10% lower than the previous year. This is attributed to the extended outage Palisades experienced in 2001. Organ dose (long lived particulates and iodine) was 50% higher than in 2000, due to the release from the containment structure Integrated Leak Rate Test (ILRT) performed during the refueling outage.

3. Liquid Effluents

Attachment 3 lists and summarizes all liquid radioactive effluents released during the reporting period. The unidentified beta was 3.51E-05% of the total release.

No liquid batch releases occurred during the 3rd quarter of 2001, therefore, the total release (not including tritium) was zero. Since only tritium was released in the second quarter, the resultant calculated organ dose was the same value as calculated for the whole body dose.

Overall dose from liquid effluents released during 2001 was about half of that released in 2000, even though liquid release volumes were nearly identical. This is a function of total Curies released. The fission and activation Curies released in 2001 were one-third that of 2000. Release tanks continue to be recirculated through the demineralizers prior to release which reduces activity concentration. Total dilution flow in the second half of 2001 was lower than 2000 due to the extended plant outage.

4. Estimate of Uncertainty

Both the Gaseous and Liquid Summation of Release data sheets include an estimate of the uncertainty associated with the measurement of radioactive effluents. These estimates are based on a statistical analysis of a series of sample results as described in the ODCM, Appendix A. These results are listed in the "Est Total Error %" columns on the Gaseous and Liquid Summation Report.

5. Solid Waste

Attachment 4 summarizes all solid radwaste classification, sources, volume shipped, curie and nuclide content. Radwaste shipments were made either to Barnwell Waste Management Facility in Barnwell, South Carolina or to Envirocare of Utah, Inc. The 2001

waste volume was slightly higher than 2000, however, the Curies shipped in 2001 were a fraction of that of the previous year. The reduction in Curies shipped was due to no shipments of irradiated hardware being made in 2001.

6. Summary of Radiological Impact on Man

Potential doses to individuals and populations were calculated using GASPAR and LADTAP computer program codes. The quarterly values for Curies released were input for each nuclide and summarized as follows:

A. The maximum total body dose to an individual in unrestricted water-related exposure pathways was:

| | |
|------------------|-----------------------------|
| First Quarter - | 3.81 E-05 millirem (adult) |
| Second Quarter- | 2.55 E-04 millirem (adult) |
| Third Quarter - | 3.35 E-08 millirem (adult) |
| Fourth Quarter - | 3.89 E-04 millirem (adult). |

The maximum organ doses were:

| | |
|------------------|-------------------------------------|
| First Quarter - | 3.70 E-05 millirem (adult GI tract) |
| Second Quarter- | 2.15 E-04 millirem (adult GI tract) |
| Third Quarter - | 3.35 E-08 millirem (adult) |
| Fourth Quarter - | 4.80 E-04 millirem (adult liver) |

B. The offsite air doses at the site boundary (0.48 mi SSE) due to noble gases were:

| | |
|------------------|--|
| First Quarter - | 2.13 E-04 millirad beta and 7.25 E-05 millirad gamma |
| Second Quarter - | 2.14 E-04 millirad beta and 7.82 E-05 millirad gamma |
| Third Quarter - | 1.56 E-06 millirad beta and 5.26 E-07 millirad gamma |
| Fourth Quarter - | 0.00 millirad beta and 0.00 millirad gamma |

The maximum noble gas offsite air dose to the nearest residence (0.50 mi S) for beta and gamma occurred during the second quarter, being 1.39 E-04 millirads beta and 5.10 E-05 millirads for gamma. There were no noble gasses released during the fourth quarter.

C. The most restrictive organ dose to an individual in an unrestricted area (based on identified critical receptors) from gaseous effluent releases were:

| | |
|------------------|-------------------------------------|
| First Quarter - | 5.64 E-03 millirem (child thyroid) |
| Second Quarter - | 1.62 E-02 millirem (child thyroid) |
| Third Quarter - | 5.47 E-03 millirem (child thyroid) |
| Fourth Quarter - | 4.98 E-03 millirem (child GI tract) |

D. Integrated total body doses to the general population and average doses to individuals within the population from liquid effluent release pathways to a distance of 50 miles from the site boundary were:

| | |
|------------------|---|
| First Quarter - | 4.28 E-04 person-Rem and 3.69 E-07 millirem |
| Second Quarter- | 2.54 E-03 person-Rem and 2.19 E-06 millirem |
| Third Quarter - | 3.84 E-07 person-Rem and 3.31 E-10 millirem |
| Fourth Quarter - | 2.97 E-03 person-Rem and 2.56 E-06 millirem |

E. Integrated total body doses to the general population and average doses to individuals within the population from gaseous effluent release pathways to a distance of 50 miles from the site boundary were:

| | |
|------------------|--|
| First Quarter - | 1.62 E-02 person-Rem and 1.40 E-05 millirem |
| Second Quarter- | 5.10 E-02 person-Rem and 4.40 E-05 millirem |
| Third Quarter - | 1.81 E-02 person-Rem and 1.56 E-05 millirem |
| Fourth Quarter - | 1.68 E-02 person-Rem and 1.45 E-05 millirem. |

7. Process Control Program (PCP)

There was no revision to the Process Control Program in 2001.

8. Offsite Dose Calculation Manual (ODCM)

Attachment 7 contains the ODCM, Revision 16, along with the safety evaluation per the requirements of Technical Specification 6.5.1.c.3.

Revision 16 to the ODCM involved changes as a result of use of the 2000 Land Use Survey. The Land Use Survey is utilized to ensure that the impact of effluent dose is accurate. These changes are listed below.

- 1) Update of Table 1.4, 2000 Palisades Land Use Census (rev 14)
- 2) Update of Table 1.4a, 2000 Palisades Land Use Census - Critical Receptor Items
- 3) Update of Table 1.9, 2001 Palisades Gaseous Design - Objective Annual Quantities

ATTACHMENT 1

NUCLEAR MANAGEMENT COMPANY, LLC
PALISADES NUCLEAR PLANT

RADIOACTIVE EFFLUENT RELEASE REPORT
BATCH RELEASES

January - December 2001

1 page follows

TABLE HP 10.5-1

PALISADES PLANT RADIOACTIVE
EFFLUENT REPORT

BATCH RELEASES

January 1, 2001 to December 31, 2001

| A. GASEOUS | Units | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
|----------------------|---------|---------|---------|---------|---------|
| Number of Releases | | 5 | 9 | 5 | 4 |
| Total Release Time | Minutes | 497 | 1127 | 495 | 391 |
| Maximum Release Time | Minutes | 150 | 185 | 135 | 180 |
| Average Release Time | Minutes | 99 | 125 | 99 | 98 |
| Minimum Release Time | Minutes | 67 | 82 | 67 | 58 |

| B. LIQUID | Units | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
|----------------------|---------|---------|---------|---------|---------|
| Number of Releases | | 1 | 2 | 0 | 1 |
| Total Release Time | Minutes | 347 | 1156 | N/A | 1947 |
| Maximum Release Time | Minutes | 347 | 594 | N/A | 1947 |
| Average Release Time | Minutes | 347 | 578 | N/A | 1947 |
| Minimum Release Time | Minutes | 347 | 562 | N/A | 1947 |

ATTACHMENT 2

**NUCLEAR MANAGEMENT COMPANY, LLC
PALISADES NUCLEAR PLANT**

**RADIOACTIVE EFFLUENT RELEASE REPORT
GASEOUS EFFLUENTS - SUMMATION OF RELEASES**

January - December 2001

3 pages follow

TABLE HP 10.5-2
PALISADES PLANT RADIOACTIVE
EFFLUENT REPORT

GASEOUS EFFLUENTS - SUMMATION OF RELEASES

January 1, 2001 to December 31, 2001

| A. FISSION AND ACTIVATION GASES | Units | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr | Est Total Error % |
|--|---------|----------|----------|----------|----------|-------------------|
| 1. Total release | Ci | 3.01E+00 | 2.92E+00 | 2.21E-02 | 0.00 | 5.6 |
| 2. Average release rate for period | μCi/sec | 3.88E-01 | 3.72E-01 | 2.78E-03 | 0.00 | |
| 3. Percent of annual avg EC | % | 1.67E-04 | 1.84E-04 | 1.16E-06 | 0.00 | |
| B. IODINES | | | | | | |
| 1. Total Iodine * | Ci | 5.52E-04 | 3.85E-04 | 5.69E-05 | 0.00 | 10.3 |
| 2. Average release rate for period | μCi/sec | 7.09E-05 | 4.90E-05 | 7.16E-06 | 0.00 | |
| 3. Percent of annual avg EC | % | 3.93E-05 | 3.52E-05 | 7.62E-06 | 0.00 | |
| C. PARTICULATES | | | | | | |
| 1. Particulates with half-life > 8 days | Ci | 2.80E-06 | 2.36E-05 | 7.72E-06 | 7.09E-06 | 18.0 |
| 2. Average release rate for period | μCi/sec | 3.59E-07 | 3.01E-06 | 9.71E-07 | 8.92E-07 | |
| 3. Percent of annual avg EC | % | 8.47E-06 | 1.92E-05 | 2.38E-05 | 2.12E-05 | |
| 4. Gross alpha radioactivity | Ci | 5.17E-07 | 2.01E-06 | 3.72E-06 | 2.07E-06 | |
| D. TRITIUM | | | | | | |
| 1. Total Release | Ci | 4.81E+00 | 1.53E+01 | 5.27E+00 | 4.93E+00 | |
| 2. Average release rate for period | μCi/sec | 6.18E-01 | 1.95E+00 | 6.63E-01 | 6.20E-01 | |
| 3. Percent of annual avg EC | % | 1.31E-03 | 4.15E-03 | 1.41E-03 | 1.32E-03 | |
| E. | | | | | | |
| 1. Beta Airdose at Site Boundary Due to Noble Gases (ODCM App A III.C) | mrads | 2.13E-04 | 2.14E-04 | 1.56E-06 | 0.00 | |
| 2. Percent limit | % | 2.13E-03 | 2.14E-03 | 1.56E-05 | 0.00 | |
| 3. Gamma Airdose at Site Boundary Due to Noble Gases (ODCM App A III.C) | mrads | 7.25E-05 | 7.82E-05 | 5.26E-07 | 0.00 | |
| 4. Percent limit | % | 1.45E-03 | 1.56E-03 | 1.05E-05 | 0.00 | |
| F. | | | | | | |
| 1. Maximum Organ Dose to Public Based on Critical Receptors (ODCM App A III.D) | mrem | 5.64E-03 | 1.62E-02 | 5.47E-03 | 4.98E-03 | |
| 2. Percent of limit | % | 7.52E-02 | 2.16E-01 | 7.29E-02 | 6.64E-02 | |

*NOTE: Data is reported for I-131 and I-133 only.

TABLE HP 10.5-2
PALISADES PLANT RADIOACTIVE
EFFLUENT REPORT
 GASEOUS EFFLUENTS
 January 1, 2001 to December 31, 2001

| 1. FISSION GASES | Units | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
|------------------|-------|----------|----------|----------|---------|
| Argon-41 | Ci | 7.33E-04 | <LLD | <LLD | <LLD |
| Krypton-85 | Ci | <LLD | <LLD | <LLD | <LLD |
| Krypton-85m | Ci | <LLD | <LLD | <LLD | <LLD |
| Krypton-87 | Ci | 2.31E-04 | <LLD | <LLD | <LLD |
| Krypton-88 | Ci | <LLD | <LLD | <LLD | <LLD |
| Xenon-131m | Ci | 4.29E-03 | 6.11E-03 | <LLD | <LLD |
| Xenon-133 | Ci | 3.00E+00 | 2.83E+00 | 2.21E-02 | <LLD |
| Xenon-133m | Ci | <LLD | <LLD | <LLD | <LLD |
| Xenon-135 | Ci | 2.21E-03 | 8.53E-02 | <LLD | <LLD |
| Xenon-135m | Ci | 4.44E-03 | 9.41E-04 | <LLD | <LLD |
| Xenon-138 | Ci | <LLD | <LLD | <LLD | <LLD |
| Total for Period | Ci | 3.01E+00 | 2.92E+00 | 2.21E-02 | <LLD |

| 2. IODINES | | | | | |
|------------------|----|----------|----------|----------|------|
| Iodine-131 | Ci | 2.22E-04 | 2.28E-04 | 5.69E-05 | <LLD |
| Iodine-132 | Ci | <LLD | 1.00E-03 | <LLD | <LLD |
| Iodine-133 | Ci | 3.30E-04 | 1.57E-04 | <LLD | <LLD |
| Iodine-134 | Ci | <LLD | <LLD | <LLD | <LLD |
| Iodine-135 | Ci | <LLD | <LLD | <LLD | <LLD |
| Total for Period | Ci | 5.52E-04 | 1.39E-03 | 5.69E-05 | <LLD |

TABLE HP 10.5-2
PALISADES PLANT RADIOACTIVE
EFFLUENT REPORT

| 3. PARTICULATES* | Units | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
|-----------------------|-------|----------|----------|----------|----------|
| Chromium-51 | Ci | <LLD | 1.80E-06 | <LLD | <LLD |
| Cobalt-58 | Ci | <LLD | 1.47E-05 | <LLD | <LLD |
| Iron-59 | Ci | <LLD | <LLD | <LLD | <LLD |
| Cobalt-60 | Ci | <LLD | 4.16E-07 | <LLD | 1.82E-06 |
| Zinc-65 | Ci | <LLD | <LLD | <LLD | <LLD |
| Strontium-89 | Ci | 9.75E-07 | 8.25E-07 | 9.95E-07 | 7.95E-07 |
| Strontium-90 | Ci | 4.80E-07 | 5.15E-07 | 4.95E-07 | 4.65E-07 |
| Niobium-95 | Ci | <LLD | 3.92E-07 | <LLD | <LLD |
| Zirconium-95 | Ci | <LLD | 5.57E-07 | <LLD | <LLD |
| Ruthenium-103 | Ci | <LLD | 1.29E-07 | <LLD | <LLD |
| Cesium-137 | Ci | <LLD | 7.92E-07 | 1.51E-06 | <LLD |
| Cerium-144 | Ci | <LLD | <LLD | <LLD | <LLD |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Net unidentified beta | Ci | 1.34E-06 | 3.51E-06 | 4.72E-06 | 4.01E-06 |
| Total | | 2.80E-06 | 2.36E-05 | 7.72E-06 | 7.09E-06 |

*Particulates with half-lives > 8 days.

ATTACHMENT 3

**NUCLEAR MANAGEMENT COMPANY, LLC
PALISADES NUCLEAR PLANT**

**RADIOACTIVE EFFLUENT RELEASE REPORT
LIQUID EFFLUENTS - SUMMATION OF RELEASES**

January - December 2001

2 pages follow

TABLE HP 10.5-3
PALISADES PLANT RADIOACTIVE
EFFLUENT REPORT
LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES
January 1, 2001 to December 31, 2001

| A. FISSION AND ACTIVATION PRODUCTS | Units | Ist Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr | Est Total Error % |
|--|--------|----------|----------|----------|----------|-------------------|
| 1. Total release (not including tritium, gases, alpha) | Ci | 2.81E-06 | 2.45E-04 | 0.000 | 3.68E-05 | 26.0 |
| 2. Average release rate for period | μCi/ml | 7.35E-14 | 9.68E-12 | N/A | 3.79E-12 | |
| 3. Percent of EC | % | 1.29E-05 | 6.02E-04 | N/A | 3.91E-04 | |
| B. TRITIUM | | | | | | |
| 1. Total Release | Ci | 2.73E+01 | 9.87E+01 | 6.80E-03 | 3.70E+01 | 4.01 |
| 2. Average diluted concentration during period | μCi/ml | 7.15E-07 | 3.90E-06 | 6.36E-10 | 3.82E-06 | |
| 3. Percent of EC | % | 7.15E-02 | 3.90E-01 | 6.36E-05 | 3.82E-01 | |
| C. DISSOLVED AND ENTRAINED GASES | | | | | | |
| 1. Total Release | Ci | 0.000 | 0.000 | 0.000 | 0.000 | N/A |
| 2. Average diluted concentration during period | μCi/ml | N/A | N/A | N/A | N/A | |
| 3. Percent of EC | % | N/A | N/A | N/A | N/A | |
| D. GROSS ALPHA RADIOACTIVITY (Total Release) | Ci | 7.45E-08 | 2.13E-06 | 0.000 | 1.65E-07 | |
| E. VOLUME OF WASTE RELEASED (Prior to Dilution) | Liters | 1.02E+05 | 3.78E+05 | 0.000 | 1.70E+05 | |
| F. VOLUME OF DILUTION WATER USED DURING PERIOD | Liters | 3.82E+10 | 2.53E+10 | 1.07E+10 | 9.68E+09 | |
| G. MAXIMUM DOSE COMMITMENT - WHOLEBODY | mrem | 3.81E-05 | 2.55E-04 | 3.35E-08 | 3.89E-04 | |
| Percent of ODCM App A III.H limit | % | 2.54E-03 | 1.70E-02 | 2.23E-06 | 2.59E-02 | |
| H. MAXIMUM DOSE COMMITMENT - ORGAN | mrem | 3.70E-05 | 2.15E-04 | 3.35E-08 | 4.80E-04 | |
| Percent of ODCM App A III.H limit | % | 7.40E-04 | 4.30E-03 | 6.70E-07 | 9.60E-03 | |

TABLE HP 10.5-3
PALISADES PLANT RADIOACTIVE
EFFLUENT REPORT

LIQUID EFFLUENTS
January 1, 2001 to December 31, 2001

| 1. NUCLIDES RELEASED | Units | Ist Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr |
|------------------------------------|-------|----------|----------|----------|----------|
| Manganese-54 | Ci | <LLD | <LLD | <LLD | <LLD |
| Cobalt-58 | Ci | <LLD | 2.23E-05 | <LLD | <LLD |
| Iron-59 | Ci | <LLD | <LLD | <LLD | <LLD |
| Cobalt-60 | Ci | <LLD | 3.44E-05 | <LLD | <LLD |
| Zirconium-95 | Ci | <LLD | <LLD | <LLD | <LLD |
| Strontium-89 | Ci | 3.57E-07 | 1.02E-06 | <LLD | 5.44E-07 |
| Strontium-90 | Ci | 2.45E-06 | 1.97E-06 | <LLD | 1.62E-06 |
| Silver-110m | Ci | <LLD | 1.28E-04 | <LLD | <LLD |
| Iodine-131 | Ci | <LLD | <LLD | <LLD | <LLD |
| Cesium-134 | Ci | <LLD | <LLD | <LLD | <LLD |
| Cesium-137 | Ci | <LLD | <LLD | <LLD | 3.46E-05 |
| Niobium-95 | Ci | <LLD | <LLD | <LLD | <LLD |
| Silver-110m | Ci | <LLD | <LLD | <LLD | <LLD |
| Antimony-125 | Ci | <LLD | <LLD | <LLD | <LLD |
| Net unidentified beta | Ci | <LLD | 5.72E-05 | <LLD | <LLD |
| Fission & Activation Product Total | Ci | 2.81E-06 | 2.45E-04 | 0.00 | 3.68E-05 |
| Tritium | Ci | 2.73E+01 | 9.87E+01 | 6.80E-03 | 3.70E+01 |
| Grand Total | Ci | 2.73E+01 | 9.87E+01 | 6.80E-03 | 3.70E+01 |

ATTACHMENT 4

NUCLEAR MANAGEMENT COMPANY, LLC
PALISADES NUCLEAR PLANT

RADIOACTIVE EFFLUENT RELEASE REPORT
SOLID WASTE

January - December 2001

1 page follows

SOLID WASTE

January 1, 2001 To December 31, 2001

| <u>Waste Class</u> | <u>Source of Waste</u> | <u>Solidification Agent</u> | <u>Container Type</u> | <u>Volume (cu ft)</u> | <u>*Total Curies</u> | <u>*Principal Radionuclides</u> |
|--------------------|------------------------|-----------------------------|-----------------------|------------------------|----------------------|--|
| AS | DAW | N/A | HIC | 194.1 | 1.05 | Co-60, Cs-137, Co-58, Cs-134, Mn-54, Fe-55, Nb-95, Ag-110m, Zr-95, Sb-125, Ni-63 |
| B | DAW | N/A | HIC | 195.7 | 0.63 | Same as above |
| AU | DAW | N/A | LSA | 1638.8 | 0.47 | Same as above |
| AS | Evap Bottoms | N/A | HIC | 256.0 | 4.25 | Co-60, Cs-137, Co-58, Cs-134, Mn-54, Fe-55, Zn-65, Sb-125, Ni-63, Ag-110m |
| TOTAL | | | | 2284.6 ft ³ | 6.40 Ci | |

*NOTE: Gamma isotopes are measured quantities; all other isotopes are estimated

ATTACHMENT 5

NUCLEAR MANAGEMENT COMPANY, LLC
PALISADES NUCLEAR PLANT

RADIOACTIVE EFFLUENT RELEASE REPORT
LOWER LIMITS OF DETECTION FOR PALISADES EFFLUENTS

January - December 2001

1 page follows

LOWER LIMITS OF DETECTION (LLDs) FOR PALISADES EFFLUENTS

| <u>Gaseous Effluents</u> | <u>Nuclide</u> | <u>LLD (uci/cc)*</u> |
|--------------------------|----------------|----------------------|
| | <u>Mn-54</u> | <u>1.36E-14</u> |
| | <u>Co-58</u> | <u>2.33E-14</u> |
| | <u>Fe-59</u> | <u>5.51E-14</u> |
| | <u>Co-60</u> | <u>6.49E-14</u> |
| | <u>Zn-65</u> | <u>6.36E-14</u> |
| 01-042-St | <u>Zr-95</u> | <u>3.02E-14</u> |
| 01-040-G | <u>Mo-99</u> | <u>1.22E-13</u> |
| | <u>I-131</u> | <u>2.80E-14</u> |
| | <u>I-133</u> | <u>1.83E-14</u> |
| | <u>Cs-134</u> | <u>2.15E-14</u> |
| | <u>Cs-137</u> | <u>2.81E-14</u> |
| | <u>Ce-141</u> | <u>2.02E-14</u> |
| | <u>Ce-144</u> | <u>9.46E-14</u> |
| | <u>Kr-87</u> | <u>1.78E-06</u> |
| | <u>Kr-88</u> | <u>1.14E-06</u> |
| | <u>Xe-133</u> | <u>6.75E-07</u> |
| | <u>Xe-133m</u> | <u>1.93E-06</u> |
| | <u>Xe-135</u> | <u>2.64E-07</u> |
| | <u>Xe-138</u> | <u>3.44E-05</u> |

| <u>Liquid Effluents</u> | <u>Nuclide</u> | <u>LLD (uci/ml)**</u> |
|-------------------------|----------------|-----------------------|
| | <u>Mn-54</u> | <u>1.30E-07</u> |
| | <u>Fe-59</u> | <u>2.49E-07</u> |
| | <u>Co-58</u> | <u>1.02E-07</u> |
| | <u>Co-60</u> | <u>2.17E-07</u> |
| | <u>Zn-65</u> | <u>2.10E-07</u> |
| Liquid Batch Release | <u>Mo-99</u> | <u>8.89E-07</u> |
| 01-005-R | <u>I-131</u> | <u>9.05E-08</u> |
| 01-019-R | <u>Cs-134</u> | <u>1.09E-07</u> |
| | <u>Cs-137</u> | <u>1.34E-07</u> |
| | <u>Ce-141</u> | <u>1.12E-07</u> |
| | <u>Ce-144</u> | <u>3.59E-07</u> |

* From a typical Stack release analysis.

** From a typical Liquid release analysis.

ATTACHMENT 6

NUCLEAR MANAGEMENT COMPANY, LLC
PALISADES NUCLEAR PLANT

RADIOACTIVE EFFLUENT RELEASE REPORT
RESULTS OF 2001 RADIOCHEMISTRY CROSS CHECK PROGRAM

15 pages follow

ANALYTICS

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RESULTS OF RADIOCHEMISTRY

CROSS CHECK PROGRAM

CONSUMERS POWER COMPANY

PALISADES PLANT

First Quarter 2001

D.M. Montgomery 3-23-01
Daniel M. Montgomery, QA Manager

| SAMPLE | ANALYSIS | PALISADES | ANALYTICS | RATIO | | COMPARISON |
|-----------|----------|------------------------|------------------------|-------------------------|------------|------------|
| | | VALUE microCi/cc/mL | VALUE microCi/cc/mL | PALISADES: ANALYTICS | RESOLUTION | |
| ***** | | | | | | |
| A14016-66 | Ce-141 | 3.22E-05 | 3.30E-05 | 0.98 | 20 | AGREEMENT |
| SOLID | Cr-51 | 9.59E-05 | 9.64E-05 | 0.99 | 20 | AGREEMENT |
| DET. #1 | Cs-134 | 2.26E-05 | 2.27E-05 | 1.00 | 20 | AGREEMENT |
| | Cs-137 | 1.80E-05 | 1.74E-05 | 1.04 | 20 | AGREEMENT |
| | Co-58 | 1.14E-05 | 1.13E-05 | 1.01 | 20 | AGREEMENT |
| | Mn-54 | 2.02E-05 | 1.86E-05 | 1.09 | 20 | AGREEMENT |
| | Fe-59 | 2.62E-05 | 2.44E-05 | 1.08 | 20 | AGREEMENT |
| | Zn-65 | 3.57E-05 | 3.50E-05 | 1.02 | 20 | AGREEMENT |
| | Co-60 | 2.47E-05 | 2.53E-05 | 0.98 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14016-66 | Ce-141 | 3.28E-05 | 3.30E-05 | 1.00 | 20 | AGREEMENT |
| SOLID | Cr-51 | 9.19E-05 | 9.64E-05 | 0.95 | 20 | AGREEMENT |
| DET.#2 | Cs-134 | 2.17E-05 | 2.27E-05 | 0.96 | 20 | AGREEMENT |
| | Cs-137 | 1.69E-05 | 1.74E-05 | 0.97 | 20 | AGREEMENT |
| | Co-58 | 1.11E-05 | 1.13E-05 | 0.98 | 20 | AGREEMENT |
| | Mn-54 | 1.84E-05 | 1.86E-05 | 0.99 | 20 | AGREEMENT |
| | Fe-59 | 2.41E-05 | 2.44E-05 | 0.99 | 20 | AGREEMENT |
| | Zn-65 | 3.39E-05 | 3.50E-05 | 0.97 | 20 | AGREEMENT |
| | Co-60 | 2.45E-05 | 2.53E-05 | 0.97 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14016-66 | Ce-141 | 3.18E-05 | 3.30E-05 | 0.96 | 20 | AGREEMENT |
| SOLID | Cr-51 | 9.65E-05 | 9.64E-05 | 1.00 | 20 | AGREEMENT |
| DET#3 | Cs-134 | 2.25E-05 | 2.27E-05 | 0.99 | 20 | AGREEMENT |
| | Cs-137 | 1.78E-05 | 1.74E-05 | 1.03 | 20 | AGREEMENT |
| | Co-58 | 1.12E-05 | 1.13E-05 | 0.99 | 20 | AGREEMENT |
| | Mn-54 | 1.97E-05 | 1.86E-05 | 1.06 | 20 | AGREEMENT |
| | Fe-59 | 2.59E-05 | 2.44E-05 | 1.06 | 20 | AGREEMENT |
| | Zn-65 | 3.56E-05 | 3.50E-05 | 1.02 | 20 | AGREEMENT |
| | Co-60 | 2.43E-05 | 2.53E-05 | 0.96 | 20 | AGREEMENT |
| ***** | | | | | | |

| SAMPLE | ANALYSIS | PALISADES | ANALYTICS | RATIO | RESOLUTION | COMPARISON |
|-----------|----------|------------------------|------------------------|-------------------------|------------|------------|
| | | VALUE microCi/cc/mL | VALUE microCi/cc/mL | PALISADES: ANALYTICS | | |
| ***** | | | | | | |
| A14017-66 | Ce-141 | 3.10E-05 | 3.28E-05 | 0.94 | 20 | AGREEMENT |
| GAS | Cr-51 | 9.12E-05 | 9.60E-05 | 0.95 | 20 | AGREEMENT |
| DET. #1 | Cs-134 | 2.06E-05 | 2.26E-05 | 0.91 | 20 | AGREEMENT |
| | Cs-137 | 1.59E-05 | 1.73E-05 | 0.92 | 20 | AGREEMENT |
| | Co-58 | 1.12E-05 | 1.13E-05 | 0.99 | 20 | AGREEMENT |
| | Mn-54 | 1.82E-05 | 1.85E-05 | 0.98 | 20 | AGREEMENT |
| | Fe-59 | 2.38E-05 | 2.43E-05 | 0.98 | 20 | AGREEMENT |
| | Zn-65 | 3.35E-05 | 3.48E-05 | 0.96 | 20 | AGREEMENT |
| | Co-60 | 2.38E-05 | 2.52E-05 | 0.95 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14017-66 | Ce-141 | 3.06E-05 | 3.28E-05 | 0.93 | 20 | AGREEMENT |
| GAS | Cr-51 | 9.10E-05 | 9.60E-05 | 0.95 | 20 | AGREEMENT |
| DET. #2 | Cs-134 | 2.05E-05 | 2.26E-05 | 0.91 | 20 | AGREEMENT |
| | Cs-137 | 1.61E-05 | 1.73E-05 | 0.93 | 20 | AGREEMENT |
| | Co-58 | 1.11E-05 | 1.13E-05 | 0.98 | 20 | AGREEMENT |
| | Mn-54 | 1.81E-05 | 1.85E-05 | 0.98 | 20 | AGREEMENT |
| | Fe-59 | 2.43E-05 | 2.43E-05 | 1.00 | 20 | AGREEMENT |
| | Zn-65 | 3.15E-05 | 3.48E-05 | 0.90 | 20 | AGREEMENT |
| | Co-60 | 2.27E-05 | 2.52E-05 | 0.90 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14017-66 | Ce-141 | 2.97E-05 | 3.28E-05 | 0.90 | 20 | AGREEMENT |
| GAS | Cr-51 | 9.16E-05 | 9.60E-05 | 0.95 | 20 | AGREEMENT |
| DET. #3 | Cs-134 | 2.12E-05 | 2.26E-05 | 0.94 | 20 | AGREEMENT |
| | Cs-137 | 1.67E-05 | 1.73E-05 | 0.97 | 20 | AGREEMENT |
| | Co-58 | 1.13E-05 | 1.13E-05 | 1.00 | 20 | AGREEMENT |
| | Mn-54 | 1.83E-05 | 1.85E-05 | 0.99 | 20 | AGREEMENT |
| | Fe-59 | 2.45E-05 | 2.43E-05 | 1.01 | 20 | AGREEMENT |
| | Zn-65 | 3.31E-05 | 3.48E-05 | 0.95 | 20 | AGREEMENT |
| | Co-60 | 2.40E-05 | 2.52E-05 | 0.95 | 20 | AGREEMENT |
| ***** | | | | | | |

| SAMPLE | ANALYSIS | PALISADES | ANALYTICS | RATIO | RESOLUTION | COMPARISON |
|-----------|----------|------------------------|------------------------|-------------------------|------------|------------|
| | | VALUE microCi/cc/mL | VALUE microCi/cc/mL | PALISADES: ANALYTICS | | |
| ***** | | | | | | |
| A14018-66 | Ce-141 | 4.52E-04 | 4.35E-04 | 1.04 | 20 | AGREEMENT |
| SOLID | Cr-51 | 1.36E-03 | 1.27E-03 | 1.07 | 20 | AGREEMENT |
| DET. #1 | Cs-134 | 2.84E-04 | 2.99E-04 | 0.95 | 20 | AGREEMENT |
| | Cs-137 | 2.34E-04 | 2.29E-04 | 1.02 | 20 | AGREEMENT |
| | Co-58 | 1.59E-04 | 1.49E-04 | 1.07 | 20 | AGREEMENT |
| | Mn-54 | 2.66E-04 | 2.45E-04 | 1.08 | 20 | AGREEMENT |
| | Fe-59 | 3.39E-04 | 3.21E-04 | 1.06 | 20 | AGREEMENT |
| | Zn-65 | 4.90E-04 | 4.61E-04 | 1.06 | 20 | AGREEMENT |
| | Co-60 | 3.34E-04 | 3.33E-04 | 1.00 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14018-66 | Ce-141 | 3.42E-04 | 4.35E-04 | 0.79 | 20 | AGREEMENT |
| SOLID | Cr-51 | 1.25E-03 | 1.27E-03 | 0.98 | 20 | AGREEMENT |
| DET. #2 | Cs-134 | 2.77E-04 | 2.99E-04 | 0.93 | 20 | AGREEMENT |
| | Cs-137 | 2.24E-04 | 2.29E-04 | 0.98 | 20 | AGREEMENT |
| | Co-58 | 1.51E-04 | 1.49E-04 | 1.01 | 20 | AGREEMENT |
| | Mn-54 | 2.47E-04 | 2.45E-04 | 1.01 | 20 | AGREEMENT |
| | Fe-59 | 3.08E-04 | 3.21E-04 | 0.96 | 20 | AGREEMENT |
| | Zn-65 | 4.58E-04 | 4.61E-04 | 0.99 | 20 | AGREEMENT |
| | Co-60 | 3.09E-04 | 3.33E-04 | 0.93 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14018-66 | Ce-141 | 4.20E-04 | 4.35E-04 | 0.97 | 20 | AGREEMENT |
| SOLID | Cr-51 | 1.29E-03 | 1.27E-03 | 1.01 | 20 | AGREEMENT |
| DET. #3 | Cs-134 | 2.93E-04 | 2.99E-04 | 0.98 | 20 | AGREEMENT |
| | Cs-137 | 2.24E-04 | 2.29E-04 | 0.98 | 20 | AGREEMENT |
| | Co-58 | 1.57E-04 | 1.49E-04 | 1.05 | 20 | AGREEMENT |
| | Mn-54 | 2.60E-04 | 2.45E-04 | 1.06 | 20 | AGREEMENT |
| | Fe-59 | 3.38E-04 | 3.21E-04 | 1.05 | 20 | AGREEMENT |
| | Zn-65 | 4.65E-04 | 4.61E-04 | 1.01 | 20 | AGREEMENT |
| | Co-60 | 3.22E-04 | 3.33E-04 | 0.97 | 20 | AGREEMENT |
| ***** | | | | | | |

| SAMPLE | ANALYSIS | PALISADES | ANALYTICS | RATIO | RESOLUTION | COMPARISON |
|-----------------|------------|------------------------|------------------------|-------------------------|------------|------------|
| | | VALUE microCi/cc/mL | VALUE microCi/cc/mL | PALISADES: ANALYTICS | | |
| A14019-66 | Gross Beta | 3.34E-03 | 3.62E-03 | 0.92 | 17 | AGREEMENT |
| LIQUID | | | | | | |
| DET. 102764 | | | | | | |
| A14019-66 | Gross Beta | 3.49E-03 | 3.62E-03 | 0.97 | 17 | AGREEMENT |
| LIQUID | | | | | | |
| DET. 8428-01130 | | | | | | |

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RESULTS OF RADIOCHEMISTRY

CROSS CHECK PROGRAM

CONSUMERS POWER COMPANY

PALISADES PLANT

SECOND QUARTER 2001

D.M. Montgomery 8-15-01
Daniel M. Montgomery, QA Manager

| SAMPLE | ANALYSIS | PALISADES | ANALYTICS | RATIO | | |
|-----------|----------|---------------------|---------------------|-------------------------|------------|------------|
| | | VALUE microCi/cc | VALUE microCi/cc | PALISADES: ANALYTICS | RESOLUTION | COMPARISON |
| A14404-66 | Ce-141 | 4.70E-02 | 4.94E-02 | 0.95 | 20 | AGREEMENT |
| FILTER | Cr-51 | 7.59E-02 | 7.71E-02 | 0.98 | 20 | AGREEMENT |
| DET. #1 | Cs-134 | 1.81E-02 | 2.03E-02 | 0.89 | 20 | AGREEMENT |
| | Cs-137 | 1.91E-02 | 1.79E-02 | 1.07 | 20 | AGREEMENT |
| | Co-58 | 2.01E-02 | 1.98E-02 | 1.02 | 20 | AGREEMENT |
| | Mn-54 | 2.54E-02 | 2.39E-02 | 1.06 | 20 | AGREEMENT |
| | Fe-59 | 2.42E-02 | 2.18E-02 | 1.11 | 20 | AGREEMENT |
| | Zn-65 | 3.14E-02 | 2.94E-02 | 1.07 | 20 | AGREEMENT |
| | Co-60 | 2.00E-02 | 2.01E-02 | 0.99 | 20 | AGREEMENT |
| A14404-66 | Ce-141 | 4.88E-02 | 4.94E-02 | 0.99 | 20 | AGREEMENT |
| FILTER | Cr-51 | 7.56E-02 | 7.71E-02 | 0.98 | 20 | AGREEMENT |
| DET. #2 | Cs-134 | 1.88E-02 | 2.03E-02 | 0.93 | 20 | AGREEMENT |
| | Cs-137 | 1.91E-02 | 1.79E-02 | 1.07 | 20 | AGREEMENT |
| | Co-58 | 2.00E-02 | 1.98E-02 | 1.01 | 20 | AGREEMENT |
| | Mn-54 | 2.52E-02 | 2.39E-02 | 1.06 | 20 | AGREEMENT |
| | Fe-59 | 2.26E-02 | 2.18E-02 | 1.04 | 20 | AGREEMENT |
| | Zn-65 | 2.98E-02 | 2.94E-02 | 1.01 | 20 | AGREEMENT |
| | Co-60 | 1.94E-02 | 2.01E-02 | 0.96 | 20 | AGREEMENT |
| A14404-66 | Ce-141 | 4.74E-02 | 4.94E-02 | 0.96 | 20 | AGREEMENT |
| FILTER | Cr-51 | 7.64E-02 | 7.71E-02 | 0.99 | 20 | AGREEMENT |
| DET. #3 | Cs-134 | 1.90E-02 | 2.03E-02 | 0.94 | 20 | AGREEMENT |
| | Cs-137 | 1.98E-02 | 1.79E-02 | 1.11 | 20 | AGREEMENT |
| | Co-58 | 2.06E-02 | 1.98E-02 | 1.04 | 20 | AGREEMENT |
| | Mn-54 | 2.60E-02 | 2.39E-02 | 1.09 | 20 | AGREEMENT |
| | Fe-59 | 2.36E-02 | 2.18E-02 | 1.08 | 20 | AGREEMENT |
| | Zn-65 | 3.11E-02 | 2.94E-02 | 1.06 | 20 | AGREEMENT |
| | Co-60 | 2.04E-02 | 2.01E-02 | 1.01 | 20 | AGREEMENT |

| SAMPLE | ANALYSIS | PALISADES | ANALYTICS | RATIO | | COMPARISON |
|-----------|----------|---------------------|---------------------|-------------------------|------------|------------|
| | | VALUE microCi/cc | VALUE microCi/cc | PALISADES: ANALYTICS | RESOLUTION | |
| ***** | | | | | | |
| A14405-66 | Ce-141 | 4.70E-02 | 5.11E-02 | 0.92 | 20 | AGREEMENT |
| CARTRIDGE | Cr-51 | 7.59E-02 | 7.97E-02 | 0.95 | 20 | AGREEMENT |
| DET. #1 | Cs-134 | 1.81E-02 | 2.09E-02 | 0.86 | 20 | AGREEMENT |
| | Cs-137 | 1.91E-02 | 1.85E-02 | 1.04 | 20 | AGREEMENT |
| | Co-58 | 2.01E-02 | 2.04E-02 | 0.98 | 20 | AGREEMENT |
| | Mn-54 | 2.54E-02 | 2.46E-02 | 1.03 | 20 | AGREEMENT |
| | Fe-59 | 2.42E-02 | 2.25E-02 | 1.07 | 20 | AGREEMENT |
| | Zn-65 | 3.14E-02 | 3.04E-02 | 1.03 | 20 | AGREEMENT |
| | Co-60 | 2.00E-02 | 2.08E-02 | 0.96 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14405-66 | Ce-141 | 5.26E-02 | 5.11E-02 | 1.03 | 20 | AGREEMENT |
| CARTRIDGE | Cr-51 | 7.98E-02 | 7.97E-02 | 1.00 | 20 | AGREEMENT |
| DET. #2 | Cs-134 | 1.99E-02 | 2.09E-02 | 0.95 | 20 | AGREEMENT |
| | Cs-137 | 1.98E-02 | 1.85E-02 | 1.07 | 20 | AGREEMENT |
| | Co-58 | 2.10E-02 | 2.04E-02 | 1.03 | 20 | AGREEMENT |
| | Mn-54 | 2.65E-02 | 2.46E-02 | 1.08 | 20 | AGREEMENT |
| | Fe-59 | 2.47E-02 | 2.25E-02 | 1.10 | 20 | AGREEMENT |
| | Zn-65 | 3.37E-02 | 3.04E-02 | 1.11 | 20 | AGREEMENT |
| | Co-60 | 2.18E-02 | 2.08E-02 | 1.05 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14405-66 | Ce-141 | 4.80E-02 | 5.11E-02 | 0.94 | 20 | AGREEMENT |
| CARTRIDGE | Cr-51 | 7.66E-02 | 7.97E-02 | 0.96 | 20 | AGREEMENT |
| DET. #3 | Cs-134 | 1.89E-02 | 2.09E-02 | 0.90 | 20 | AGREEMENT |
| | Cs-137 | 1.86E-02 | 1.85E-02 | 1.01 | 20 | AGREEMENT |
| | Co-58 | 1.98E-02 | 2.04E-02 | 0.97 | 20 | AGREEMENT |
| | Mn-54 | 2.54E-02 | 2.46E-02 | 1.03 | 20 | AGREEMENT |
| | Fe-59 | 2.37E-02 | 2.25E-02 | 1.05 | 20 | AGREEMENT |
| | Zn-65 | 3.18E-02 | 3.04E-02 | 1.05 | 20 | AGREEMENT |
| | Co-60 | 2.11E-02 | 2.08E-02 | 1.01 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14406-66 | Tritium | 1.90E-03 | 1.77E-03 | 1.07 | 12.5 | AGREEMENT |
| LIQUID | | | | | | |
| ***** | | | | | | |

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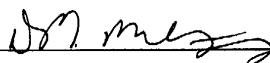
RESULTS OF RADIOCHEMISTRY

CROSS CHECK PROGRAM

CONSUMERS POWER COMPANY

PALISADES PLANT

THIRD QUARTER, 2001

 10-2-01

Daniel M. Montgomery, QA Manager

| SAMPLE | ANALYSIS | PALISADES | ANALYTICS | RATIO | | COMPARISON |
|-----------|----------|---------------------|---------------------|-------------------------|------------|------------|
| | | VALUE microCi/cc | VALUE microCi/cc | PALISADES: ANALYTICS | RESOLUTION | |
| ***** | | | | | | |
| A14687-66 | Ce-141 | 4.15E-04 | 4.05E-04 | 1.02 | 20 | AGREEMENT |
| SIMULATED | Cr-51 | 1.44E-03 | 1.43E-03 | 1.01 | 20 | AGREEMENT |
| GAS | Cs-134 | 2.12E-04 | 2.29E-04 | 0.93 | 20 | AGREEMENT |
| DET. 1 | Cs-137 | 4.56E-04 | 4.43E-04 | 1.03 | 20 | AGREEMENT |
| | Co-58 | 3.82E-04 | 3.67E-04 | 1.04 | 20 | AGREEMENT |
| | Mn-54 | 3.31E-04 | 3.11E-04 | 1.06 | 20 | AGREEMENT |
| | Fe-59 | 2.43E-04 | 2.26E-04 | 1.08 | 20 | AGREEMENT |
| | Zn-65 | 4.20E-04 | 3.96E-04 | 1.06 | 20 | AGREEMENT |
| | Co-60 | 3.83E-04 | 3.73E-04 | 1.03 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14687-66 | Ce-141 | 3.94E-04 | 4.05E-04 | 0.97 | 20 | AGREEMENT |
| SIMULATED | Cr-51 | 1.31E-03 | 1.43E-03 | 0.92 | 20 | AGREEMENT |
| GAS | Cs-134 | 2.08E-04 | 2.29E-04 | 0.91 | 20 | AGREEMENT |
| DET. 2 | Cs-137 | 4.18E-04 | 4.43E-04 | 0.94 | 20 | AGREEMENT |
| | Co-58 | 3.55E-04 | 3.67E-04 | 0.97 | 20 | AGREEMENT |
| | Mn-54 | 3.04E-04 | 3.11E-04 | 0.98 | 20 | AGREEMENT |
| | Fe-59 | 2.25E-04 | 2.26E-04 | 1.00 | 20 | AGREEMENT |
| | Zn-65 | 3.63E-04 | 3.96E-04 | 0.92 | 20 | AGREEMENT |
| | Co-60 | 3.40E-04 | 3.73E-04 | 0.91 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14687-66 | Ce-141 | 4.34E-04 | 4.05E-04 | 1.07 | 20 | AGREEMENT |
| SIMULATED | Cr-51 | 1.52E-03 | 1.43E-03 | 1.06 | 20 | AGREEMENT |
| GAS | Cs-134 | 2.32E-04 | 2.29E-04 | 1.01 | 20 | AGREEMENT |
| DET. 3 | Cs-137 | 4.76E-04 | 4.43E-04 | 1.08 | 20 | AGREEMENT |
| | Co-58 | 4.02E-04 | 3.67E-04 | 1.10 | 20 | AGREEMENT |
| | Mn-54 | 3.78E-04 | 3.11E-04 | 1.22 | 20 | AGREEMENT |
| | Fe-59 | 2.49E-04 | 2.26E-04 | 1.10 | 20 | AGREEMENT |
| | Zn-65 | 4.48E-04 | 3.96E-04 | 1.13 | 20 | AGREEMENT |
| | Co-60 | 4.05E-04 | 3.73E-04 | 1.09 | 20 | AGREEMENT |
| ***** | | | | | | |

| SAMPLE | ANALYSIS | PALISADES | ANALYTICS | RATIO | | COMPARISON |
|-----------|----------|---------------------|---------------------|-------------------------|------------|------------|
| | | VALUE microCi/cc | VALUE microCi/cc | PALISADES: ANALYTICS | RESOLUTION | |
| ***** | | | | | | |
| A14688-66 | Ce-141 | 2.79E-05 | 2.92E-05 | 0.95 | 20 | AGREEMENT |
| SAND | Cr-51 | 9.89E-05 | 1.03E-04 | 0.96 | 20 | AGREEMENT |
| DET. 1 | Cs-134 | 1.54E-05 | 1.65E-05 | 0.93 | 20 | AGREEMENT |
| | Cs-137 | 3.16E-05 | 3.19E-05 | 0.99 | 20 | AGREEMENT |
| | Co-58 | 2.65E-05 | 2.65E-05 | 1.00 | 20 | AGREEMENT |
| | Mn-54 | 2.20E-05 | 2.24E-05 | 0.98 | 20 | AGREEMENT |
| | Fe-59 | 1.65E-05 | 1.63E-05 | 1.01 | 20 | AGREEMENT |
| | Zn-65 | 2.80E-05 | 2.85E-05 | 0.98 | 20 | AGREEMENT |
| | Co-60 | 2.65E-05 | 2.69E-05 | 0.98 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14688-66 | Ce-141 | 2.85E-05 | 2.92E-05 | 0.97 | 20 | AGREEMENT |
| SAND | Cr-51 | 9.72E-05 | 1.03E-04 | 0.94 | 20 | AGREEMENT |
| DET. 2 | Cs-134 | 1.50E-05 | 1.65E-05 | 0.91 | 20 | AGREEMENT |
| | Cs-137 | 3.07E-05 | 3.19E-05 | 0.96 | 20 | AGREEMENT |
| | Co-58 | 2.55E-05 | 2.65E-05 | 0.96 | 20 | AGREEMENT |
| | Mn-54 | 2.11E-05 | 2.24E-05 | 0.94 | 20 | AGREEMENT |
| | Fe-59 | 1.48E-05 | 1.63E-05 | 0.91 | 20 | AGREEMENT |
| | Zn-65 | 2.95E-05 | 2.85E-05 | 1.03 | 20 | AGREEMENT |
| | Co-60 | 2.54E-05 | 2.69E-05 | 0.94 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14688-66 | Ce-141 | 2.78E-05 | 2.92E-05 | 0.95 | 20 | AGREEMENT |
| SAND | Cr-51 | 1.07E-04 | 1.03E-04 | 1.04 | 20 | AGREEMENT |
| DET. 3 | Cs-134 | 1.55E-05 | 1.65E-05 | 0.94 | 20 | AGREEMENT |
| | Cs-137 | 3.10E-05 | 3.19E-05 | 0.97 | 20 | AGREEMENT |
| | Co-58 | 2.75E-05 | 2.65E-05 | 1.04 | 20 | AGREEMENT |
| | Mn-54 | 2.20E-05 | 2.24E-05 | 0.98 | 20 | AGREEMENT |
| | Fe-59 | 1.74E-05 | 1.63E-05 | 1.07 | 20 | AGREEMENT |
| | Zn-65 | 2.77E-05 | 2.85E-05 | 0.97 | 20 | AGREEMENT |
| | Co-60 | 2.74E-05 | 2.69E-05 | 1.02 | 20 | AGREEMENT |
| ***** | | | | | | |

| SAMPLE | ANALYSIS | PALISADES | ANALYTICS | RATIO | RESOLUTION | COMPARISON |
|-----------|----------|---------------------|---------------------|--------------------------|------------|------------|
| | | VALUE microCi/cc | VALUE microCi/cc | PALISADES : ANALYTICS | | |
| ***** | | | | | | |
| A14689-66 | Ce-141 | 2.89E-02 | 2.93E-02 | 0.99 | 20 | AGREEMENT |
| CARTRIDGE | Cr-51 | 1.00E-01 | 1.03E-01 | 0.97 | 20 | AGREEMENT |
| DET. 1 | Cs-134 | 1.54E-02 | 1.66E-02 | 0.93 | 20 | AGREEMENT |
| | Cs-137 | 3.34E-02 | 3.20E-02 | 1.04 | 20 | AGREEMENT |
| | Co-58 | 2.74E-02 | 2.66E-02 | 1.03 | 20 | AGREEMENT |
| | Mn-54 | 2.40E-02 | 2.25E-02 | 1.07 | 20 | AGREEMENT |
| | Fe-59 | 1.77E-02 | 1.63E-02 | 1.08 | 20 | AGREEMENT |
| | Zn-65 | 3.11E-02 | 2.86E-02 | 1.09 | 20 | AGREEMENT |
| | Co-60 | 2.72E-02 | 2.70E-02 | 1.01 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14689-66 | Ce-141 | 2.78E-02 | 2.93E-02 | 0.95 | 20 | AGREEMENT |
| CARTRIDGE | Cr-51 | 9.52E-02 | 1.03E-01 | 0.92 | 20 | AGREEMENT |
| DET. 2 | Cs-134 | 1.49E-02 | 1.66E-02 | 0.90 | 20 | AGREEMENT |
| | Cs-137 | 3.17E-02 | 3.20E-02 | 0.99 | 20 | AGREEMENT |
| | Co-58 | 2.65E-02 | 2.66E-02 | 1.00 | 20 | AGREEMENT |
| | Mn-54 | 2.27E-02 | 2.25E-02 | 1.01 | 20 | AGREEMENT |
| | Fe-59 | 1.66E-02 | 1.63E-02 | 1.02 | 20 | AGREEMENT |
| | Zn-65 | 2.87E-02 | 2.86E-02 | 1.00 | 20 | AGREEMENT |
| | Co-60 | 2.55E-02 | 2.70E-02 | 0.94 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14689-66 | Ce-141 | 2.88E-02 | 2.93E-02 | 0.98 | 20 | AGREEMENT |
| CARTRIDGE | Cr-51 | 1.04E-01 | 1.03E-01 | 1.01 | 20 | AGREEMENT |
| DET. 3 | Cs-134 | 1.56E-02 | 1.66E-02 | 0.94 | 20 | AGREEMENT |
| | Cs-137 | 3.25E-02 | 3.20E-02 | 1.01 | 20 | AGREEMENT |
| | Co-58 | 2.68E-02 | 2.66E-02 | 1.01 | 20 | AGREEMENT |
| | Mn-54 | 2.36E-02 | 2.25E-02 | 1.05 | 20 | AGREEMENT |
| | Fe-59 | 1.71E-02 | 1.63E-02 | 1.05 | 20 | AGREEMENT |
| | Zn-65 | 3.01E-02 | 2.86E-02 | 1.05 | 20 | AGREEMENT |
| | Co-60 | 2.75E-02 | 2.70E-02 | 1.02 | 20 | AGREEMENT |
| ***** | | | | | | |



ANALYTICS

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RESULTS OF RADIOCHEMISTRY

CROSS CHECK PROGRAM

CONSUMERS POWER COMPANY

PALISADES PLANT

Fourth

~~THIRD~~ QUARTER 2001

mlb 2/2/01

D.M. Montgomery 12-14-01
Daniel M. Montgomery, QA Manager

| SAMPLE | ANALYSIS | PALISADES | ANALYTICS | RATIO | RESOLUTION | COMPARISON |
|---------------|----------|---------------------|---------------------|-------------------------|------------|------------|
| | | VALUE microCi/cc | VALUE microCi/cc | PALISADES: ANALYTICS | | |
| ***** | | | | | | |
| A14984-66 | Ce-141 | 6.03E-02 | 6.03E-02 | 1.00 | 20 | AGREEMENT |
| CARTRIDGE | Cr-51 | 8.95E-02 | 8.73E-02 | 1.03 | 20 | AGREEMENT |
| <i>Det #1</i> | Cs-134 | 1.68E-02 | 1.82E-02 | 0.92 | 20 | AGREEMENT |
| | Cs-137 | 3.12E-02 | 2.84E-02 | 1.10 | 20 | AGREEMENT |
| | Co-58 | 1.17E-02 | 1.05E-02 | 1.11 | 20 | AGREEMENT |
| | Mn-54 | 1.56E-02 | 1.41E-02 | 1.11 | 20 | AGREEMENT |
| | Fe-59 | 1.53E-02 | 1.38E-02 | 1.11 | 20 | AGREEMENT |
| | Zn-65 | 2.22E-02 | 1.99E-02 | 1.12 | 20 | AGREEMENT |
| | Co-60 | 3.16E-02 | 3.18E-02 | 0.99 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14984-66 | Ce-141 | 5.93E-02 | 6.03E-02 | 0.98 | 20 | AGREEMENT |
| CARTRIDGE | Cr-51 | 8.62E-02 | 8.73E-02 | 0.99 | 20 | AGREEMENT |
| <i>Det #2</i> | Cs-134 | 1.69E-02 | 1.82E-02 | 0.93 | 20 | AGREEMENT |
| | Cs-137 | 3.03E-02 | 2.84E-02 | 1.07 | 20 | AGREEMENT |
| | Co-58 | 1.13E-02 | 1.05E-02 | 1.08 | 20 | AGREEMENT |
| | Mn-54 | 1.54E-02 | 1.41E-02 | 1.09 | 20 | AGREEMENT |
| | Fe-59 | 1.54E-02 | 1.38E-02 | 1.11 | 20 | AGREEMENT |
| | Zn-65 | 2.16E-02 | 1.99E-02 | 1.09 | 20 | AGREEMENT |
| | Co-60 | 3.09E-02 | 3.18E-02 | 0.97 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14984-66 | Ce-141 | 6.06E-02 | 6.03E-02 | 1.01 | 20 | AGREEMENT |
| CARTRIDGE | Cr-51 | 8.82E-02 | 8.73E-02 | 1.01 | 20 | AGREEMENT |
| <i>Det #3</i> | Cs-134 | 1.71E-02 | 1.82E-02 | 0.94 | 20 | AGREEMENT |
| | Cs-137 | 2.96E-02 | 2.84E-02 | 1.04 | 20 | AGREEMENT |
| | Co-58 | 1.13E-02 | 1.05E-02 | 1.08 | 20 | AGREEMENT |
| | Mn-54 | 1.51E-02 | 1.41E-02 | 1.07 | 20 | AGREEMENT |
| | Fe-59 | 1.59E-02 | 1.38E-02 | 1.15 | 20 | AGREEMENT |
| | Zn-65 | 2.26E-02 | 1.99E-02 | 1.14 | 20 | AGREEMENT |
| | Co-60 | 3.37E-02 | 3.18E-02 | 1.06 | 20 | AGREEMENT |
| ***** | | | | | | |

| SAMPLE | ANALYSIS | PALISADES | ANALYTICS | RATIO | | COMPARISON |
|---------------|----------|---------------------|---------------------|-------------------------|------------|------------|
| | | VALUE microCi/cc | VALUE microCi/cc | PALISADES: ANALYTICS | RESOLUTION | |
| ***** | | | | | | |
| A14985-66 | Ce-141 | 1.70E-03 | 1.77E-03 | 0.96 | 20 | AGREEMENT |
| SOLID | Cr-51 | 2.30E-03 | 2.56E-03 | 0.90 | 20 | AGREEMENT |
| <i>Det #1</i> | Cs-134 | 5.28E-04 | 5.34E-04 | 0.99 | 20 | AGREEMENT |
| | Cs-137 | 8.62E-04 | 8.35E-04 | 1.03 | 20 | AGREEMENT |
| | Co-58 | 3.12E-04 | 3.09E-04 | 1.01 | 20 | AGREEMENT |
| | Mn-54 | 4.33E-04 | 4.15E-04 | 1.04 | 20 | AGREEMENT |
| | Fe-59 | 4.52E-04 | 4.06E-04 | 1.11 | 20 | AGREEMENT |
| | Zn-65 | 5.71E-04 | 5.84E-04 | 0.98 | 20 | AGREEMENT |
| | Co-60 | 9.44E-04 | 9.35E-04 | 1.01 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14985-66 | Ce-141 | 1.74E-03 | 1.77E-03 | 0.98 | 20 | AGREEMENT |
| SOLID | Cr-51 | 2.60E-03 | 2.56E-03 | 1.01 | 20 | AGREEMENT |
| <i>Det #2</i> | Cs-134 | 5.77E-04 | 5.34E-04 | 1.08 | 20 | AGREEMENT |
| | Cs-137 | 8.37E-04 | 8.35E-04 | 1.00 | 20 | AGREEMENT |
| | Co-58 | 3.13E-04 | 3.09E-04 | 1.01 | 20 | AGREEMENT |
| | Mn-54 | 3.81E-04 | 4.15E-04 | 0.92 | 20 | AGREEMENT |
| | Fe-59 | 3.16E-04 | 4.06E-04 | 0.78 | 20 | AGREEMENT |
| | Zn-65 | 6.45E-04 | 5.84E-04 | 1.10 | 20 | AGREEMENT |
| | Co-60 | 8.85E-04 | 9.35E-04 | 0.95 | 20 | AGREEMENT |
| ***** | | | | | | |
| A14985-66 | Ce-141 | 1.66E-03 | 1.77E-03 | 0.94 | 20 | AGREEMENT |
| SOLID | Cr-51 | 2.62E-03 | 2.56E-03 | 1.02 | 20 | AGREEMENT |
| <i>Det #3</i> | Cs-134 | 5.45E-04 | 5.34E-04 | 1.02 | 20 | AGREEMENT |
| | Cs-137 | 8.89E-04 | 8.35E-04 | 1.06 | 20 | AGREEMENT |
| | Co-58 | 3.59E-04 | 3.09E-04 | 1.16 | 20 | AGREEMENT |
| | Mn-54 | 4.30E-04 | 4.15E-04 | 1.04 | 20 | AGREEMENT |
| | Fe-59 | 4.14E-04 | 4.06E-04 | 1.02 | 20 | AGREEMENT |
| | Zn-65 | 6.34E-04 | 5.84E-04 | 1.09 | 20 | AGREEMENT |
| | Co-60 | 9.04E-04 | 9.35E-04 | 0.97 | 20 | AGREEMENT |
| ***** | | | | | | |

ATTACHMENT 7

NUCLEAR MANAGEMENT COMPANY, LLC
PALISADES NUCLEAR PLANT

RADIOACTIVE EFFLUENT RELEASE REPORT
OFFSITE DOSE CALCULATION MANUAL

106 pages follow

**PALISADES NUCLEAR PLANT
10CFR50.54 SAFETY REVIEW**

Proc No 3.07
Attachment 1
Revision 10
Page 1 of 1

Log No SDR- 00-1537

Item Identification: No DDCM Rev 16 Title OFFSITE DOSE
CALCULATION MANUAL

Describe Issue/Change: Update Tables 1.4, 1.4a, 1.9

Reason for Issue/Change: ANNUAL LAND USE CENSUS CAUSE CHANGES
IN THE SITE CRITICAL RECEPTORS WHICH AFFECTS PROTECTED
OFFSITE DOSES

1. Does the item involve a change to procedures as described in the FSAR?
 FSAR Sections affected None
 FSAR Sections reviewed 9, 11
2. Does the item involve a change to the facility as described or implied in the FSAR?
 FSAR Sections affected None
 FSAR Sections reviewed 9, 11
3. Does the item involve a test or experiment not described in the FSAR?
 FSAR Sections affected None
 FSAR Sections reviewed 9, 11
4. Should the Technical Specifications or any of their Bases be changed in conjunction with this item?
 TS Sections affected DDCM (None in tech Spec)
 TS Sections reviewed 5

| Yes | No |
|-----|----------|
| | ✓ |
| | ✓ |
| | ✓ |
| ✓ | ✗ JPM |

If any Safety Review question listed above is answered "YES," perform a written USQ Evaluation. Justify "NO" answers below if logic is not obvious:

CRITICAL RECEPTORS (NEAREST RESIDENCE, GARDEN, BEEF CATTLE,
DAIRY COW AND GOATS) DETERMINE THE MAXIMUM DOSES TO AN
INDIVIDUAL OFFSITE AND IS REPORTED TO THE NRC. THESE ARE AN ANNUAL

NOTE: DBD change requests shall be processed in accordance with Administrative Procedure 3.15.

DBD Sections Reviewed N/A Affected None

This attachment shall accompany other review materials for the item to document whether or not a USQ Evaluation was required.

Prepared by JPM Date 11/27/00 Reviewed by Paul F Bruce Date 12-7-00

PALISADES NUCLEAR PLANT
10CFR50.59 UNREVIEWED SAFETY QUESTION EVALUATION

Proc No 3.07
 Attachment 2
 Revision 10
 Page 1 of 1

Log No SDR- 00-1537

Item Identification: No ODCM Rev 16 Title OFFSITE DOSE
CALCULATION MANUAL

SECTION I

- | | Yes | No |
|---|-----|----|
| 1. Will the probability of an accident previously evaluated in the FSAR be increased? | | ✓ |
| 2. Will the consequences of an accident previously evaluated in the FSAR be increased? | | ✓ |
| 3. Will the probability of malfunctions of equipment important to safety previously evaluated in the FSAR be increased? | | ✓ |
| 4. Will the consequences of a malfunction of equipment important to safety previously evaluated in the FSAR be increased? | | ✓ |
| 5. Will the possibility of an accident of a different type than any previously evaluated in the FSAR be created? | | ✓ |
| 6. Will the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in the FSAR be created? | | ✓ |
| 7. Will the margin of safety as defined by Plant Licensing Bases be reduced? | | ✓ |

A written Safety Analysis which documents the bases for these answers shall accompany this form. If any of the above questions are answered "YES," an unreviewed safety question is involved and the item shall not be implemented without prior NRC concurrence.

SECTION II

- | | Yes | No |
|---|-----|----|
| 1. Should this be included in an FSAR update? | | ✓ |
| 2. Is an application for amendment to the Palisades Operating License required? | | ✓ |
| 3. Is NRC approval required prior to implementation of this item? | | ✓ |

SECTION III

J. P. Neal

11/27/00

Paul F. Bruce

12/7-00

Prepared by

Date

Reviewed by

Date

**PALISADES NUCLEAR PLANT
SAFETY ANALYSIS**

Proc No 3.07
Attachment 3
Revision 9
Page 1 of 1

Item Identification: No ODCM Rev 16 Log No SDR-

DESCRIPTION OF ITEM

Page _____

update Tables 1.4, 1.4a and 1.9

JUSTIFICATION

CRITICAL RECEPTORS (NEAREST RESIDENCE, GARDEN, BEEF
CATTLE, MILK COWS AND GOATS) DETERMINE THE PARAMETERS
FOR THE MAXIMUM WHOLE BODY AND ORGAN DOSES THAT
AN OFFSITE INDIVIDUAL COULD RECEIVE FROM PLANT EFFLUENTS.
THESE ARE UPDATED ANNUALLY AFTER A LAND USE CENSUS
IS CONDUCTED ON THE AREA WITHIN A 10 MILE RADIUS OF THE
PLANT SITE. DESIGN BASIS QUANTITIES (DBQ'S) ARE JUST A TOOL
TO PERFORM AN OFFSITE DOSE CALCULATION ESTIMATE (CONSERVATIVE)
TO INSURE NOT EXCEEDING ODCM LIMITS. THE DBQ'S, ARE AFFECTED
BY CHANGES IN THE CRITICAL RECEPTOR AND MUST BE REVISED WHEN THEY CHANGE.
DOSE ESTIMATING AND PROTECTS ARE ADMIN FUNCTIONS WHICH
DON'T AFFECT PLANT EQUIPMENT OR OPERATIONS.

PALISADES NUCLEAR PLANT
OFFSITE DOSE CALCULATION MANUAL

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Appendix A, "Relocated Technical Specification"

Appendix B, "Request to Retain Soil in Accordance With 10 CFR 20.302"

PALISADES NUCLEAR PLANT
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I. **GASEOUS EFFLUENTS**

A. **ALARM/TRIP SETPOINT METHOD**

Appendix A, Section III.B.1 requires that the dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY shall be limited to the following:

- For noble gases: Less than or equal to 500 mrems/yr to the total body and less than or equal to 3000 mrems/yr to the skin, and
- For iodine-131, for iodine-133, for tritium, and for all radionuclides in particulate form with half lives greater than 8 days: Less than or equal to 1500 mrems/yr to any organ.

Appendix A, Section III.A.1 requires gaseous effluent monitors to have alarm/trip setpoints to ensure that offsite concentrations, when averaged over 1 hour, will not be greater than Appendix A, Section III.B.1. This section of the ODCM describes the methodology that will be used to determine these setpoints.

The methodology for determining alarm/trip setpoints is divided into two major parts. The first consists of calculating an allowable concentration for the nuclide mixture to be released. The second consists of determining monitor response to this mixture in order to establish the physical settings on the monitors.

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1. **Allowable Concentration**

The total EC-fraction (R_k) for each release point will be calculated by the relationship defined by Note 4 of Appendix B, 10 CFR 20:

$$R_{(k)} = \left(\frac{X}{Q} \right) (F) \sum_i \frac{C_i}{EC_i} \leq 5.0 \quad (1.1)$$

If gaseous tritium and noble gasses are not present then:

$$R_{(k)} \leq 10$$

where:

- C_i = Actual or measured concentration, at ambient temperature and pressure of nuclide i ($\mu\text{Ci/cc}$)
- EC_i = The EC of nuclide i from 10 CFR 20, Appendix B, Table 2
- $R_{(k)}$ = The total EC-fraction for release point k
- X/Q = Most conservative sector site boundary dispersion (sec/m^3) - Table 1.3
- F = Release flow rate (83,000 cfm = 39.2 m^3/sec) for stack monitor considerations; variable for other monitors

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NOTE: If a batch release is made while a continuous release or another batch release is in progress, the sum of all values of R_k must be less than 5.0.

2. **Monitor Response**

Normal radioactivity releases consist mainly of well-decayed fission gases. Therefore, monitor response calibrations are performed to fission gas typical of normal releases (mainly Xe-133). Response of monitors used to define fission product release rates under accident conditions may vary from that of Xe-133, however. Monitor response for the two categories of monitor is determined as follows:

a. Normal Release (aged fission gasses)

Total gas concentration ($\mu\text{Ci/cc}$) at the monitor is calculated. The calibration curve or constant for $\text{cpm}/\mu\text{Ci/cc}$ is applied to determine cpm expected. The setting for monitor alarms is established at some factor (b) greater than 1 but less than $1/R_k$ (Equation 1.1) times the measured concentration (c):

$$s = b \times c \quad (1.2)$$

b. Accident Releases

Monitors are preset to alarm at or before precalculated offsite dose rates would be achieved under hypothetical accident conditions. These setpoints are established in accordance with Emergency Plan requirements for defining Emergency Action Levels and associated actions. Emergency Implementing Procedures contain monitor-specific curves or calibration constants for conversion between cpm and $\mu\text{Ci/cc}$ (or R/hr and $\mu\text{Ci/cc}$), depending on monitor type, for fission product mixtures as a function of mixture decay time.

When these monitors are utilized for other than accident conditions, either an appropriately decayed "accident" conversion curve may be used, or a decayed fission gas calibration factor may be applied. In these cases, setpoints are established as in 1.A above.

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Setpoints of accident monitors (if set to monitor normal releases) are reset to the accident alarm settings at the end of normal release. Setpoints of other release monitors are maintained at the level used at the latest release (well below the level which would allow 10 times EC to be exceeded at the site boundary), or are reset to approximately three times background in order to detect leakage or inadvertent releases of low level gases.

B. DOSE RATE CALCULATION

1. Dose rates are calculated for (1) noble gases and (2) iodines and particulates. Dose rates as defined in this section are based on 10 CFR 50 Appendix I limits of mrem per quarter and millirem per year. All dose pathways of major importance in the Palisades environs are considered.
 - a. Equations and assumptions for calculating doses from noble gases are as follows:
 - 1) Assumptions
 - a) Doses to be calculated are the maximum offsite point in air, total body and skin.
 - b) Exposure pathway is submersion within a cloud of noble gases.
 - c) Noble gas radionuclide mix is based on the historically observed source term given in Table 1.1, plus additional nuclides.
 - d) Basic radionuclide data are given in Table 1.2.
 - e) All releases are treated as ground-level.
 - f) Meteorological data expressed as joint-frequency distribution of wind speed, wind direction, and atmospheric stability for the period resulting in X/Q's and D/Q's shown in Table 1.3.

PALISADES NUCLEAR PLANT
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- g) Raw meteorological data consists of wind speed and direction measurements at 10m and temperature measurements at 10m and 60m.
- h) Dose is to be evaluated at the offsite exposure points where maximum concentrations are expected to exist (overland sector site boundaries), and nearest residents.
- i) Potential maximum population (resident) exposure points are identified in Table 1.4.
- j) A semi-infinite cloud model is used.
- k) For person exposures, credit is taken for shielding by residence (factor of 0.7).
- l) Radioactive decay is considered for the plume.
- m) Building wake effects on effluent dispersion are considered.
- n) A sector-average dispersion equation is used.
- o) The wind speed classes that are used are as follows:

| <u>Wind Speed</u> <u>Class Number</u> | <u>Range (m/s)</u> | <u>Midpoint (m/s)</u> |
|--|--------------------|-----------------------|
| 1 | 0.0-0.4 | 0.2 |
| 2 | 0.4-1.5 | 0.95 |
| 3 | 1.5-3.0 | 2.25 |
| 4 | 3.0-5.0 | 4.0 |
| 5 | 5.0-7.5 | 6.25 |
| 6 | 7.5-10.0 | 8.75 |
| 7 | > 10.0 | -- |

PALISADES NUCLEAR PLANT
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- p) The stability classes that will be used are the standard A through G classifications. The stability classes 1-7 will correspond to A = 1, B = 2, ..., G = 7.
- q) Terrain effects are not considered.

2) Equations

To calculate the dose for any one of the exposure points, the following equations are used.

For determining the air concentration of any radionuclide:

$$X_i = \sum_{j=1}^9 \sum_{k=1}^7 \left(\frac{2}{\pi} \right)^{1/2} \frac{f_{jk} Q_i p}{z_k U^j (2 x/n)} \left[\exp^{- \left(i \frac{x}{u_j} \right)} \right]$$

(1.3)

where:

- X_i = Air concentration of radionuclide i , $\mu\text{Ci}/\text{m}^3$.
- f_{jk} = Joint relative frequency of occurrence of winds in wind speed class j , stability class k , blowing toward this exposure point, expressed as a fraction.
- Q_i = Average release rate of radionuclide i , $\mu\text{Ci}/\text{s}$.
- p = Fraction of radionuclide remaining in plume.
- z_k = Vertical dispersion coefficient for stability class k (m).
- u_j = Midpoint value of wind speed class interval j , m/s.

PALISADES NUCLEAR PLANT
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- x = Downwind distance, m.
- n = Number of sectors, 16.
- λ_i = Radioactive decay coefficient of radionuclide i, s⁻¹.
- 2 x/n = Sector width at point of interest, m.

For determining the total body dose rate:

$$D_{TB} = \sum_i X_i DFB_i \quad (1.4)$$

where:

- D_{TB} = Total body dose rate, mrem/y.
- X_i = Air concentration of radionuclide i, $\mu\text{Ci}/\text{m}^3$.
- DFB_i = Total body dose factor due to gamma radiation, mrem/y per $\mu\text{Ci}/\text{m}^3$ (Table 1.5).

For determining the skin dose rate:

$$D_s = \sum_i X_i (DFS_i + 1.11 DFY_i) \quad (1.5)$$

where:

- D_s = Skin dose rate, mrem/y.
- X_i = Air concentration of radionuclide i, $\mu\text{Ci}/\text{m}^3$
- DFS_i = Skin dose factor due to beta radiation, mrem/y per $\mu\text{Ci}/\text{m}^3$ (Table 1.5).

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1.11 = The average ratio of tissue to air energy absorption coefficients, mrem/mrad.

DFY_i = Gamma-to-air dose factor for radionuclide i , mrad/y per $\mu\text{Ci}/\text{m}^3$ (Table 1.5).

For determining dose rate to a point in air:

$$D_a = \sum_i X_i (DFY_i \text{ or } DFB_i) \quad (1.6)$$

where:

D_a = Air dose rate, mrad/yr.

DFB_i = Air dose factor for beta radiation (Table 1.5).

b. Equations and assumptions for calculating doses from radioiodines and particulates are as follows:

1) Assumptions

- a) Dose is to be calculated for the critical organ, thyroid, and the critical age groups (adult, teen, child, infant), infant (milk) and child (green, leafy vegetables).
- b) Exposure pathways from iodines and particulates are milk ingestion, ground contamination, green leafy vegetables from home gardens, and inhalation.
- c) The radioiodine and particulate mix is based on the historically observed source term given in Table 1.1.
- d) Basic radionuclide data are given in Table 1.2.
- e) All releases are treated as ground-level.

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- f) Mean annual average X/Q's are given in Table 1.3.
- g) Raw meteorological data for ground-level releases consist of wind speed and direction measurements at 10m and temperature measurements at 10m and 60m.
- h) Dose is to be evaluated at the potential offsite exposure points where maximum doses to man are expected to exist.
- i) Real cow, goat and garden locations are considered.
- j) Potential maximum exposure points (Table 1.4) considered are the nearest cow, goat, and home garden locations in each sector.
- k) Terrain effects and open terrain recirculation factors are not considered.
- l) Building wake effects on effluent dispersion are considered.
- m) Plume depletion and radioactive decay are considered for air-concentration calculations.
- n) Radioactive decay is considered for ground-concentration calculations.
- o) Deposition is calculated based on the curves given in Figure 1.2.
- p) Milk cows and goats obtain 100% of their food from pasture grass May through October of each year. Use default values of 0.58 for cows and 0.67 for goats for fraction of year on pasture.
- q) Credit is taken for shielding by residence (factor of 0.7).

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2) Equations

To calculate the dose for any one of the potential maximum-exposure points, the following equations in Section 1.2.2 are used.

a) Inhalation

Equation for calculating air concentration, X_i is the same as in the Noble Gas Section (Equation 1.3).

For determining the organ dose rate:

$$D_i = 1 \times 10^6 \sum_i X_i DFI_i BR \quad (1.7)$$

where:

D_i = Organ dose rate due to inhalation, mrem/y.

X_i = Air concentration of radionuclide i , $\mu\text{Ci}/\text{m}^3$.

DFI_i = Inhalation dose factor, mrem/pCi (Table 1.7).

BR = Breathing rate 1400 m^3/y infant; 3700 m^3/y child; or 8000 m^3/y teen and adult.

1×10^6 = pCi/ μCi conversion factor.

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b) Ground Contamination

For determining the ground concentration of any nuclide;

$$G_i = 3.15 \times 10^7 \sum_{k=1}^7 \frac{f_k Q_i DR}{(2 x/n)^2} [1 - \exp(-\lambda_i t_b)] \quad (1.8)$$

where:

- G_i = Ground concentration of radionuclide i , $\mu\text{Ci}/\text{m}^2$.
- k = Stability class.
- f_k = Joint relative frequency of occurrence of winds in stability class k blowing toward this exposure point, expressed as a fraction.
- Q_i = Average release rate of radionuclide i , $\mu\text{Ci}/\text{s}$.
- DR = Relative deposition rate, m^{-1} (Fig 1.2).
- x = Downwind distance, m.
- n = Number of sectors, 16.
- $2 x/n$ = Sector width at point of interest, m.
- λ_i = Radioactive decay coefficient of radionuclide i , y^{-1} .
- t_b = Time for buildup of radionuclides on the ground, 15 y.
- 3.15×10^7 = s/y conversion factor.

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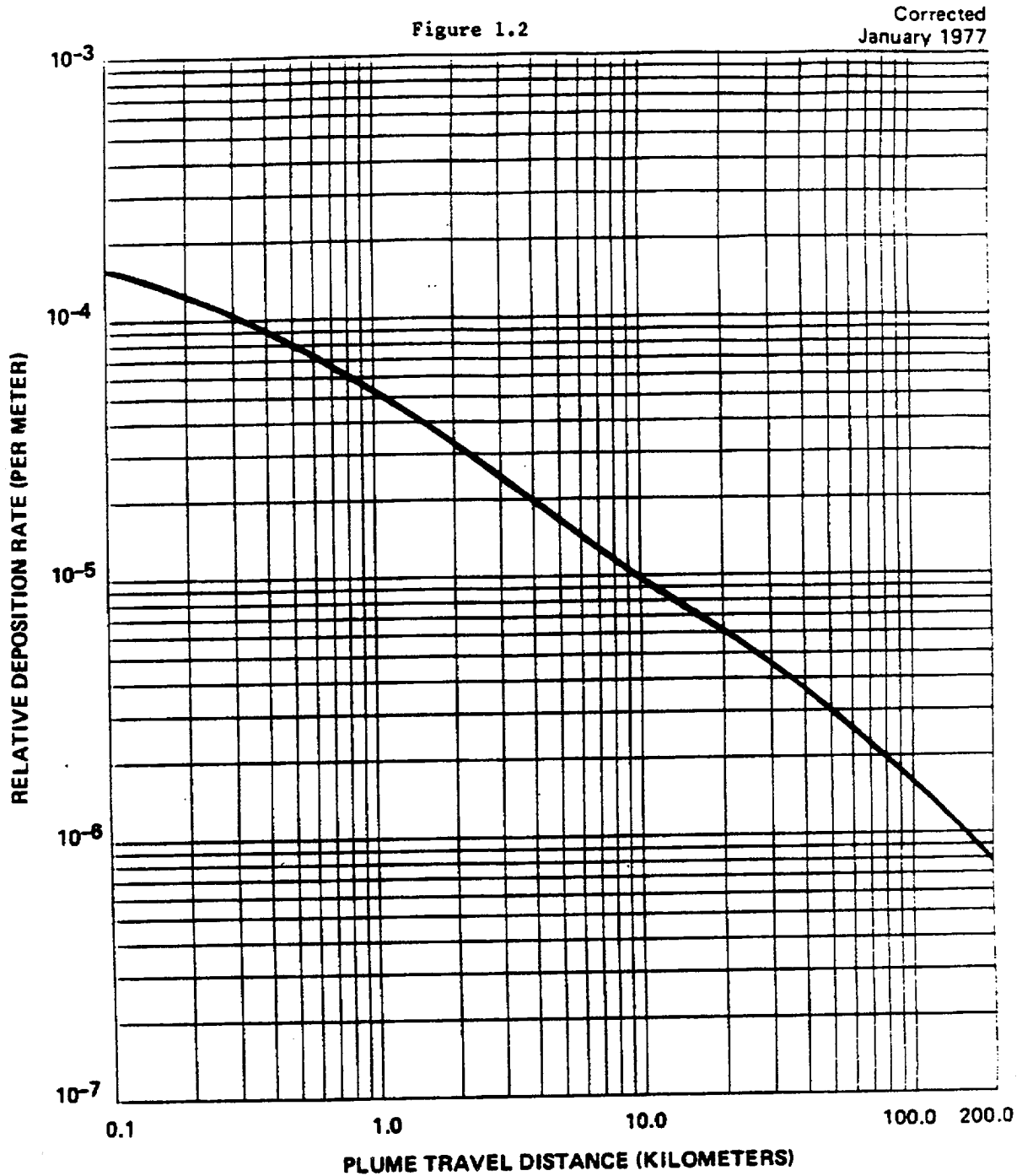


Figure 7. Relative Deposition for Ground Level Releases (All Atmospheric Stability Classes)

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For determining the total body or organ dose rate from ground contamination:

$$D_G = (8,760)(1 \times 10^6)(0.7) \sum_i G_i DFG_i \quad (1.9)$$

where:

- D_G = Dose rate due to ground contamination, mrem/y.
- G_i = Ground concentration of radionuclide i , $\mu\text{Ci}/\text{m}^2$.
- DFG_i = Dose factor for standing on contaminated ground, mrem/h per pCi/m^2 (Table 1.8).
- 8,760 = Occupation time, h/y.
- 1×10^6 = $\text{pCi}/\mu\text{Ci}$ conversion factor.
- 0.7 = Shielding factor accounting for a distance of 1.0 meter above ordinary ground, dimensionless.

c) Milk and Vegetation Ingestion

For determining the concentration of any nuclide (except C-14 and H-3) in and on vegetation:

$$CV_i = 3,600 \sum_{k=1}^7 \frac{f_k Q_i DR}{(2 \times/n)} \left(\frac{r[1 - \exp(-\lambda_{ei} t_e)]}{Y_v \lambda_{ei}} + B_{iv} \left[\frac{1 - \exp(-\lambda_{ib} t_b)]}{P_i} \right] \right) [\exp(-\lambda_{ih} t_h)] \quad (1.10)$$

where:

- CV_i = Concentration of radionuclide i in and on vegetation, $\mu\text{Ci}/\text{kg}$.
- k = Stability class.

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| | | |
|-------------|---|---|
| f_k | = | Frequency of this stability class and wind direction combination, expressed as a fraction. |
| Q_i | = | Average release rate of radionuclide i , $\mu\text{Ci/s}$. |
| DR | = | Relative deposition rate, m^{-1} (Figure 1.2). |
| x | = | Downwind distance, m. |
| n | = | Number of sectors, 16. |
| $2x/n$ | = | Sector width at point of interest, m. |
| r | = | Fraction of deposited activity retained on vegetation (1.0 for iodines, 0.2 for particulates). |
| E_i | = | Effective removal rate constant, $E_i = \lambda_i + \lambda_w$, where λ_i is the radioactive decay coefficient, h^{-1} , and λ_w is a measure of physical loss by weathering ($\lambda_w = 0.0021 \text{ h}^{-1}$). |
| t_e | = | Period over which deposition occurs, 720 h. |
| Y_v | = | Agricultural yield, 0.7 kg/m^2 . |
| B_{iv} | = | Transfer factor from soil to vegetation of radionuclide i (Table 1.6). |
| λ_i | = | Radioactive decay coefficient of radionuclide i , h^{-1} . |
| t_b | = | Time for buildup of radionuclides on the ground, $1.31 \times 10^5 \text{ h}$ (15Y). |

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p = Effective surface density of soil,
240 kg/m².

3,600 = s/h conversion factor.

t_h = Holdup time between harvest and
consumption of food (2,160 hours
for stored food).

For determining the concentration of C-14 in
vegetation:

$$CV_{14} = 1 \times 10^3 X_{14} (0.11/0.16) \quad (1.11)$$

where:

CV₁₄ = Concentration of C-14 in
vegetation, μCi/kg.

X₁₄ = Air concentration of C-14, μCi/m³.

0.11 = Fraction of total Plant mass that is
natural carbon.

0.16 = Concentration of natural carbon in
the atmosphere, g/m³.

1x10³ = g/kg conversion factor.

For determining the concentration of H-3 in
vegetation:

$$CV_T = 1 \times 10^3 X_T (0.75)(0.5/H) \quad (1.12)$$

where:

CV_T = Concentration of H-3 in vegetation,
μCi/m³.

X_T = Air concentration of H-3, μCi/m³.

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0.75 = Fraction of total Plant mass that is water.

0.5 = Ratio of tritium concentration in Plant water to tritium concentration in atmospheric water.

H = Absolute humidity of the atmosphere, g/m³.

1x10³ = g/kg conversion factor.

For determining the concentration of any nuclide in cow's or goat's milk:

$$CM_i = CV_i FM_i Q_f \exp(-\lambda_i t_f) \quad (1.13)$$

where:

CM_i = Concentration of radionuclide i (including C-14 and H-3) in milk, μCi/ .

CV_i = Concentration of radionuclide i in and on vegetation, μCi/kg.

FM_i = Transfer factor from feed to milk for radionuclide i, d/ (Table 1.6).

Q_f = Amount of feed consumed by the milk animal per day, kg/d (cow, 50 kg/d or goat 6 kg/d).

λ_i = Radioactive decay coefficient of radionuclide i, d⁻¹.

t_f = Transport time of activity from feed to milk to receptor, 2 days.

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For determining the organ dose rate from ingestion of green leafy vegetables and milk:

$$D = 1 \times 10^6 \sum_i CM_i DF_i UM \quad (1.14)$$

where:

D = Organ dose rate due to ingestion, mrem/y.

CM_i = Concentration of radionuclide i in vegetables or milk, μCi/kg (or liters).

DF_i = Ingestion dose factor, mrem/pCi (Table 2.1).

UM = Ingestion rate for milk, 330 /y; for vegetables 26 kg/yr (child), no ingestion by infant.

1x10⁶ = pCi/μCi conversion factor.

d) Meat Ingestion (Beef)

To calculate the concentration of a nuclide in animal flesh:

$$C_{fi} = F_{fi} CV_i Q_{fi} \exp(-\lambda_i t) \quad (1.15)$$

where:

C_{fi} = Concentration of nuclide i in the animal flesh, pCi/kg.

F_{fi} = Fraction of animal's daily intake which appears in each kg of flesh, days/kg (Table 1.6).

CV_i = Concentration of radionuclide i in the animal's feed (Equation 1.10).

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Q_f = Amount of feed consumed by the cow per day, 50 kg/d.

t_s = Average time from slaughter to consumption, 20 days.

To determine the organ dose from ingestion of beef:

$$D^f = \sum_i C_{fi} D_{fi} U_f \quad (1.16)$$

where:

D_{fi} = Ingestion dose factor for age group, mrem/pCi (Table 2.1) for nuclide i.

U_f = Ingestion rate of meat for age group, kg/y (child-41, teen-65, adult-110).

e) Organ Dose Rates

For determining the total body and organ dose rate from iodines and particulates:

$$D = D_I + D_G + D_M + D_V + D_F \quad (1.17)$$

where:

D = Total organ dose rate, mrem/y.

D_I = Dose rate due to inhalation, mrem/y.

D_G = Dose rate due to ground contamination, mrem/y.

D_M = Dose rate due to milk ingestion, mrem/y.

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D_v = Dose rate due to vegetable ingestion, mrem/y.

D_f = Dose rate due to beef ingestion, mrem/y.

- 3) The maximum organ dose rate, maximum total body dose rate, and maximum skin dose rate calculated in the previous section (Sec I.B) are used to calculate design basis quantities as described in Section I.B.1.3.

c. Design Basis Quantities

The design basis quantity of a radionuclide emitted to the atmosphere is the amount of that nuclide, when released in one year, which would result in a dose not exceeding any of the following:

- 1) 15 millirem to any organ of an individual from iodines and particulates with half-life greater than 8 days (Appendix A, Section III.D.1).
- 2) 15 millirem to skin of an individual from noble gas (Appendix A, Section III.C.1.b).
- 3) 5 millirem to the total body of an individual from noble gas (Appendix A, Section III.C.1.a).

Design basis quantity (C_i) is the smallest value for each nuclide, calculated by dividing the dose limits (a through c above) by the appropriate dose calculated from the amount of radionuclide (C_i) used to conservatively estimate the doses of Section D, as listed in Table 1.1 (or a hypothetical 1 Ci/year); the result is then multiplied by the amount of radionuclide used.

$$DBQ = \frac{D_{AI}}{D_c} (C_c) \tag{1.18}$$

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where:

D_{AI} = Appendix I dose limit (mrem or mrad).

D_c = Calculated dose (mrem or mrad).

C_c = Quantity of nuclide resulting in dose D_c (Ci).

DBQ = Design Basis Quantity (Ci).

The limiting values for Design Basis Quantities for radionuclides released to the atmosphere are given in Table 1.9.

The inverse of the ratio C_c/D_c in the above equation (ie, D_c/C_c) is a useful value, since it represents the most limiting dose per unit quantity of each nuclide released. Use of the D_c/C_c ratio in quarterly evaluation of offsite dose is discussed in Section D. Values of D_c/C_c are given in Table 1.9.

d. Land Use Census and DBQ Changes

Appendix A, Sections J.3.b and J.3.c describe the requirements for an annual land use census and revision of the ODCM for use in the following calendar year. Areas of the ODCM which will be reviewed, and changed if appropriate, are Table 1.4 (Land Use Census Data by Sector), Table 1.4a (Critical Receptors), and Table 1.9 (Gaseous Design Basis Objective Annual Quantities). Changes will be effective on January 1 of the year following the year of the survey.

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e. **Gaseous Releases From the Steam Generator Blowdown Vent and Atmosphere Release Valves**

Releases from the steam generator blowdown vent and atmospheric relief valves are difficult to quantify as there are no sampling capabilities on these steam release systems. However, neither system is a normal release path. The steam generator blowdown vent is normally routed to the main condenser and recirculated. Radioactive releases will be calculated by analyzing steam generator blowdown liquid and assuming that 100 percent of Noble Gases, 10 percent of the Iodines and 1 percent of the Particulates will be released to the environment in the steam phase. Volumes will be released to the environment in the steam phase. Volumes will be calculated using water balances or alternate means as available.

C. **DESIGN OBJECTIVE QUANTITY (DBQ) LIMITS ON BATCH AND CONTINUOUS RELEASES**

1. **Batch Releases**

Prior to each batch release (waste decay tank release or Containment purge), the quantity of each nuclide identified is summed with the quantity of that nuclide released since the first of the current calendar year. The cumulative total for each nuclide then is divided by the design objective quantity for each nuclide (from Table 1.9), and the resultant fractions are summed in order to assure that the sum fraction of all nuclides does not exceed 1.0:

$$i \quad \frac{A_i}{(DBQ)_i} < 1.0 \tag{1.19}$$

The amount in any calendar quarter should not exceed 0.5. This is checked by subtracting the value obtained at the end of the previous quarter from the value obtained from the cumulative total to date, including the batch to be released.

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2. **Continuous Releases**

Low level continuous releases from the vent gas collection header and other low level sources are totaled on a weekly basis and summed with any batch releases for the week in order to establish the cumulative DBQ fraction from batch plus continuous released for the year-to-date. Calculations are performed in the same manner as for batch releases described in C.1.

3. **Exceeding DBQ Limits**

As discussed under B.1.3, the DBQ is a very conservative estimate of activity which could give doses at Appendix I limits. Because different organs are summed together and doses to different people are summed, the DBQ typically overestimates dose by about a factor of five. Thus, if calculations of DBQ fraction exceed 1.0 for year-to-date or 0.5 for the quarter, technical specifications probably still would not be exceeded. However, further discretionary releases should be deferred until an accurate assessment of dose is made by use of GASPAR computer code or by analysis of appropriate release data via the segment gaussian dose model used in emergency planning (inhalation dose, total body external dose, and boundary dose in air). See also Section D.1.2.

It should be noted that Palisades Plant to date (based on review of semiannual effluent data) has never exceeded the annual or quarterly DBQ fraction, despite its conservatism. Thus, it is not expected that an alternate to the DBQ method will be required unless the Plant is in a significantly off-normal condition.

4. **Releasing Radionuclides Not Listed in Table 1.9**

Table 1.9 contains all nuclides identified to date as routine constituents of gaseous releases at Palisades Plant, plus those common to PWRs in general, even if not previously detected at Palisades. From time to time, however, other nuclides may be detected.

If the unlisted nuclide constitutes less than 10% of the EC-fraction for the release, and all unlisted nuclides total less than 25% of the EC-fraction, the nuclide may be considered not present.

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If the unlisted nuclide constitutes greater than 10% of the EC-fraction, or all unlisted nuclides together constitute greater than 25%, then each nuclide should be assigned a DBQ equal to the most conservative value listed for the physical form of the nuclide involved (noble gas, halogen, or particulate).

Should a nuclide not listed in Table 1.9 begin to appear in significant quantities on a routine basis, revision to this ODCM should be made in order to include a design basis quantity specific to that nuclide.

D. OPTIONAL QUARTERLY DOSE CALCULATIONS

1. Methodology for Optional Quarterly Dose Calculations

This option may be used in place of, or in addition to, the Design Basis Quantity (DBQ) fraction calculation described by Equation 1.19. This optional conservative calculation relates the DBQ fraction to the doses from which it was originally derived. Use of this method may assist in identification of the critical dose pathway or characteristics of the assumed critical individual (infant, child, teen, and adult), since Table 1.9 indicates these parameters.

a. Simplified Conservative Approach

This method utilizes a limiting dose concept such that the limiting dose for each nuclide is summed with the limiting dose for each other nuclide, regardless if such sum is physically possible. It also assumes critical pathways, such as milk and vegetables, are in effect even in winter when the pathway is absent.

As such, the method is highly conservative and significantly over-estimates dose. If limits appear to be exceeded by this method, Section D.1.2 (a concise method, but requiring computer support) will be utilized.

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1) Assumptions

- a) All assumptions of Section 1.1 are utilized.
- b) Limiting doses for each gaseous nuclide are summed, regardless of limiting decay mode (gamma or beta).
- c) Limiting doses for each particulate and iodine nuclide are summed, regardless of dose point location, exposure pathway, or organ affected.
- d) Doses are summed for detected nuclides such that all nuclides which contribute greater than 10% individually or 25% in aggregate, to the EC of released radioactivity, are included in the dose calculation.

2) Equations

For determining gaseous effluent dose:

$$D_G = \sum_0^i A_{iG} (D_c/C_c)_{iG} < 5 \text{ millirad/quarter, } 10 \text{ mrad/yr} \quad (1.20)$$

where:

D_G = Dose from gaseous effluents (mrad).

A_{iG} = Quantity of gaseous nuclide i released (Ci).

$(D_c/C_c)_{iG}$ = Dose per Ci factor for gaseous nuclide i (mrad/Ci).

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The limit for this mixture is conservatively taken as that for gamma exposure (5 mrem/quarter, 10 mrem/year) although as indicated in Table 1.9, a majority of the gaseous effluents are beta-limiting and on an individual basis have the higher limit of 10 millirem/quarter and 20 millirem/year.

For determining tritium, particulate and iodine dose to organs:

$$D_{TPI} = \sum_i A_{TPIi} (D_c/C_c)_{TPIi} < 7.5 \text{ mrem/q, } 15 \text{ mrem/y} \quad (1.21)$$

where:

D_{TPI} = Dose from particulates and iodines (mrem).

A_{TPIi} = Quantity of particulate or iodine nuclide i released (Ci).

$(D_c/C_c)_{TPIi}$ = Dose per Ci factor for particulate or iodine nuclide i (mrad/Ci).

b. **Realistic Calculation**

This methodology is to be used if the highly conservative calculations described in C.1 or D.1 yield values that appear to exceed applicable limits.

Doses for released particulates, iodines and noble gases will be determined by use of the NRC GASPAR computer code. The computer run will utilize the annual average joint frequency meteorological data based on not less than 3 years of meteorological measurement, and will reflect demographic and land use information from the land use survey generated in the most recent prior year. Where appropriate, seasonal adjustments will be applied to obtain realistic dose estimates since both recreational and agricultural activities can vary greatly in relation to season of the year.

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An alternative to GASPAR for offsite dose calculation is the use of the Palisades Segmented Gaussian Plume Emergency offsite dose calculation program. This dose model allows evaluation of dose under the actual meteorological conditions present at the time of release. It is anticipated that the system may be used in major short-term releases such as Containment purges are to be made under conditions which depart significantly from mean annual conditions.

E. GASEOUS RADWASTE TREATMENT SYSTEM OPERATION

The gaseous radwaste treatment system (GRTS) described below shall be maintained and operated to keep releases ALARA.

1. System Description

A flow diagram for the GRTS is given in Figure 1-1. The system consists of three waste-gas compressor packages, six gas decay tanks, and the associated piping, valves, and instrumentation. Gaseous wastes are received from the following: degassing of the reactor coolant and purging of the volume control tank prior to a cold shutdown, displacing of cover gases caused by liquid accumulation in the tanks connected to the vent header, and boron recycle process operation.

Design of the system precludes hydrogen explosion by means of ignition source elimination (diaphragm valves, low flow diaphragm compressors and system electrical grounding), and minimization of leakage outside the system. Explosive mixtures of hydrogen and oxygen have been demonstrated compatible with the system by operational experience over the past 13 years.

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2. **Determination of Satisfactory Operation**

Design basis quantity fraction will be calculated for batch and continuous releases as described in Section I.C. These calculations will be used to ensure that the GRTS is operating as designed. Because the Plant was designed to collect and hold for decay a vast majority of the high level gases generated within the primary system, and because the 13-year operating history (to date of writing the initial ODCM) of the Plant has demonstrated the system's consistent performance well below Appendix I limits, no additional operability requirements are specified.

F. **RELEASE RATE FOR OFFSITE EC**

10 CFR 20.1302 requires radioactive effluent releases to unrestricted areas be in concentrations less than the limits specified in Appendix B, Table 2 when averaged over a period not to exceed one year. (Note: there are no unrestricted areas anywhere within the site boundary as defined by Figure 1-1.) Concentrations at this level if inhaled or ingested continuously for one year will result in a dose of 50 mrem whole body except for submersion dose isotopes (gaseous tritium and noble gasses) which will result in a dose of 100 mrem whole body. 10 CFR 50.36a requires that the release of radioactive materials be kept as low as reasonably achievable. However, the section further states that the licensee is permitted the flexibility of operation, to assure a dependable source of power even under unusual operating conditions, to release quantities of material higher than a small percentage of 10 CFR 20.1302 limits but still within those limits. Appendix I to 10 CFR 50 provides the numerical guidelines on limiting conditions for operations to meet the as low as reasonably achievable requirement.

The GASPAR code has been run to determine the dose due to external radiation and inhalation. The source term used is listed in Table 1.1. The meteorology data is given in Table 1.3. Dose using annual average meteorology, to the most limiting organ of the person assume to be residing at the site boundary with highest X/Q, is 2.15E-02 mrem (for one year). The release rate which would result in a dose rate equivalent to 50 mrem/year (using the more conservative total body limit) is the curies/year given in Table 1.1 multiplied by 50/2.15E-02 or 0.11 Ci/sec.

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G. PARTICULATE AND IODINE SAMPLING

Particulate and iodine samples are obtained from the continuous sample stream pulled from the Plant stack. Samples typically are obtained to represent an integrated release from a gas batch (waste gas decay tank or Containment purge, for example), or a series of samples are obtained to follow the course of a release. In any event, sample intervals are weekly, at a minimum.

Because HEPA filters are present between most source inputs to the stack and the sample point, releases of particulates normally are significantly less than pre-release calculations indicate. This provides for conservatism in establishing setpoints and in estimation of pre-release design basis quantity fraction. However, for the sake of maintaining accurate release totals, monitor results (for gases) and sample results (for particulates and iodines) are utilized rather than the pre-release estimates, for cumulative records.

Gamma analytical results for particulate and halogen filters are combined for determination of total activity of particulates and halogens released. Beta and alpha counting also is performed on the particulate filters. Beta yields of the gamma isotopes detected on particulate filters are applied to determine "identified" beta, and the "identified" count rate is subtracted from the observed count rate to give "unidentified" beta. The "unidentified" beta is assumed to be Sr-90 until results on actual Sr-90 (chemically separated from a quarterly composite of filters) are obtained. Sampling and analysis will be performed per Appendix A, Table B-1 requirements.

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H. **NOBLE GAS SAMPLING**

Noble gases will be sampled from Waste Gas Decay Tanks prior to release and the Containment prior to purging. Analysis of these samples will be used for accountability of noble gases. Off gas will be sampled at least weekly and used to calculate monthly noble gas releases. Nonroutine releases will be quantified from the stack noble gas monitor (RE 2326) which has a LLD of $1\text{E-}06 \mu\text{Ci/cc}$. Sampling and analysis will be performed per Appendix A, Table B-1 requirements.

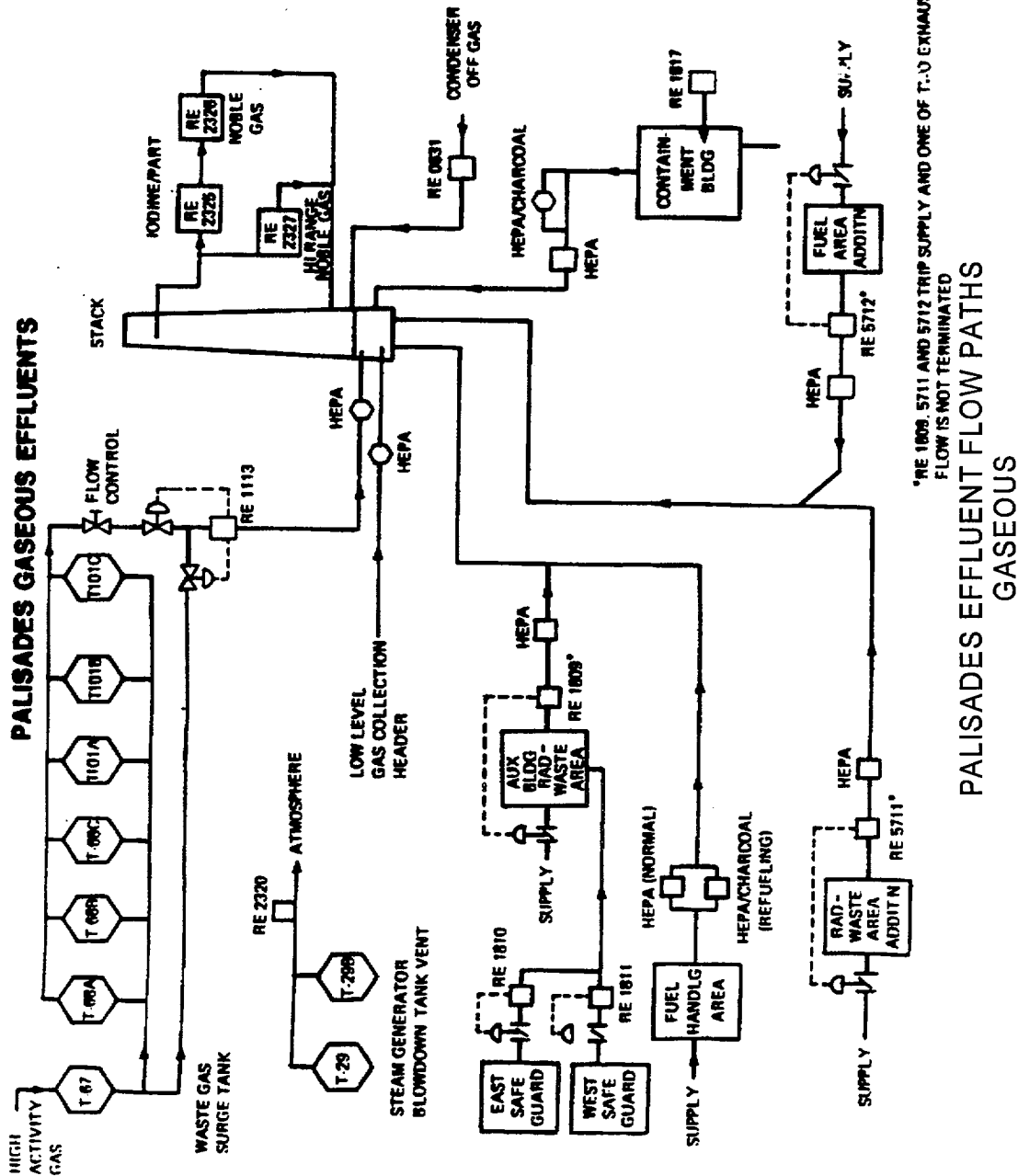
I. **TRITIUM SAMPLING**

Tritium has a low dose consequence to the public because of low production rates. The major contributors to tritium effluents are evaporation from the fuel pool and reactor cavity (when flooded). Because of the low dose impact, gaseous tritium sampling will not be required. Tritium effluents will be estimated using conservative evaporation rate calculations from the fuel pool and reactor cavity.

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J. FIGURES AND TABLES



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TABLE 1.1
PALISADES GASEOUS AND LIQUID SOURCE TERMS, CURIES/YEAR (1)

| <u>Nuclide</u> | <u>Gaseous(2)</u> | <u>Liquid(2)</u> |
|-------------------|-------------------|------------------|
| H-3 | 5.5 | 159 |
| Kr-85 | 4.1 | NA |
| Kr-85m | 0.12 | NA |
| Kr-87 | 8.4E-02 | NA |
| Kr-88 | 2.1E-01 | NA |
| Ar-41 | 3.1E-02 | NA |
| Xe-131m | 2.2 | NA |
| Xe-133 | 1493 | NA |
| Xe-133m | 0.43 | NA |
| Xe-135 | 1.11 | NA |
| Xe-135m | 0.3 | NA |
| I-131 | 0.025 | 3.21E-03 |
| I-132 | 2.91E-03 | NA |
| I-133 | 6.5E-03 | 4.7E-05 |
| I-134 | 4.8E-04 | NA |
| I-135 | 1.84E-02 | NA |
| Na-24 | 1.5E-06 | NA |
| Cr-51 | 2.5E-04 | 3.9E-03 |
| Mn-54 | 4.1E-04 | 7.8E-03 |
| Co-57 | 2.1E-06 | 3.2E-05 |
| Co-58 | 8.6E-04 | 2.9E-02 |
| Fe-59 | 6.6E-06 | 4.1E-04 |
| Co-60 | 1.1E-03 | 1.24E-02 |
| Se-75 | 3.7E-06 | NA |
| Nb-95 | 2.4E-05 | 4.53E-04 |
| Zr-95 | 4.7E-06 | 1.79E-04 |
| Mo-99 | 1.5E-07 | NA |
| Ru-103 | .3E-07 | .1E-05 |
| Sb-127 | NA | 3.5E-05 |
| Cs-134 | 4.5E-05 | 0.7 |
| Cs-136 | NA | 1.8E-06 |
| Cs-137 | 2.6E-04 | 1.36E-02 |
| Ba-140 | 2.8E-07 | NA |
| La-140 | 7.5E-07 | 1.1E-04 |
| Unidentified beta | 3.9E-04 | 3.3E-03 |

- (1) Data derived from taking the effluents released during July-December 1978 through January-June 1982 and dividing by 4.
- (2) Nuclide values listed as NA have not been observed at detectable levels in these waste streams.

PALISADES NUCLEAR PLANT
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Revision 16

TABLE 1.2
BASIC RADIONUCLIDE DATA

| | <u>NUCLIDE</u> | <u>HALF-LIFE</u> <u>(days)</u> | <u>LAMBDA</u> <u>(1/s)</u> | <u>BETA¹</u> <u>(MEV/DIS)</u> | <u>GAMMA¹</u> <u>(MEV/DIS)</u> |
|----|----------------|-----------------------------------|-------------------------------|---|--|
| 1 | Tritium | 4.49E 03 | 1.79E-09 | 5.68E-03 | 0.0 |
| 2 | C-14 | 2.09E 06 | 3.84E-12 | 4.95E-02 | 0.0 |
| 3 | N-13 | 6.94E-03 | 1.16E-03 | 4.91E-01 | 1.02E 00 |
| 4 | O-19 | 3.36E-04 | 2.39E-02 | 1.02E 00 | 1.05E 00 |
| 5 | F-18 | 7.62E-02 | 1.05E-04 | 2.50E-01 | 1.02E 00 |
| 6 | NA-24 | 6.33E-01 | 1.27E-05 | 5.55E-01 | 4.12E 00 |
| 7 | P-32 | 1.43E 01 | 5.61E-07 | 6.95E-01 | 0.0 |
| 8 | AR-41 | 7.63E-02 | 1.05E-04 | 4.64E-01 | 1.28E 00 |
| 9 | CR-51 | 2.78E 01 | 2.89E-07 | 3.86E-03 | 3.28E-02 |
| 10 | MN-54 | 3.03E 02 | 2.65E-08 | 3.80E-03 | 8.36E-01 |
| 11 | MN-56 | 1.07E-01 | 7.50E-05 | 8.29E-01 | 1.69E 00 |
| 12 | FE-59 | 4.50E 01 | 1.78E-07 | 1.18E-01 | 1.19E 00 |
| 13 | CO-58 | 7.13E 01 | 1.12E-07 | 3.41E-02 | 9.78E-01 |
| 14 | CO-60 | 1.92E 03 | 4.18E-09 | 9.68E-02 | 2.50E 00 |
| 15 | ZN-69m | 5.75E-01 | 1.39E-05 | 2.21E-02 | 4.16E-01 |
| 16 | ZN-69 | 3.96E-02 | 2.03E-04 | 3.19E-01 | 0.0 |
| 17 | BR-84 | 2.21E-02 | 3.63E-04 | 1.28E 00 | 1.77E 00 |
| 18 | BR-85 | 2.08E-03 | 3.86E-03 | 1.04E 00 | 6.60E-02 |
| 19 | KR-85m | 1.83E-01 | 4.38E-05 | 2.53E-01 | 1.59E-01 |
| 20 | KR-85 | 3.93E 03 | 2.04E-09 | 2.51E-01 | 2.21E-03 |
| 21 | KR-87 | 5.28E-02 | 1.52E-04 | 1.32E 00 | 7.93E-01 |
| 22 | KR-88 | 1.17E-01 | 6.86E-05 | 3.61E-01 | 1.96E 00 |
| 23 | KR-89 | 2.21E-03 | 3.63E-03 | 1.36E 00 | 1.83E 00 |
| 24 | RB-88 | 1.24E-02 | 6.47E-04 | 2.06E 00 | 6.26E-01 |
| 25 | RB-89 | 1.07E-02 | 7.50E-04 | 1.01E 00 | 2.05E-00 |
| 26 | SR-89 | 5.20E 01 | 1.54E-07 | 5.83E-01 | 8.45E-05 |
| 27 | SR-90 | 1.03E 04 | 7.79E-10 | 1.96E-01 | 0.0 |
| 28 | SR-91 | 4.03E-01 | 1.99E-05 | 6.50E-01 | 6.95E-01 |
| 29 | SR-92 | 1.13E-01 | 7.10E-05 | 1.95E-01 | 1.34E 00 |
| 30 | SR-93 | 5.56E-03 | 1.44E-03 | 9.20E-01 | 2.24E 00 |
| 31 | Y-90 | 2.67E 00 | 3.00E-06 | 9.36E-01 | 0.0 |
| 32 | Y-91m | 3.47E-02 | 2.31E-04 | 2.73E-02 | 5.30E-01 |
| 33 | Y-91 | 5.88E 01 | 1.36E-07 | 6.06E-01 | 3.61E-03 |
| 34 | Y-92 | 1.47E-01 | 5.46E-05 | 1.44E 00 | 2.50E-01 |
| 35 | Y-93 | 4.29E-01 | 1.87E-05 | 1.17E 00 | 8.94E-02 |
| 36 | ZR-95 | 6.50E 01 | 1.23E-07 | 1.16E-01 | 7.35E-01 |
| 37 | NB-95m | 3.75E 00 | 2.14E-06 | 1.81E-01 | 6.06E-02 |
| 38 | NB-95 | 3.50E 01 | 2.29E-07 | 4.44E-02 | 7.64E-01 |
| 39 | MO-99 | 2.79E 00 | 2.87E-06 | 3.96E-01 | 1.50E-01 |
| 40 | TC-99m | 2.50E-01 | 3.21E-05 | 1.56E-02 | 1.26E-01 |

**PALISADES NUCLEAR PLANT
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Revision 16

**TABLE 1.2 (continued)
BASIC RADIONUCLIDE DATA**

| | <u>NUCLIDE</u> | <u>HALF-LIFE</u> <u>(days)</u> | <u>LAMBDA</u> <u>(1/s)</u> | <u>BETA¹</u> <u>(MEV/DIS)</u> | <u>GAMMA¹</u> <u>(MEV/DIS)</u> |
|----|----------------|-----------------------------------|-------------------------------|---|--|
| 41 | TC-99 | 7.74E 07 | 1.04E-13 | 8.46E-02 | 0.0 |
| 42 | TC-104 | 1.25E-02 | 6.42E-04 | 1.60E 00 | 1 .95E 00 |
| 43 | RU-106 | 3.67E 02 | 2.19E-08 | 1.01E-02 | 0.0 |
| 44 | TE-132 | 3.24E 00 | 2.48E-06 | 1.00E-01 | 2.33E-01 |
| 45 | I-129 | 6.21E 09 | 1.29E-15 | 5.43E-02 | 2.46E-02 |
| 46 | I-131 | 8.05E 00 | 9.96E-07 | 1.94E-01 | 3.81E-01 |
| 47 | I-132 | 9.58E-02 | 8.37E-05 | 4.89E-01 | 2.24E 00 |
| 48 | I-133 | 8.75E-01 | 9.17E-06 | 4.08E-01 | 6.02E-01 |
| 49 | I-134 | 3.61E-02 | 2.22E-04 | 6.16E-01 | 2.59E 00 |
| 50 | I-135 | 2.79E-01 | 2.87E-05 | 3.68E-01 | 1.55E 00 |
| 51 | XE-131m | 1.18E 01 | 6.80E-07 | 1.43E-01 | 2.01E-02 |
| 52 | XE-133m | 2.26E 00 | 3.55E-06 | 1.90E-01 | 4.15E-02 |
| 53 | XE-133 | 5.27E 00 | 1.52E-06 | 1.35E-01 | 4.60E-02 |
| 54 | XE-135m | 1.08E-02 | 7.43E-04 | 9.58E-02 | 4.32E-01 |
| 55 | XE-135 | 3.83E-01 | 2.09E-05 | 3.17E-01 | 2.47E-01 |
| 56 | XE-137 | 2.71E 03 | 2.96E-03 | 1.77E 00 | 1.88E-01 |
| 57 | XE-138 | 9.84E-03 | 8.15E-04 | 6.65E-01 | 1.10E 00 |
| 58 | CS-134 | 7.48E 02 | 1.07E-08 | 1.63E-01 | 1.55E 00 |
| 59 | CS-135 | 1.10E 09 | 7.29E-15 | 5.63E-02 | 0.0 |
| 60 | CS-136 | 1.30E 01 | 6.17E-07 | 1.37E-01 | 2.15E 00 |
| 61 | CS-137 | 1.10E 04 | 7.29E-10 | 1.71E-01 | 5.97E-01 |
| 62 | CS-138 | 2.24E-02 | 3.58E-04 | 1.20E 00 | 2.30E 00 |
| 63 | BA-139 | 5.76E-02 | 1.39E-04 | 8.96E-01 | 3.53E-02 |
| 64 | BA-140 | 1.28E 01 | 6.27E-07 | 3.15E-01 | 1.71E-01 |
| 65 | LA-140 | 1.68E 00 | 4.77E-06 | 5.33E-01 | 2.31E 00 |
| 66 | CE-144 | 2.84E 02 | 2.82E-08 | 9.13E-02 | 1.93E-02 |
| 67 | PR-143 | 1.36E 01 | 5.90E-07 | 3.14E-01 | 0.0 |
| 68 | PR-144 | 1.20E-02 | 6.68E-04 | 1.21E 00 | 3.18E 00 |

¹ Average energy per disintegration values were obtained from ICRP Publication No 38, Radionuclide Transformations: Energy and Intensity of Emissions 1983 and NUREG/CR-1413 (ORNL/NUREG-70), a Radionuclide Decay Data Base - Index and Summary Table, DC Kocher, May 1980.

PALISADES NUCLEAR PLANT OFFSITE DOSE CALCULATION MANUAL

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TABLE 1.3

| USNRC COMPUTER CODE - XQDDQ, VERSION 2.0 | | RUN DATE: 970513 | | | | | | | | | |
|--|---------------------------------|------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| ***** PALISADES XQDDQ82 ***** USING 01/01/92 - 12/31/96 MET DATA ***** | | | | | | | | | | | |
| GROUND LEVEL RELEASE - TOP OF CONTAINMENT BUILDING NO DECAY, UNDEPLETED | | | | | | | | | | | |
| SECTOR | DISTANCE IN MILES FROM THE SITE | | | | | | | | | | |
| | 0.250 | 0.500 | 0.750 | 1.000 | 1.500 | 2.000 | 2.500 | 3.000 | 3.500 | 4.000 | 4.500 |
| S | 4.208E-06 | 1.381E-06 | 7.556E-07 | 4.993E-07 | 2.782E-07 | 1.842E-07 | 1.340E-07 | 1.033E-07 | 8.298E-08 | 6.867E-08 | 5.813E-08 |
| SSW | 3.330E-06 | 1.086E-06 | 5.856E-07 | 3.870E-07 | 2.160E-07 | 1.437E-07 | 1.048E-07 | 8.108E-08 | 6.528E-08 | 5.413E-08 | 4.590E-08 |
| SW | 3.890E-06 | 1.242E-06 | 6.590E-07 | 4.333E-07 | 2.413E-07 | 1.614E-07 | 1.184E-07 | 9.203E-08 | 7.440E-08 | 6.191E-08 | 5.267E-08 |
| WSW | 4.060E-06 | 1.279E-06 | 6.715E-07 | 4.401E-07 | 2.450E-07 | 1.648E-07 | 1.215E-07 | 9.484E-08 | 7.694E-08 | 6.422E-08 | 5.477E-08 |
| W | 5.544E-06 | 1.759E-06 | 9.224E-07 | 6.035E-07 | 3.349E-07 | 2.249E-07 | 1.657E-07 | 1.292E-07 | 1.047E-07 | 8.735E-08 | 7.447E-08 |
| WNW | 7.378E-06 | 2.346E-06 | 1.235E-06 | 8.084E-07 | 4.487E-07 | 3.010E-07 | 2.216E-07 | 1.726E-07 | 1.399E-07 | 1.166E-07 | 9.937E-08 |
| NW | 9.531E-06 | 2.974E-06 | 1.551E-06 | 1.012E-06 | 5.610E-07 | 3.784E-07 | 2.800E-07 | 2.191E-07 | 1.781E-07 | 1.490E-07 | 1.273E-07 |
| NNW | 1.286E-05 | 3.959E-06 | 2.052E-06 | 1.339E-06 | 7.443E-07 | 5.039E-07 | 3.741E-07 | 2.935E-07 | 2.391E-07 | 2.003E-07 | 1.715E-07 |
| N | 1.087E-05 | 3.347E-06 | 1.739E-06 | 1.138E-06 | 6.348E-07 | 4.300E-07 | 3.192E-07 | 2.504E-07 | 2.040E-07 | 1.709E-07 | 1.462E-07 |
| NNE | 5.487E-06 | 1.717E-06 | 9.119E-07 | 6.000E-07 | 3.353E-07 | 2.258E-07 | 1.664E-07 | 1.299E-07 | 1.054E-07 | 8.793E-08 | 7.501E-08 |
| NE | 5.450E-06 | 1.803E-06 | 9.856E-07 | 6.476E-07 | 3.578E-07 | 2.355E-07 | 1.705E-07 | 1.310E-07 | 1.049E-07 | 8.657E-08 | 7.312E-08 |
| ENE | 4.258E-06 | 1.379E-06 | 7.464E-07 | 4.886E-07 | 2.697E-07 | 1.773E-07 | 1.282E-07 | 9.850E-08 | 7.885E-08 | 6.507E-08 | 5.496E-08 |
| E | 4.618E-06 | 1.531E-06 | 8.321E-07 | 5.438E-07 | 2.990E-07 | 1.959E-07 | 1.413E-07 | 1.082E-07 | 8.645E-08 | 7.120E-08 | 6.002E-08 |
| ESE | 4.436E-06 | 1.479E-06 | 8.008E-07 | 5.210E-07 | 2.848E-07 | 1.860E-07 | 1.338E-07 | 1.023E-07 | 8.153E-08 | 6.704E-08 | 5.644E-08 |
| SE | 5.091E-06 | 1.678E-06 | 9.044E-07 | 5.872E-07 | 3.207E-07 | 2.096E-07 | 1.509E-07 | 1.155E-07 | 9.217E-08 | 7.586E-08 | 6.391E-08 |
| SSE | 6.044E-06 | 2.000E-06 | 1.088E-06 | 7.106E-07 | 3.901E-07 | 2.557E-07 | 1.845E-07 | 1.415E-07 | 1.131E-07 | 9.317E-08 | 7.858E-08 |
| SECTOR | DISTANCE IN MILES FROM THE SITE | | | | | | | | | | |
| | 5.000 | 7.500 | 10.000 | 15.000 | 20.000 | 25.000 | 30.000 | 35.000 | 40.000 | 45.000 | 50.000 |
| S | 5.010E-08 | 2.837E-08 | 1.901E-08 | 1.086E-08 | 7.228E-09 | 5.410E-09 | 4.227E-09 | 3.433E-09 | 2.869E-09 | 2.450E-09 | 2.127E-09 |
| SSW | 3.963E-08 | 2.257E-08 | 1.519E-08 | 8.728E-09 | 5.913E-09 | 4.379E-09 | 3.431E-09 | 2.793E-09 | 2.338E-09 | 2.000E-09 | 1.740E-09 |
| SW | 4.560E-08 | 2.627E-08 | 1.782E-08 | 1.037E-08 | 7.086E-09 | 5.284E-09 | 4.163E-09 | 3.405E-09 | 2.863E-09 | 2.458E-09 | 2.145E-09 |
| WSW | 4.753E-08 | 2.763E-08 | 1.886E-08 | 1.106E-08 | 7.602E-09 | 5.693E-09 | 4.501E-09 | 3.693E-09 | 3.113E-09 | 2.678E-09 | 2.342E-09 |
| W | 6.459E-08 | 3.749E-08 | 2.557E-08 | 1.498E-08 | 1.029E-08 | 7.706E-09 | 6.091E-09 | 4.996E-09 | 4.211E-09 | 3.623E-09 | 3.168E-09 |
| WNW | 8.615E-08 | 4.992E-08 | 3.400E-08 | 1.989E-08 | 1.364E-08 | 1.021E-08 | 8.059E-09 | 6.606E-09 | 5.565E-09 | 4.785E-09 | 4.183E-09 |
| NW | 1.106E-07 | 6.471E-08 | 4.436E-08 | 2.618E-08 | 1.808E-08 | 1.359E-08 | 1.077E-08 | 8.857E-09 | 7.481E-09 | 6.449E-09 | 5.649E-09 |
| NNW | 1.492E-07 | 8.772E-08 | 6.035E-08 | 3.579E-08 | 2.479E-08 | 1.867E-08 | 1.483E-08 | 1.221E-08 | 1.033E-08 | 8.915E-09 | 7.817E-09 |
| N | 1.273E-07 | 7.475E-08 | 5.139E-08 | 3.045E-08 | 2.107E-08 | 1.586E-08 | 1.259E-08 | 1.036E-08 | 8.762E-09 | 7.559E-09 | 6.625E-09 |
| NNE | 6.508E-08 | 3.782E-08 | 2.581E-08 | 1.513E-08 | 1.039E-08 | 7.81E-09 | 6.148E-09 | 5.042E-09 | 4.248E-09 | 3.654E-09 | 3.194E-09 |
| NE | 6.291E-08 | 3.539E-08 | 2.361E-08 | 1.342E-08 | 9.033E-09 | 6.656E-09 | 5.193E-09 | 4.213E-09 | 3.517E-09 | 3.000E-09 | 2.604E-09 |
| ENE | 4.729E-08 | 2.665E-08 | 1.781E-08 | 1.015E-08 | 6.847E-09 | 5.056E-09 | 3.951E-09 | 3.211E-09 | 2.684E-09 | 2.293E-09 | 1.993E-09 |
| E | 5.155E-08 | 2.883E-08 | 1.915E-08 | 1.083E-08 | 7.262E-09 | 5.337E-09 | 4.155E-09 | 3.366E-09 | 2.806E-09 | 2.392E-09 | 2.074E-09 |
| ESE | 4.843E-08 | 2.698E-08 | 1.788E-08 | 1.007E-08 | 6.742E-09 | 4.948E-09 | 3.848E-09 | 3.114E-09 | 2.594E-09 | 2.210E-09 | 1.915E-09 |
| SE | 5.488E-08 | 3.069E-08 | 2.039E-08 | 1.154E-08 | 7.748E-09 | 5.702E-09 | 4.445E-09 | 3.604E-09 | 3.008E-09 | 2.566E-09 | 2.227E-09 |
| SSE | 6.753E-08 | 3.785E-08 | 2.519E-08 | 1.428E-08 | 9.595E-09 | 7.064E-09 | 5.507E-09 | 4.466E-09 | 3.727E-09 | 3.179E-09 | 2.758E-09 |

| VENT AND BUILDING PARAMETERS: | | | |
|-------------------------------|-------|--|--------|
| RELEASE HEIGHT (METERS) | 58.10 | REP. WIND HEIGHT (METERS) | 10.0 |
| DIAMETER (METERS) | 0.00 | BUILDING HEIGHT (METERS) | 58.1 |
| EXIT VELOCITY (METERS) | 0.00 | BLDG. MIN. CRS. SEC. AREA (SQ. METERS) | 2000.0 |
| | | HEAT EMISSION RATE (CAL/SEC) | 0.0 |
| ALL GROUND LEVEL RELEASES. | | | |

**PALISADES NUCLEAR PLANT
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TABLE 1.3

USNRC COMPUTER CODE - XQDDQ, VERSION 2.0 RUN DATE: 970513

***** PALISADES XQDDQ82 ***** USING 01/01/92 - 12/31/96 MET DATA *****

GROUND LEVEL RELEASE - TOP OF CONTAINMENT BUILDING
NO DECAY, UNDEPLETED

| DIRECTION FROM SITE | SEGMENT BOUNDARIES IN MILES FROM THE SITE | | | | | | | | | |
|------------------------|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | .5-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-10 | 10-20 | 20-30 | 30-40 | 40-50 |
| S | 7.808E-07 | 2.856E-07 | 1.351E-07 | 8.334E-08 | 5.828E-08 | 2.904E-08 | 1.110E-08 | 5.448E-09 | 3.445E-09 | 2.454E-09 |
| SSW | 6.085E-07 | 2.219E-07 | 1.057E-07 | 6.555E-08 | 4.602E-08 | 2.308E-08 | 8.912E-09 | 4.409E-09 | 2.802E-09 | 2.004E-09 |
| SW | 6.883E-07 | 2.484E-07 | 1.193E-07 | 7.468E-08 | 5.279E-08 | 2.681E-08 | 1.057E-08 | 5.316E-09 | 3.415E-09 | 2.462E-09 |
| WSW | 7.038E-07 | 2.527E-07 | 1.224E-07 | 7.721E-08 | 5.489E-08 | 2.815E-08 | 1.126E-08 | 5.725E-09 | 3.703E-09 | 2.683E-09 |
| W | 9.666E-07 | 3.457E-07 | 1.669E-07 | 1.051E-07 | 7.463E-08 | 3.821E-08 | 1.525E-08 | 7.749E-09 | 5.010E-09 | 3.629E-09 |
| WNW | 1.292E-06 | 4.630E-07 | 2.232E-07 | 1.404E-07 | 9.958E-08 | 5.089E-08 | 2.025E-08 | 1.026E-08 | 6.625E-09 | 4.793E-09 |
| NW | 1.627E-06 | 5.800E-07 | 2.819E-07 | 1.787E-07 | 1.276E-07 | 6.587E-08 | 2.662E-08 | 1.366E-08 | 8.879E-09 | 6.458E-09 |
| NNW | 2.159E-06 | 7.695E-07 | 3.765E-07 | 2.399E-07 | 1.718E-07 | 8.923E-08 | 3.636E-08 | 1.877E-08 | 1.224E-08 | 8.928E-09 |
| N | 1.829E-06 | 6.557E-07 | 3.212E-07 | 2.046E-07 | 1.465E-07 | 7.604E-08 | 3.093E-08 | 1.594E-08 | 1.039E-08 | 7.569E-09 |
| NNE | 9.521E-07 | 3.454E-07 | 1.676E-07 | 1.057E-07 | 7.516E-08 | 3.854E-08 | 1.540E-08 | 7.825E-09 | 5.056E-09 | 3.660E-09 |
| NE | 1.017E-06 | 3.678E-07 | 1.720E-07 | 1.054E-07 | 7.332E-08 | 3.627E-08 | 1.374E-08 | 6.704E-09 | 4.227E-09 | 3.006E-09 |
| ENE | 7.724E-07 | 2.773E-07 | 1.294E-07 | 7.922E-08 | 5.511E-08 | 2.731E-08 | 1.038E-08 | 5.092E-09 | 3.222E-09 | 2.298E-09 |
| E | 8.592E-07 | 3.076E-07 | 1.426E-07 | 8.686E-08 | 6.020E-08 | 2.958E-08 | 1.109E-08 | 5.378E-09 | 3.378E-09 | 2.397E-09 |
| ESE | 8.271E-07 | 2.934E-07 | 1.351E-07 | 8.193E-08 | 5.661E-08 | 2.770E-08 | 1.033E-08 | 4.986E-09 | 3.126E-09 | 2.214E-09 |
| SE | 9.353E-07 | 3.305E-07 | 1.524E-07 | 9.262E-08 | 6.411E-08 | 3.149E-08 | 1.182E-08 | 5.745E-09 | 3.617E-09 | 2.571E-09 |
| SSE | 1.123E-06 | 4.016E-07 | 1.863E-07 | 1.136E-07 | 7.881E-08 | 3.882E-08 | 1.462E-08 | 7.116E-09 | 4.482E-09 | 3.186E-09 |

PALISADES NUCLEAR PLANT OFFSITE DOSE CALCULATION MANUAL

Revision 16

TABLE 1.3

| SECTOR | DISTANCE IN MILES FROM THE SITE | | | | | | | | | | SECTOR |
|--------|---------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | 0.250 | 0.500 | 0.750 | 1.000 | 1.500 | 2.000 | 2.500 | 3.000 | 3.500 | 4.000 | |
| S | 4.205E-06 | 1.379E-06 | 7.540E-07 | 4.979E-07 | 2.769E-07 | 1.831E-07 | 1.330E-07 | 1.024E-07 | 8.212E-08 | 6.785E-08 | 5.735E-08 |
| SSW | 3.327E-06 | 1.084E-06 | 5.842E-07 | 3.858E-07 | 2.150E-07 | 1.428E-07 | 1.040E-07 | 8.032E-08 | 6.457E-08 | 5.346E-08 | 4.526E-08 |
| SW | 3.887E-06 | 1.240E-06 | 6.575E-07 | 4.319E-07 | 2.402E-07 | 1.604E-07 | 1.175E-07 | 9.117E-08 | 7.359E-08 | 6.114E-08 | 5.193E-08 |
| WSW | 4.057E-06 | 1.277E-06 | 6.699E-07 | 4.388E-07 | 2.439E-07 | 1.637E-07 | 1.206E-07 | 9.394E-08 | 7.609E-08 | 6.341E-08 | 5.400E-08 |
| W | 5.550E-06 | 1.757E-06 | 9.203E-07 | 6.016E-07 | 3.334E-07 | 2.235E-07 | 1.644E-07 | 1.280E-07 | 1.036E-07 | 8.628E-08 | 7.344E-08 |
| WNW | 7.373E-06 | 2.343E-06 | 1.232E-06 | 8.062E-07 | 4.468E-07 | 2.993E-07 | 2.009E-07 | 1.712E-07 | 1.385E-07 | 1.153E-07 | 9.810E-08 |
| NW | 9.524E-06 | 2.969E-06 | 1.547E-06 | 1.009E-06 | 5.585E-07 | 3.761E-07 | 2.779E-07 | 2.171E-07 | 1.762E-07 | 1.472E-07 | 1.256E-07 |
| NNW | 1.285E-05 | 3.953E-06 | 2.047E-06 | 1.335E-06 | 7.408E-07 | 5.008E-07 | 3.712E-07 | 2.907E-07 | 2.365E-07 | 1.979E-07 | 1.691E-07 |
| N | 1.087E-05 | 3.341E-06 | 1.735E-06 | 1.134E-06 | 6.316E-07 | 4.271E-07 | 3.165E-07 | 2.478E-07 | 2.016E-07 | 1.686E-07 | 1.440E-07 |
| NNE | 5.483E-06 | 1.714E-06 | 9.099E-07 | 5.982E-07 | 3.388E-07 | 2.242E-07 | 1.652E-07 | 1.287E-07 | 1.042E-07 | 8.687E-08 | 7.398E-08 |
| NE | 5.447E-06 | 1.800E-06 | 9.837E-07 | 6.458E-07 | 3.563E-07 | 2.343E-07 | 1.693E-07 | 1.299E-07 | 1.039E-07 | 8.564E-08 | 7.223E-08 |
| ENE | 4.255E-06 | 1.377E-06 | 7.448E-07 | 4.872E-07 | 2.685E-07 | 1.763E-07 | 1.273E-07 | 9.763E-08 | 7.804E-08 | 6.431E-08 | 5.423E-08 |
| E | 4.615E-06 | 1.528E-06 | 8.303E-07 | 5.423E-07 | 2.977E-07 | 1.948E-07 | 1.403E-07 | 1.073E-07 | 8.559E-08 | 7.039E-08 | 5.925E-08 |
| ESE | 4.433E-06 | 1.477E-06 | 7.992E-07 | 5.196E-07 | 2.837E-07 | 1.850E-07 | 1.328E-07 | 1.014E-07 | 8.075E-08 | 6.631E-08 | 5.575E-08 |
| SE | 5.088E-06 | 1.676E-06 | 9.026E-07 | 5.856E-07 | 3.194E-07 | 2.085E-07 | 1.499E-07 | 1.145E-07 | 9.128E-08 | 7.502E-08 | 6.312E-08 |
| SSE | 6.040E-06 | 1.997E-06 | 1.086E-06 | 7.087E-07 | 3.885E-07 | 2.543E-07 | 1.833E-07 | 1.403E-07 | 1.120E-07 | 9.213E-08 | 7.760E-08 |

| SECTOR | DISTANCE IN MILES FROM THE SITE | | | | | | | | | | SECTOR |
|--------|---------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | 5.000 | 7.500 | 10.000 | 15.000 | 20.000 | 25.000 | 30.000 | 35.000 | 40.000 | 45.000 | |
| S | 4.936E-08 | 2.774E-08 | 1.845E-08 | 1.039E-08 | 6.911E-09 | 5.029E-09 | 3.874E-09 | 3.103E-09 | 2.557E-09 | 2.153E-09 | 1.844E-09 |
| SSW | 3.901E-08 | 2.204E-08 | 1.472E-08 | 8.327E-09 | 5.555E-09 | 4.051E-09 | 3.126E-09 | 2.506E-09 | 2.067E-09 | 1.742E-09 | 1.492E-09 |
| SW | 4.489E-08 | 2.566E-08 | 1.727E-08 | 9.893E-09 | 6.657E-09 | 4.889E-09 | 3.793E-09 | 3.056E-09 | 2.531E-09 | 2.140E-09 | 1.840E-09 |
| WSW | 4.678E-08 | 2.698E-08 | 1.827E-08 | 1.055E-08 | 7.141E-09 | 5.267E-09 | 4.101E-09 | 3.314E-09 | 2.751E-09 | 2.332E-09 | 2.009E-09 |
| W | 6.361E-08 | 3.664E-08 | 2.480E-08 | 1.431E-08 | 9.688E-09 | 7.147E-09 | 5.566E-09 | 4.500E-09 | 3.738E-09 | 3.170E-09 | 2.732E-09 |
| WNW | 8.494E-08 | 4.886E-08 | 3.304E-08 | 1.906E-08 | 1.289E-08 | 9.508E-09 | 7.405E-09 | 5.987E-09 | 4.975E-09 | 4.220E-09 | 3.639E-09 |
| NW | 1.090E-07 | 6.323E-08 | 4.301E-08 | 2.500E-08 | 1.700E-08 | 1.259E-08 | 9.836E-09 | 7.972E-09 | 6.638E-09 | 5.641E-09 | 4.872E-09 |
| NNW | 1.469E-07 | 8.570E-08 | 5.851E-08 | 3.417E-08 | 2.331E-08 | 1.730E-08 | 1.354E-08 | 1.099E-08 | 9.164E-09 | 7.796E-09 | 6.739E-09 |
| N | 1.251E-07 | 7.285E-08 | 4.966E-08 | 2.893E-08 | 1.969E-08 | 1.458E-08 | 1.139E-08 | 9.223E-09 | 7.674E-09 | 6.516E-09 | 5.622E-09 |
| NNE | 6.410E-08 | 3.697E-08 | 2.504E-08 | 1.446E-08 | 9.786E-09 | 7.218E-09 | 5.620E-09 | 4.541E-09 | 3.771E-09 | 3.196E-09 | 2.754E-09 |
| NE | 6.206E-08 | 3.468E-08 | 2.298E-08 | 1.289E-08 | 8.558E-09 | 6.223E-09 | 4.791E-09 | 3.836E-09 | 3.160E-09 | 2.662E-09 | 2.280E-09 |
| ENE | 4.659E-08 | 2.607E-08 | 1.729E-08 | 9.711E-09 | 6.459E-09 | 4.702E-09 | 3.624E-09 | 2.904E-09 | 2.395E-09 | 2.018E-09 | 1.730E-09 |
| E | 5.082E-08 | 2.822E-08 | 1.861E-08 | 1.037E-08 | 6.861E-09 | 4.973E-09 | 3.819E-09 | 3.051E-09 | 2.509E-09 | 2.110E-09 | 1.805E-09 |
| ESE | 4.776E-08 | 2.643E-08 | 1.739E-08 | 9.664E-09 | 6.380E-09 | 4.619E-09 | 3.544E-09 | 2.830E-09 | 2.327E-09 | 1.956E-09 | 1.673E-09 |
| SE | 5.413E-08 | 3.005E-08 | 1.983E-08 | 1.106E-08 | 7.329E-09 | 5.320E-09 | 4.091E-09 | 3.273E-09 | 2.695E-09 | 2.268E-09 | 1.943E-09 |
| SSE | 6.659E-08 | 3.706E-08 | 2.449E-08 | 1.369E-08 | 9.073E-09 | 6.588E-09 | 5.066E-09 | 4.053E-09 | 3.337E-09 | 2.808E-09 | 2.404E-09 |

| VENT AND BUILDING PARAMETERS: | | | |
|-------------------------------|-------|--|--------|
| RELEASE HEIGHT (METERS) | 58.10 | REP. WIND HEIGHT (METERS) | 10.0 |
| DIAMETER (METERS) | 0.00 | BUILDING HEIGHT (METERS) | 58.1 |
| EXIT VELOCITY (METERS) | 0.00 | BLDG. MIN. CRS. SEC. AREA (SQ. METERS) | 2000.0 |
| | | HEAT EMISSION RATE (CAL/SEC) | 0.0 |

ALL GROUND LEVEL RELEASES.

**PALISADES NUCLEAR PLANT
OFFSITE DOSE CALCULATION MANUAL**

Revision 16

TABLE 1.3

USNRC COMPUTER CODE - XOODQO, VERSION 2.0 RUN DATE: 970513

***** PALISADES XOODQO82 ***** USING 01/01/92 - 12/31/96 NET DATA *****

GROUND LEVEL RELEASE - TOP OF CONTAINMENT BUILDING
2.260 DAY DECAY, UNDEPLETED

| DIRECTION FROM SITE | SEGMENT BOUNDARIES IN MILES FROM THE SITE | | | | | | | | | |
|------------------------|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | .5-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-10 | 10-20 | 20-30 | 30-40 | 40-50 |
| S | 7.791E-07 | 2.843E-07 | 1.341E-07 | 8.248E-08 | 5.750E-08 | 2.842E-08 | 1.064E-08 | 5.069E-09 | 3.115E-09 | 2.158E-09 |
| SSW | 6.072E-07 | 2.209E-07 | 1.049E-07 | 6.484E-08 | 4.537E-08 | 2.256E-08 | 8.515E-09 | 4.082E-09 | 2.516E-09 | 1.746E-09 |
| SW | 6.867E-07 | 2.473E-07 | 1.184E-07 | 7.387E-08 | 5.205E-08 | 2.621E-08 | 1.010E-08 | 4.922E-09 | 3.066E-09 | 2.145E-09 |
| WSW | 7.022E-07 | 2.516E-07 | 1.214E-07 | 7.636E-08 | 5.412E-08 | 2.751E-08 | 1.075E-08 | 5.300E-09 | 3.324E-09 | 2.337E-09 |
| W | 9.645E-07 | 3.441E-07 | 1.656E-07 | 1.040E-07 | 7.360E-08 | 3.737E-08 | 1.459E-08 | 7.192E-09 | 4.514E-09 | 3.176E-09 |
| WNW | 1.290E-06 | 4.611E-07 | 2.216E-07 | 1.390E-07 | 9.832E-08 | 4.985E-08 | 1.942E-08 | 9.569E-09 | 6.007E-09 | 4.229E-09 |
| NW | 1.624E-06 | 5.775E-07 | 2.798E-07 | 1.768E-07 | 1.258E-07 | 6.441E-08 | 2.545E-08 | 1.267E-08 | 7.996E-09 | 5.651E-09 |
| NNW | 2.154E-06 | 7.661E-07 | 3.736E-07 | 2.373E-07 | 1.694E-07 | 8.722E-08 | 3.475E-08 | 1.740E-08 | 1.102E-08 | 7.810E-09 |
| N | 1.825E-06 | 6.524E-07 | 3.185E-07 | 2.022E-07 | 1.443E-07 | 7.415E-08 | 2.943E-08 | 1.466E-08 | 9.251E-09 | 6.528E-09 |
| NNE | 9.500E-07 | 3.438E-07 | 1.663E-07 | 1.046E-07 | 7.414E-08 | 3.770E-08 | 1.473E-08 | 7.263E-09 | 4.556E-09 | 3.203E-09 |
| NE | 1.015E-06 | 3.664E-07 | 1.709E-07 | 1.044E-07 | 7.244E-08 | 3.557E-08 | 1.321E-08 | 6.272E-09 | 3.851E-09 | 2.668E-09 |
| ENE | 7.708E-07 | 2.761E-07 | 1.285E-07 | 7.840E-08 | 5.439E-08 | 2.673E-08 | 9.950E-09 | 4.739E-09 | 2.916E-09 | 2.023E-09 |
| E | 8.574E-07 | 3.063E-07 | 1.416E-07 | 8.600E-08 | 5.943E-08 | 2.897E-08 | 1.064E-08 | 5.015E-09 | 3.064E-09 | 2.115E-09 |
| ESE | 8.255E-07 | 2.922E-07 | 1.342E-07 | 8.115E-08 | 5.592E-08 | 2.715E-08 | 9.921E-09 | 4.659E-09 | 2.842E-09 | 1.961E-09 |
| SE | 9.335E-07 | 3.292E-07 | 1.514E-07 | 9.173E-08 | 6.332E-08 | 3.086E-08 | 1.135E-08 | 5.364E-09 | 3.286E-09 | 2.274E-09 |
| SSE | 1.121E-06 | 4.000E-07 | 1.850E-07 | 1.125E-07 | 7.783E-08 | 3.804E-08 | 1.404E-08 | 6.642E-09 | 4.070E-09 | 2.815E-09 |

PALISADES NUCLEAR PLANT
OFFSITE DOSE CALCULATION MANUAL

Revision 16

TABLE 1.3

| SECTOR | ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) | 0.250 | 0.500 | 0.750 | 1.000 | 1.500 | 2.000 | 2.500 | 3.000 | 3.500 | 4.000 | 4.500 |
|---------------------------------|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| DISTANCE IN MILES FROM THE SITE | | | | | | | | | | | | |
| S | 3.982E-06 | 1.261E-06 | 6.730E-07 | 4.367E-07 | 2.359E-07 | 1.523E-07 | 1.083E-07 | 8.186E-08 | 6.456E-08 | 5.254E-08 | 4.378E-08 | 3.788E-08 |
| SSW | 3.150E-06 | 9.913E-07 | 5.215E-07 | 3.384E-07 | 1.832E-07 | 1.187E-07 | 8.473E-08 | 6.423E-08 | 5.078E-08 | 4.141E-08 | 3.457E-08 | 3.057E-08 |
| SW | 3.681E-06 | 1.134E-06 | 5.869E-07 | 3.789E-07 | 2.047E-07 | 1.334E-07 | 9.572E-08 | 7.291E-08 | 5.787E-08 | 4.736E-08 | 3.966E-08 | 3.457E-08 |
| WSW | 3.842E-06 | 1.168E-06 | 5.980E-07 | 3.849E-07 | 2.078E-07 | 1.362E-07 | 9.823E-08 | 7.513E-08 | 5.985E-08 | 4.912E-08 | 4.125E-08 | 3.608E-08 |
| W | 5.256E-06 | 1.606E-06 | 8.215E-07 | 5.278E-07 | 2.841E-07 | 1.859E-07 | 1.339E-07 | 1.023E-07 | 8.146E-08 | 6.682E-08 | 5.608E-08 | 4.912E-08 |
| WNW | 6.982E-06 | 2.141E-06 | 1.100E-06 | 7.071E-07 | 3.806E-07 | 2.488E-07 | 1.791E-07 | 1.368E-07 | 1.088E-07 | 8.923E-08 | 7.486E-08 | 6.508E-08 |
| NW | 9.018E-06 | 2.715E-06 | 1.381E-06 | 8.849E-07 | 4.758E-07 | 3.128E-07 | 2.263E-07 | 1.736E-07 | 1.386E-07 | 1.140E-07 | 9.588E-08 | 8.378E-08 |
| NW | 1.217E-05 | 3.613E-06 | 1.827E-06 | 1.171E-06 | 6.312E-07 | 4.155E-07 | 3.024E-07 | 2.325E-07 | 1.860E-07 | 1.532E-07 | 1.291E-07 | 1.101E-07 |
| N | 1.029E-05 | 3.055E-06 | 1.549E-06 | 9.954E-07 | 5.384E-07 | 3.584E-07 | 2.579E-07 | 1.983E-07 | 1.586E-07 | 1.307E-07 | 1.101E-07 | 9.708E-08 |
| NNE | 5.192E-06 | 1.567E-06 | 8.121E-07 | 5.248E-07 | 2.844E-07 | 1.865E-07 | 1.345E-07 | 1.029E-07 | 8.196E-08 | 6.727E-08 | 5.649E-08 | 4.912E-08 |
| NNE | 5.157E-06 | 1.645E-06 | 8.778E-07 | 5.664E-07 | 3.035E-07 | 1.947E-07 | 1.378E-07 | 1.038E-07 | 8.162E-08 | 6.625E-08 | 5.509E-08 | 4.815E-08 |
| ENE | 4.029E-06 | 1.259E-06 | 6.648E-07 | 4.273E-07 | 2.287E-07 | 1.466E-07 | 1.037E-07 | 7.804E-08 | 6.135E-08 | 4.978E-08 | 4.139E-08 | 3.608E-08 |
| E | 4.370E-06 | 1.397E-06 | 7.103E-07 | 4.756E-07 | 2.536E-07 | 1.620E-07 | 1.142E-07 | 8.576E-08 | 6.727E-08 | 5.448E-08 | 4.522E-08 | 3.966E-08 |
| ESE | 4.198E-06 | 1.350E-06 | 7.132E-07 | 4.557E-07 | 2.416E-07 | 1.538E-07 | 1.081E-07 | 8.103E-08 | 6.344E-08 | 5.130E-08 | 4.252E-08 | 3.788E-08 |
| SE | 4.817E-06 | 1.532E-06 | 8.055E-07 | 5.136E-07 | 2.720E-07 | 1.733E-07 | 1.220E-07 | 9.152E-08 | 7.172E-08 | 5.805E-08 | 4.815E-08 | 4.139E-08 |
| SSE | 5.719E-06 | 1.826E-06 | 9.691E-07 | 6.216E-07 | 3.309E-07 | 2.114E-07 | 1.492E-07 | 1.121E-07 | 8.798E-08 | 7.129E-08 | 5.920E-08 | 5.130E-08 |

| SECTOR | ANNUAL AVERAGE CHI/Q (SEC/METER CUBED) | 5.000 | 7.500 | 10.000 | 15.000 | 20.000 | 25.000 | 30.000 | 35.000 | 40.000 | 45.000 | 50.000 |
|---------------------------------|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| DISTANCE IN MILES FROM THE SITE | | | | | | | | | | | | |
| S | 3.719E-08 | 1.987E-08 | 1.266E-08 | 6.668E-09 | 4.208E-09 | 2.931E-09 | 2.174E-09 | 1.683E-09 | 1.345E-09 | 1.102E-09 | 9.195E-10 | 8.057E-10 |
| SSW | 2.941E-08 | 1.580E-08 | 1.011E-08 | 5.355E-09 | 3.392E-09 | 2.370E-09 | 1.762E-09 | 1.367E-09 | 1.094E-09 | 8.973E-10 | 7.499E-10 | 6.557E-10 |
| SW | 3.384E-08 | 1.840E-08 | 1.187E-08 | 6.362E-09 | 4.065E-09 | 2.860E-09 | 2.138E-09 | 1.667E-09 | 1.340E-09 | 1.103E-09 | 9.248E-10 | 8.057E-10 |
| WSW | 3.527E-08 | 1.935E-08 | 1.256E-08 | 6.786E-09 | 4.361E-09 | 3.081E-09 | 2.311E-09 | 1.807E-09 | 1.457E-09 | 1.202E-09 | 1.010E-09 | 8.861E-10 |
| W | 4.794E-08 | 2.626E-08 | 1.703E-08 | 9.195E-09 | 5.907E-09 | 4.173E-09 | 3.130E-09 | 2.448E-09 | 1.973E-09 | 1.628E-09 | 1.368E-09 | 1.202E-09 |
| WNW | 6.396E-08 | 3.498E-08 | 2.266E-08 | 1.222E-08 | 7.839E-09 | 5.533E-09 | 4.148E-09 | 3.241E-09 | 2.612E-09 | 2.154E-09 | 1.810E-09 | 1.595E-09 |
| NW | 8.212E-08 | 4.532E-08 | 2.954E-08 | 1.607E-08 | 1.037E-08 | 7.352E-09 | 5.531E-09 | 4.335E-09 | 3.502E-09 | 2.894E-09 | 2.436E-09 | 2.139E-09 |
| NW | 1.107E-07 | 6.143E-08 | 4.019E-08 | 2.196E-08 | 1.422E-08 | 1.011E-08 | 7.617E-09 | 5.980E-09 | 4.836E-09 | 4.002E-09 | 3.371E-09 | 2.916E-09 |
| N | 9.439E-08 | 5.231E-08 | 3.419E-08 | 1.866E-08 | 1.207E-08 | 8.564E-09 | 6.449E-09 | 5.058E-09 | 4.087E-09 | 3.379E-09 | 2.844E-09 | 2.436E-09 |
| NNE | 4.831E-08 | 2.649E-08 | 1.719E-08 | 9.289E-09 | 5.967E-09 | 4.214E-09 | 3.160E-09 | 2.470E-09 | 1.991E-09 | 1.642E-09 | 1.379E-09 | 1.202E-09 |
| NE | 4.671E-08 | 2.481E-08 | 1.574E-08 | 8.249E-09 | 5.194E-09 | 3.612E-09 | 2.676E-09 | 2.070E-09 | 1.653E-09 | 1.353E-09 | 1.129E-09 | 9.861E-10 |
| ENE | 3.510E-08 | 1.867E-08 | 1.186E-08 | 6.231E-09 | 3.932E-09 | 2.740E-09 | 2.032E-09 | 1.574E-09 | 1.259E-09 | 1.031E-09 | 8.614E-10 | 7.509E-10 |
| E | 3.827E-08 | 2.020E-08 | 1.276E-08 | 6.651E-09 | 4.172E-09 | 2.894E-09 | 2.139E-09 | 1.652E-09 | 1.317E-09 | 1.077E-09 | 8.971E-10 | 7.861E-10 |
| ESE | 3.596E-08 | 1.891E-08 | 1.192E-08 | 6.190E-09 | 3.875E-09 | 2.684E-09 | 1.981E-09 | 1.529E-09 | 1.219E-09 | 9.955E-10 | 8.292E-10 | 7.202E-10 |
| SE | 4.075E-08 | 2.150E-08 | 1.359E-08 | 7.089E-09 | 4.453E-09 | 3.093E-09 | 2.288E-09 | 1.769E-09 | 1.413E-09 | 1.166E-09 | 9.641E-10 | 8.415E-10 |
| SSE | 5.014E-08 | 2.653E-08 | 1.679E-08 | 8.772E-09 | 5.515E-09 | 3.831E-09 | 2.836E-09 | 2.192E-09 | 1.750E-09 | 1.432E-09 | 1.194E-09 | 1.030E-09 |

| SECTOR | RELEASE HEIGHT (METERS) | 58.10 | REP. WIND HEIGHT (METERS) | 10.0 |
|---------------|----------------------------|-------|---|--------|
| DIAMETER | (METERS) | 0.00 | BUILDING HEIGHT (METERS) | 58.1 |
| EXIT VELOCITY | (METERS) | 0.00 | BLDG.-MIN. CRS. SEC. AREA (SQ. METERS) | 2000.0 |
| | | | HEAT EMISSION RATE (CAL/SEC) | 0.0 |

VENT AND BUILDING PARAMETERS:
RELEASE HEIGHT (METERS) 58.10
DIAMETER (METERS) 0.00
EXIT VELOCITY (METERS) 0.00
ALL GROUND LEVEL RELEASES.

USNRC COMPUTER CODE - XOODOO, VERSION 2.0, RUN DATE: 970513
***** PALISADES XOODOO82 ***** USING 01/01/92 - 12/31/96 MET DATA *****
GROUND LEVEL RELEASE - TOP OF CONTAINMENT BUILDING
8.000 DAY DECAY, DEPLETED

PALISADES NUCLEAR PLANT OFFSITE DOSE CALCULATION MANUAL

Revision 16

TABLE 1.3

USNRC COMPUTER CODE - XQDDQ, VERSION 2.0 RUN DATE: 970513

***** PALISADES XQDDQ82 ***** USING 01/01/92 - 12/31/96 MET DATA *****

GROUND LEVEL RELEASE - TOP OF CONTAINMENT BUILDING
8.000 DAY DECAY, DELETED

CHI/Q (SEC/METER CUBED) FOR EACH SEGMENT

| DIRECTION FROM SITE | SEGMENT BOUNDARIES IN MILES FROM THE SITE | | | | | | | | | |
|---------------------|---|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | 5-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-10 | 10-20 | 20-30 | 30-40 | 40-50 |
| S | 6.986E-07 | 2.434E-07 | 1.094E-07 | 6.492E-08 | 4.393E-08 | 2.052E-08 | 6.907E-09 | 2.969E-09 | 1.695E-09 | 1.106E-09 |
| SSW | 5.445E-07 | 1.891E-07 | 8.560E-08 | 5.105E-08 | 3.468E-08 | 1.630E-08 | 5.540E-09 | 2.399E-09 | 1.376E-09 | 9.011E-10 |
| SW | 6.160E-07 | 2.117E-07 | 9.664E-08 | 5.816E-08 | 3.979E-08 | 1.893E-08 | 6.565E-09 | 2.892E-09 | 1.677E-09 | 1.107E-09 |
| WSW | 6.299E-07 | 2.153E-07 | 9.911E-08 | 6.013E-08 | 4.137E-08 | 1.987E-08 | 6.991E-09 | 3.114E-09 | 1.818E-09 | 1.206E-09 |
| W | 8.653E-07 | 2.946E-07 | 1.351E-07 | 8.184E-08 | 5.625E-08 | 2.697E-08 | 9.475E-09 | 4.218E-09 | 2.462E-09 | 1.634E-09 |
| WNW | 1.157E-06 | 3.946E-07 | 1.808E-07 | 1.094E-07 | 7.508E-08 | 3.594E-08 | 1.259E-08 | 5.594E-09 | 3.261E-09 | 2.162E-09 |
| NW | 1.457E-06 | 4.943E-07 | 2.283E-07 | 1.392E-07 | 9.614E-08 | 4.648E-08 | 1.653E-08 | 7.429E-09 | 4.359E-09 | 2.904E-09 |
| NNW | 1.932E-06 | 6.557E-07 | 3.049E-07 | 1.868E-07 | 1.295E-07 | 6.295E-08 | 2.257E-08 | 1.021E-08 | 6.012E-09 | 4.016E-09 |
| N | 1.637E-06 | 5.586E-07 | 2.601E-07 | 1.593E-07 | 1.104E-07 | 5.361E-08 | 1.918E-08 | 8.652E-09 | 5.085E-09 | 3.391E-09 |
| NNE | 8.521E-07 | 2.943E-07 | 1.357E-07 | 8.234E-08 | 5.665E-08 | 2.721E-08 | 9.569E-09 | 4.260E-09 | 2.485E-09 | 1.648E-09 |
| NE | 9.101E-07 | 3.136E-07 | 1.394E-07 | 8.210E-08 | 5.529E-08 | 2.565E-08 | 8.556E-09 | 3.659E-09 | 2.084E-09 | 1.359E-09 |
| ENE | 6.913E-07 | 2.364E-07 | 1.049E-07 | 6.171E-08 | 4.155E-08 | 1.930E-08 | 6.461E-09 | 2.775E-09 | 1.585E-09 | 1.036E-09 |
| E | 7.689E-07 | 2.622E-07 | 1.156E-07 | 6.768E-08 | 4.539E-08 | 2.091E-08 | 6.908E-09 | 2.932E-09 | 1.663E-09 | 1.081E-09 |
| ESE | 7.403E-07 | 2.502E-07 | 1.095E-07 | 6.384E-08 | 4.269E-08 | 1.959E-08 | 6.434E-09 | 2.721E-09 | 1.540E-09 | 1.000E-09 |
| SE | 8.371E-07 | 2.818E-07 | 1.235E-07 | 7.217E-08 | 4.834E-08 | 2.236E-08 | 7.362E-09 | 3.134E-09 | 1.782E-09 | 1.161E-09 |
| SSE | 1.005E-06 | 3.424E-07 | 1.510E-07 | 8.852E-08 | 5.943E-08 | 2.745E-08 | 9.106E-09 | 3.882E-09 | 2.208E-09 | 1.438E-09 |

PALISADES NUCLEAR PLANT OFFSITE DOSE CALCULATION MANUAL

Revision 16

TABLE 1.3

USNRC COMPUTER CODE - XQDDQ, VERSION 2.0 RUN DATE: 970513

***** PALISADES XQDDQ82 ***** USING 01/01/92 - 12/31/96 MET DATA *****

GROUND LEVEL RELEASE - TOP OF CONFINEMENT BUILDING

| ***** | | RELATIVE DEPOSITION PER UNIT AREA (M ⁻²) AT FIXED POINTS BY DOWNWIND SECTORS | | | | | | | | | | ***** | | |
|---------------------|--|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--|--|
| DIRECTION FROM SITE | | DISTANCES IN MILES | | | | | | | | | | | | |
| | | 0.25 | 0.50 | 0.75 | 1.00 | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | | |
| S | | 2.600E-08 | 8.794E-09 | 4.515E-09 | 2.772E-09 | 1.382E-09 | 8.383E-10 | 5.668E-10 | 4.107E-10 | 3.123E-10 | 2.460E-10 | 1.992E-10 | | |
| SSW | | 1.731E-08 | 5.852E-09 | 3.005E-09 | 1.845E-09 | 9.198E-10 | 5.579E-10 | 3.772E-10 | 2.733E-10 | 2.078E-10 | 1.637E-10 | 1.325E-10 | | |
| SW | | 1.866E-08 | 6.309E-09 | 3.239E-09 | 1.989E-09 | 9.916E-10 | 6.014E-10 | 4.066E-10 | 2.946E-10 | 2.240E-10 | 1.765E-10 | 1.429E-10 | | |
| WSW | | 1.829E-08 | 6.183E-09 | 3.175E-09 | 1.949E-09 | 9.719E-10 | 5.894E-10 | 3.985E-10 | 2.888E-10 | 2.196E-10 | 1.730E-10 | 1.401E-10 | | |
| W | | 2.673E-08 | 9.040E-09 | 4.641E-09 | 2.850E-09 | 1.421E-09 | 8.618E-10 | 5.826E-10 | 4.222E-10 | 3.210E-10 | 2.529E-10 | 2.048E-10 | | |
| NNW | | 4.142E-08 | 1.401E-08 | 7.191E-09 | 4.416E-09 | 2.201E-09 | 1.335E-09 | 9.027E-10 | 6.541E-10 | 4.974E-10 | 3.919E-10 | 3.172E-10 | | |
| NW | | 4.847E-08 | 1.639E-08 | 8.416E-09 | 5.169E-09 | 2.576E-09 | 1.563E-09 | 1.056E-09 | 7.656E-10 | 5.821E-10 | 4.586E-10 | 3.713E-10 | | |
| NNW | | 5.897E-08 | 1.994E-08 | 1.024E-08 | 6.287E-09 | 3.135E-09 | 1.901E-09 | 1.285E-09 | 9.314E-10 | 7.082E-10 | 5.580E-10 | 4.517E-10 | | |
| N | | 4.172E-08 | 1.411E-08 | 7.244E-09 | 4.449E-09 | 2.218E-09 | 1.345E-09 | 9.093E-10 | 6.599E-10 | 5.010E-10 | 3.947E-10 | 3.196E-10 | | |
| NNE | | 2.423E-08 | 8.194E-09 | 4.207E-09 | 2.583E-09 | 1.288E-09 | 7.811E-10 | 5.281E-10 | 3.877E-10 | 2.910E-10 | 2.292E-10 | 1.856E-10 | | |
| NE | | 4.208E-08 | 1.423E-08 | 7.306E-09 | 4.486E-09 | 2.237E-09 | 1.356E-09 | 9.171E-10 | 6.646E-10 | 5.053E-10 | 3.981E-10 | 3.223E-10 | | |
| ENE | | 3.387E-08 | 1.145E-08 | 5.881E-09 | 3.611E-09 | 1.800E-09 | 1.092E-09 | 7.382E-10 | 5.349E-10 | 4.067E-10 | 3.204E-10 | 2.594E-10 | | |
| E | | 3.926E-08 | 1.328E-08 | 6.816E-09 | 4.185E-09 | 2.087E-09 | 1.265E-09 | 8.556E-10 | 6.200E-10 | 4.715E-10 | 3.714E-10 | 3.007E-10 | | |
| ESE | | 4.148E-08 | 1.403E-08 | 7.202E-09 | 4.423E-09 | 2.205E-09 | 1.337E-09 | 9.041E-10 | 6.552E-10 | 4.982E-10 | 3.925E-10 | 3.177E-10 | | |
| SE | | 4.919E-08 | 1.663E-08 | 8.540E-09 | 5.244E-09 | 2.614E-09 | 1.586E-09 | 1.072E-09 | 7.769E-10 | 5.907E-10 | 4.654E-10 | 3.768E-10 | | |
| SSE | | 5.133E-08 | 1.736E-08 | 8.913E-09 | 5.473E-09 | 2.728E-09 | 1.655E-09 | 1.119E-09 | 8.107E-10 | 6.165E-10 | 4.857E-10 | 3.932E-10 | | |

| ***** | | RELATIVE DEPOSITION PER UNIT AREA (M ⁻²) AT FIXED POINTS BY DOWNWIND SECTORS | | | | | | | | | | ***** | | |
|---------------------|--|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--|--|
| DIRECTION FROM SITE | | DISTANCES IN MILES | | | | | | | | | | | | |
| | | 5.00 | 7.50 | 10.00 | 15.00 | 20.00 | 25.00 | 30.00 | 35.00 | 40.00 | 45.00 | 50.00 | | |
| S | | 1.648E-10 | 8.074E-11 | 5.066E-11 | 2.561E-11 | 1.550E-11 | 1.039E-11 | 7.446E-12 | 5.591E-12 | 4.347E-12 | 3.473E-12 | 2.834E-12 | | |
| SSW | | 1.096E-10 | 5.373E-11 | 3.371E-11 | 1.704E-11 | 1.031E-11 | 6.915E-12 | 4.955E-12 | 3.721E-12 | 2.893E-12 | 2.311E-12 | 1.886E-12 | | |
| SW | | 1.182E-10 | 5.792E-11 | 3.634E-11 | 1.837E-11 | 1.112E-11 | 7.455E-12 | 5.342E-12 | 4.011E-12 | 3.119E-12 | 2.491E-12 | 2.033E-12 | | |
| WSW | | 1.159E-10 | 5.677E-11 | 3.562E-11 | 1.801E-11 | 1.090E-11 | 7.307E-12 | 5.236E-12 | 3.931E-12 | 3.057E-12 | 2.442E-12 | 1.993E-12 | | |
| W | | 1.694E-10 | 8.300E-11 | 5.208E-11 | 2.632E-11 | 1.593E-11 | 1.068E-11 | 7.654E-12 | 5.748E-12 | 4.469E-12 | 3.570E-12 | 2.914E-12 | | |
| NNW | | 2.624E-10 | 1.286E-10 | 8.069E-11 | 4.078E-11 | 2.468E-11 | 1.655E-11 | 1.186E-11 | 8.905E-12 | 6.924E-12 | 5.531E-12 | 4.514E-12 | | |
| NW | | 3.071E-10 | 1.505E-10 | 9.443E-11 | 4.773E-11 | 2.889E-11 | 1.937E-11 | 1.388E-11 | 1.042E-11 | 8.103E-12 | 6.473E-12 | 5.283E-12 | | |
| NNW | | 3.736E-10 | 1.831E-10 | 1.149E-10 | 5.807E-11 | 3.515E-11 | 2.357E-11 | 1.689E-11 | 1.268E-11 | 9.859E-12 | 7.875E-12 | 6.428E-12 | | |
| N | | 2.643E-10 | 1.295E-10 | 8.128E-11 | 4.108E-11 | 2.487E-11 | 1.667E-11 | 1.195E-11 | 8.970E-12 | 6.975E-12 | 5.571E-12 | 4.547E-12 | | |
| NNE | | 1.535E-10 | 7.523E-11 | 4.720E-11 | 2.386E-11 | 1.444E-11 | 9.682E-12 | 6.938E-12 | 5.210E-12 | 4.051E-12 | 3.236E-12 | 2.641E-12 | | |
| NE | | 2.666E-10 | 1.306E-10 | 8.198E-11 | 4.143E-11 | 2.508E-11 | 1.681E-11 | 1.205E-11 | 9.047E-12 | 7.034E-12 | 5.619E-12 | 4.586E-12 | | |
| ENE | | 2.146E-10 | 1.052E-10 | 6.598E-11 | 3.335E-11 | 2.019E-11 | 1.353E-11 | 9.698E-12 | 7.282E-12 | 5.662E-12 | 4.523E-12 | 3.692E-12 | | |
| E | | 2.487E-10 | 1.219E-10 | 7.648E-11 | 3.866E-11 | 2.340E-11 | 1.569E-11 | 1.124E-11 | 8.441E-12 | 6.563E-12 | 5.242E-12 | 4.279E-12 | | |
| ESE | | 2.628E-10 | 1.288E-10 | 8.081E-11 | 4.085E-11 | 2.472E-11 | 1.658E-11 | 1.188E-11 | 8.919E-12 | 6.935E-12 | 5.539E-12 | 4.521E-12 | | |
| SE | | 3.117E-10 | 1.527E-10 | 9.583E-11 | 4.844E-11 | 2.932E-11 | 1.966E-11 | 1.408E-11 | 1.058E-11 | 8.223E-12 | 6.569E-12 | 5.361E-12 | | |
| SSE | | 3.252E-10 | 1.594E-10 | 1.000E-10 | 5.055E-11 | 3.059E-11 | 2.051E-11 | 1.470E-11 | 1.104E-11 | 8.581E-12 | 6.855E-12 | 5.595E-12 | | |

**PALISADES NUCLEAR PLANT
OFFSITE DOSE CALCULATION MANUAL**

Revision 16

TABLE 1.3

USNRC COMPUTER CODE - XQDDQ, VERSION 2.0 RUN DATE: 970513

***** PALISADES XQDDQ82 ***** USING 01/01/92 - 12/31/96 MET DATA *****

GROUND LEVEL RELEASE - TOP OF CONTAINMENT BUILDING

***** RELATIVE DEPOSITION PER UNIT AREA (M**2) BY DOWNWIND SECTORS
SEGMENT BOUNDARIES IN MILES *****

| DIR FROM SITE | .5-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-10 | 10-20 | 20-30 | 30-40 | 40-50 |
|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| S | 4.691E-09 | 1.449E-09 | 5.768E-10 | 3.152E-10 | 2.003E-10 | 8.604E-11 | 2.668E-11 | 1.057E-11 | 5.647E-12 | 3.495E-12 |
| SSW | 3.122E-09 | 9.645E-10 | 3.838E-10 | 2.097E-10 | 1.333E-10 | 5.726E-11 | 1.776E-11 | 7.037E-12 | 3.758E-12 | 2.326E-12 |
| SW | 3.366E-09 | 1.040E-09 | 4.138E-10 | 2.261E-10 | 1.437E-10 | 6.173E-11 | 1.914E-11 | 7.587E-12 | 4.051E-12 | 2.508E-12 |
| WSW | 3.299E-09 | 1.019E-09 | 4.055E-10 | 2.216E-10 | 1.409E-10 | 6.050E-11 | 1.876E-11 | 7.436E-12 | 3.971E-12 | 2.458E-12 |
| W | 4.823E-09 | 1.490E-09 | 5.929E-10 | 3.240E-10 | 2.059E-10 | 8.845E-11 | 2.743E-11 | 1.087E-11 | 5.805E-12 | 3.593E-12 |
| WNW | 7.472E-09 | 2.308E-09 | 9.186E-10 | 5.020E-10 | 3.190E-10 | 1.370E-10 | 4.249E-11 | 1.684E-11 | 8.994E-12 | 5.567E-12 |
| NW | 8.745E-09 | 2.702E-09 | 1.075E-09 | 5.875E-10 | 3.734E-10 | 1.604E-10 | 4.974E-11 | 1.971E-11 | 1.053E-11 | 6.516E-12 |
| NW | 1.064E-08 | 3.287E-09 | 1.308E-09 | 7.147E-10 | 4.543E-10 | 1.951E-10 | 6.051E-11 | 2.398E-11 | 1.281E-11 | 7.927E-12 |
| N | 7.527E-09 | 2.325E-09 | 9.253E-10 | 5.057E-10 | 3.214E-10 | 1.380E-10 | 4.281E-11 | 1.697E-11 | 9.060E-12 | 5.608E-12 |
| NNE | 4.371E-09 | 1.351E-09 | 5.374E-10 | 2.937E-10 | 1.866E-10 | 8.017E-11 | 2.486E-11 | 9.853E-12 | 5.262E-12 | 3.257E-12 |
| NE | 7.591E-09 | 2.345E-09 | 9.333E-10 | 5.100E-10 | 3.241E-10 | 1.392E-10 | 4.317E-11 | 1.711E-11 | 9.138E-12 | 5.656E-12 |
| ENE | 6.110E-09 | 1.888E-09 | 7.512E-10 | 4.105E-10 | 2.609E-10 | 1.121E-10 | 3.475E-11 | 1.377E-11 | 7.355E-12 | 4.552E-12 |
| E | 7.082E-09 | 2.188E-09 | 8.707E-10 | 4.758E-10 | 3.024E-10 | 1.299E-10 | 4.028E-11 | 1.596E-11 | 8.525E-12 | 5.277E-12 |
| ESE | 7.484E-09 | 2.312E-09 | 9.200E-10 | 5.028E-10 | 3.195E-10 | 1.373E-10 | 4.256E-11 | 1.687E-11 | 9.008E-12 | 5.576E-12 |
| SE | 8.874E-09 | 2.742E-09 | 1.091E-09 | 5.962E-10 | 3.789E-10 | 1.628E-10 | 5.047E-11 | 2.000E-11 | 1.068E-11 | 6.612E-12 |
| SSE | 9.261E-09 | 2.861E-09 | 1.139E-09 | 6.222E-10 | 3.954E-10 | 1.699E-10 | 5.267E-11 | 2.088E-11 | 1.115E-11 | 6.900E-12 |

| VENT AND BUILDING PARAMETERS: | REP. WIND HEIGHT (METERS) | 10.0 |
|-------------------------------|--|--------|
| RELEASE HEIGHT (METERS) | 58.10 | 58.1 |
| DIAMETER (METERS) | 0.00 | 2000.0 |
| EXIT VELOCITY (METERS) | 0.00 | 0.0 |
| | BUILDING HEIGHT (METERS) | 10.0 |
| | BLDG. MIN. CRS. SEC. AREA (SQ. METERS) | 2000.0 |
| | HEAT EMISSION RATE (CAL/SEC) | 0.0 |

ALL GROUND LEVEL RELEASES.

PALISADES NUCLEAR PLANT OFFSITE DOSE CALCULATION MANUAL

Revision 16

TABLE 1.3

| RELEASE ID | TYPE OF LOCATION | DIRECTION FROM SITE | DISTANCE (MILES) | DISTANCE (METERS) | X/Q (SEC/CUB.METER) | | X/Q (SEC/CUB.METER) | | D/Q (PER SQ.METER) |
|------------|------------------|---------------------|------------------|-------------------|---------------------|------------|---------------------|-----------------|--------------------|
| | | | | | NO DECAY | UNDEPLETED | 2,260 DAY DECAY | 8,000 DAY DECAY | |
| A | SITE BOUNDARY | NNE | 0.50 | 805. | 1.72E-06 | 1.71E-06 | 1.57E-06 | 8.19E-09 | |
| A | SITE BOUNDARY | NE | 0.65 | 1046. | 1.22E-06 | 1.22E-06 | 1.10E-06 | 9.30E-09 | |
| A | SITE BOUNDARY | ENE | 0.87 | 1400. | 5.99E-07 | 5.98E-07 | 5.29E-07 | 4.58E-09 | |
| A | SITE BOUNDARY | E | 0.82 | 1320. | 7.28E-07 | 7.27E-07 | 6.45E-07 | 5.86E-09 | |
| A | SITE BOUNDARY | ESE | 0.76 | 1223. | 7.85E-07 | 7.83E-07 | 6.98E-07 | 7.04E-09 | |
| A | SITE BOUNDARY | SE | 0.63 | 1014. | 1.18E-06 | 1.18E-06 | 1.06E-06 | 1.14E-08 | |
| A | SITE BOUNDARY | SSE | 0.48 | 772. | 2.13E-06 | 2.12E-06 | 1.95E-06 | 1.86E-08 | |
| A | SITE BOUNDARY | S | 0.42 | 676. | 1.78E-06 | 1.78E-06 | 1.64E-06 | 1.16E-08 | |
| A | SITE BOUNDARY | SSW | 0.48 | 772. | 1.16E-06 | 1.15E-06 | 1.06E-06 | 6.26E-09 | |
| A | GARDEN | NNE | 1.60 | 2575. | 3.06E-07 | 3.04E-07 | 2.58E-07 | 1.15E-09 | |
| A | GARDEN | NE | 1.20 | 1931. | 4.96E-07 | 4.95E-07 | 4.28E-07 | 3.29E-09 | |
| A | GARDEN | ENE | 2.70 | 4345. | 1.15E-07 | 1.14E-07 | 9.20E-08 | 6.45E-10 | |
| A | GARDEN | E | 2.20 | 3541. | 1.70E-07 | 1.69E-07 | 1.40E-07 | 1.07E-09 | |
| A | GARDEN | ESE | 2.30 | 3701. | 1.51E-07 | 1.50E-07 | 1.23E-07 | 1.05E-09 | |
| A | GARDEN | SE | 1.80 | 2897. | 2.45E-07 | 2.44E-07 | 2.04E-07 | 1.91E-09 | |
| A | GARDEN | SSE | 1.60 | 2575. | 3.55E-07 | 3.53E-07 | 2.99E-07 | 2.44E-09 | |
| A | GARDEN | S | 1.50 | 2414. | 2.78E-07 | 2.77E-07 | 2.36E-07 | 1.38E-09 | |
| A | BEEF COW | NE | 2.90 | 4667. | 1.38E-07 | 1.36E-07 | 1.09E-07 | 7.06E-10 | |
| A | BEEF COW | ENE | 4.00 | 6437. | 6.51E-08 | 6.43E-08 | 4.98E-08 | 3.20E-10 | |
| A | BEEF COW | E | 3.50 | 5633. | 8.64E-08 | 8.56E-08 | 6.73E-08 | 4.71E-10 | |
| A | BEEF COW | ESE | 4.00 | 6437. | 6.70E-08 | 6.63E-08 | 5.13E-08 | 3.93E-10 | |
| A | BEEF COW | SSE | 3.00 | 4828. | 1.41E-07 | 1.40E-07 | 1.12E-07 | 8.11E-10 | |
| A | DAIRY COW | SE | 4.30 | 6920. | 6.83E-08 | 6.75E-08 | 5.18E-08 | 4.09E-10 | |
| A | GOAT | NE | 3.20 | 5150. | 1.19E-07 | 1.18E-07 | 9.39E-08 | 5.93E-10 | |
| A | GOAT | ESE | 3.00 | 4828. | 1.02E-07 | 1.01E-07 | 8.10E-08 | 6.55E-10 | |

| VENT AND BUILDING PARAMETERS: | | | |
|-------------------------------|-------|--|--------|
| RELEASE HEIGHT (METERS) | 58.10 | REP. WIND HEIGHT (METERS) | 10.0 |
| DIAMETER (METERS) | 0.00 | BUILDING HEIGHT (METERS) | 58.1 |
| EXIT VELOCITY (METERS) | 0.00 | BLDG. MIN. CFS. SEC. AREA (SQ. METERS) | 2000.0 |
| | | HEAT EMISSION RATE (CAL./SEC) | 0.0 |

ALL GROUND LEVEL RELEASES.

PALISADES NUCLEAR PLANT OFFSITE DOSE CALCULATION MANUAL

Revision 16

TABLE 1.3

USNRC COMPUTER CODE - X00DQ0, VERSION 2.0 RUN DATE: 970513

***** PALISADES X00DQ082 ***** USING 01/01/92 - 12/31/96 MET DATA *****

GROUND LEVEL RELEASE - TOP OF CONTAINMENT BUILDING
SPECIFIC POINTS OF INTEREST

| RELEASE ID | TYPE OF LOCATION | DIRECTION FROM SITE | DISTANCE (MILES) | DISTANCE (METERS) | X/Q (SEC/CUB.METER) | | X/Q (SEC/CUB.METER) | | D/Q (PER SQ.METER) |
|------------|------------------|---------------------|------------------|-------------------|---------------------|------------|---------------------|-----------------|--------------------|
| | | | | | NO DECAY | UNDEPLETED | 2,260 DAY DECAY | 8,000 DAY DECAY | |
| A | SITE BOUNDARY | NNE | 0.50 | 805. | 1.72E-06 | 1.71E-06 | 1.57E-06 | 8.19E-09 | |
| A | SITE BOUNDARY | NE | 0.65 | 1046. | 1.22E-06 | 1.22E-06 | 1.10E-06 | 9.30E-09 | |
| A | SITE BOUNDARY | ENE | 0.87 | 1400. | 5.99E-07 | 5.99E-07 | 5.29E-07 | 4.58E-09 | |
| A | SITE BOUNDARY | E | 0.82 | 1320. | 7.28E-07 | 7.27E-07 | 6.45E-07 | 5.86E-09 | |
| A | SITE BOUNDARY | ESE | 0.76 | 1223. | 7.85E-07 | 7.83E-07 | 6.98E-07 | 7.04E-09 | |
| A | SITE BOUNDARY | SE | 0.63 | 1014. | 1.18E-06 | 1.18E-06 | 1.06E-06 | 1.14E-08 | |
| A | SITE BOUNDARY | SSE | 0.48 | 772. | 2.13E-06 | 2.12E-06 | 1.95E-06 | 1.86E-08 | |
| A | SITE BOUNDARY | S | 0.42 | 676. | 1.78E-06 | 1.78E-06 | 1.64E-06 | 1.16E-08 | |
| A | SITE BOUNDARY | SSW | 0.48 | 772. | 1.16E-06 | 1.15E-06 | 1.06E-06 | 6.26E-09 | |
| A | RESIDENCE | NNE | 1.10 | 1770. | 5.23E-07 | 5.21E-07 | 4.55E-07 | 2.20E-09 | |
| A | RESIDENCE | NE | 1.20 | 1931. | 4.96E-07 | 4.95E-07 | 4.28E-07 | 3.29E-09 | |
| A | RESIDENCE | ENE | 1.30 | 2092. | 3.33E-07 | 3.31E-07 | 2.85E-07 | 2.30E-09 | |
| A | RESIDENCE | E | 1.00 | 1609. | 5.44E-07 | 5.42E-07 | 4.76E-07 | 4.19E-09 | |
| A | RESIDENCE | ESE | 1.00 | 1609. | 5.21E-07 | 5.20E-07 | 4.56E-07 | 4.42E-09 | |
| A | RESIDENCE | SE | 1.00 | 1609. | 5.87E-07 | 5.86E-07 | 5.14E-07 | 5.25E-09 | |
| A | RESIDENCE | SSE | 0.70 | 1127. | 1.21E-06 | 1.20E-06 | 1.08E-06 | 1.00E-08 | |
| A | RESIDENCE | S | 0.50 | 805. | 1.38E-06 | 1.38E-06 | 1.26E-06 | 8.79E-09 | |
| A | RESIDENCE | SSW | 0.70 | 1127. | 6.50E-07 | 6.49E-07 | 5.81E-07 | 3.37E-09 | |
| A | BEEF COW | NE | 2.90 | 4667. | 1.38E-07 | 1.36E-07 | 1.09E-07 | 7.06E-10 | |
| A | BEEF COW | ENE | 4.00 | 6437. | 6.51E-08 | 6.43E-08 | 4.98E-08 | 3.20E-10 | |
| A | BEEF COW | E | 3.50 | 5633. | 8.64E-08 | 8.56E-08 | 6.73E-08 | 4.71E-10 | |
| A | BEEF COW | ESE | 4.00 | 6437. | 6.70E-08 | 6.63E-08 | 5.13E-08 | 3.93E-10 | |
| A | BEEF COW | SSE | 3.00 | 4828. | 1.41E-07 | 1.40E-07 | 1.12E-07 | 8.11E-10 | |
| A | DAIRY COW | SE | 4.30 | 6920. | 6.83E-08 | 6.75E-08 | 5.18E-08 | 4.09E-10 | |
| A | GOAT | NE | 3.20 | 5150. | 1.19E-07 | 1.18E-07 | 9.39E-08 | 5.93E-10 | |
| A | GOAT | ESE | 3.00 | 4828. | 1.02E-07 | 1.01E-07 | 8.10E-08 | 6.55E-10 | |

| VENT AND BUILDING PARAMETERS: | | | |
|-------------------------------|-------|--|--------|
| RELEASE HEIGHT (METERS) | 58.10 | REP. WIND HEIGHT (METERS) | 10.0 |
| DIAMETER (METERS) | 0.00 | BUILDING HEIGHT (METERS) | 58.1 |
| EXIT VELOCITY (METERS) | 0.00 | BLDG. MIN. CRS. SEC. AREA (SQ. METERS) | 2000.0 |
| | | HEAT EMISSION RATE (CAL/SEC) | 0.0 |

ALL GROUND LEVEL RELEASES.

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TABLE 1.4

2000 PALISADES LAND USE CENSUS

Distance to the nearest residence, garden, dairy/beef cattle, and goat in each sector.

| <u>SECTOR</u> | <u>RESIDENCE</u> | <u>GARDEN</u> | <u>BEEF CATTLE</u> | <u>DAIRY COW</u> | <u>GOAT</u> |
|---------------|------------------|---------------|--------------------|------------------|-------------|
| NNE | 1.1 mi | 1.8 mi | >5 mi | >5 mi | >5 mi |
| NE | 1.2 mi | 1.2 mi | 2.9 mi | >5 mi | 3.2 mi |
| ENE | 1.3 mi | 3.3 mi | 1.8 mi | >5 mi | >5 mi |
| E | 1.0 mi | 2.1 mi | 3.5 mi | >5 mi | >5 mi |
| ESE | 1.0 mi | *1.0 mi | *4.0 mi | >5 mi | *2.0 mi |
| SE | 1.0 mi | *1.0 mi | 2.2 mi | 4.3 mi | *2.0 mi |
| SSE | 0.7 mi | 1.6 mi | >5 mi | >5 mi | >5 mi |
| S | 0.5 mi | 4.0 mi | >5 mi | >5 mi | 4.7 mi |
| SSW | 0.7 mi | 4.9 mi | >5 mi | >5 mi | >5 mi |

*Note: Garden and Farm bisected by ESE/SE sector line.

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TABLE 1.4a

2000 PALISADES LAND USE CENSUS

Critical Receptor Items

| <u>Sector</u> | <u>Distance Miles</u> | <u>Location/Description</u> | <u>Item</u> | <u>*X/Q (sec/m³)</u> |
|---------------|---------------------------|--|----------------|---------------------------------|
| SSE | 0.48 | Site Boundary | N/A | 2.13E-06 |
| S | 0.50 | Residence, Palisades Park; 1/2 mile west of 29th Avenue and Blue Star intersection | Residence | 1.38E-06 |
| SE | 1.0 | 77550 28th Avenue | Garden | 5.87E-07 |
| ENE | 1.8 | 22595 76th Ave .3 miles N of 24th, East side of road | Beef Cattle | 2.14E-07 |
| SE | 4.3 | 72401 36th Ave | Dairy Cow | 6.83E-08 |
| SE | 2.0 | SE corner of 30th and 76th | Goat | 2.10E-07 |

*Based on Palisades 5-year composite meteorological data, 1992 - 1996.

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TABLE 1.5

DOSE FACTORS FOR SUBMERSION IN NOBLE GASES*

| | <u>DFR¹</u> | <u>DFY²</u> | <u>DFS¹</u> | <u>DFB²</u> |
|---------|------------------------|------------------------|------------------------|------------------------|
| Kr-85m | 1.17(+3) ³ | 1.23(+3) | 1.46(+3) | 1.97(+3) |
| Kr-85 | 1.61(+1) | 1.72(+1) | 1.34(+3) | 1.95(+3) |
| Kr-87 | 5.92(+3) | 6.17(+3) | 9.73(+3) | 1.03(+4) |
| Kr-88 | 1.47(+4) | 1.52(+4) | 2.37(+3) | 2.93(+3) |
| Kr-89 | 1.66(+4) | 1.73(+4) | 1.01(+4) | 1.06(+4) |
| Xe-131m | 9.15(+1) | 1.56(+2) | 4.76(+2) | 1.11(+3) |
| Xe-133m | 2.51(+2) | 3.27(+2) | 9.94(+2) | 1.48(+3) |
| Xe-133 | 2.94(+2) | 3.53(+2) | 3.06(+2) | 1.05(+3) |
| Xe-135m | 3.12(+3) | 3.36(+3) | 7.11(+2) | 7.39(+3) |
| Xe-135 | 1.81(+3) | 1.92(+3) | 1.86(+3) | 2.46(+3) |
| Xe-137 | 1.42(+3) | 1.51(+3) | 1.22(+4) | 1.27(+4) |
| Xe-138 | 8.83(+3) | 9.21(+3) | 4.13(+3) | 4.75(+3) |
| Ar-41 | 8.84(+3) | 9.30(+3) | 2.69(+3) | 3.28(+3) |

1. mrem/y per $\mu\text{Ci}/\text{m}^3$
2. mrad/y per $\mu\text{Ci}/\text{m}^3$
3. $1.17(+3) = 1.17 \times 10^3$

*Dose factors for exposure to a semi-infinite cloud of noble gases. Values were obtained from USNRC Regulatory Guide 1.109, Revision 1 (October 1977).

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TABLE 1.6

STABLE ELEMENT TRANSFER DATA

| <u>ELEMENT</u> | <u>F_m - MILK (COW)</u> <u>(DAYS/L)</u> | <u>F_m - MILK (GOAT)</u> <u>(DAYS/L)</u> | <u>F_f - MEAT</u> <u>(DAYS/KG)</u> | <u>B_{iv}</u> <u>(VEG/SOIL)</u> |
|----------------|--|---|---|--|
| H | 1.0E-02 | 1.7E-01 | 1.2E-02 | 4.8E-00 |
| C | 1.2E-02 | 1.0E-01 | 3.1E-02 | 5.5E-00 |
| Na | 4.0E-02 | 4.0E-02 | 3.0E-02 | 5.2E-02 |
| P | 2.5E-02 | 2.5E-01 | 4.6E-02 | 1.1E-00 |
| Cr | 2.2E-03 | 2.2E-03 | 2.4E-03 | 2.5E-04 |
| Mn | 2.5E-04 | 2.5E-04 | 8.0E-04 | 2.9E-02 |
| Fe | 1.2E-03 | 1.3E-04 | 4.0E-02 | 6.6E-04 |
| Co | 1.0E-03 | 1.0E-03 | 1.3E-02 | 9.4E-03 |
| Ni | 6.7E-03 | 6.7E-03 | 5.3E-02 | 1.9E-02 |
| Cu | 1.4E-02 | 1.3E-02 | 8.0E-03 | 1.2E-01 |
| Zn | 3.9E-02 | 3.9E-02 | 3.0E-02 | 4.0E-01 |
| Rb | 3.0E-02 | 3.0E-02 | 3.1E-02 | 1.3E-01 |
| Sr | 8.0E-04 | 1.4E-02 | 6.0E-04 | 1.7E-02 |
| Y | 1.0E-05 | 1.0E-05 | 4.6E-03 | 2.6E-03 |
| Zr | 5.0E-06 | 5.0E-06 | 3.4E-02 | 1.7E-04 |
| Nb | 2.5E-03 | 2.5E-03 | 2.8E-01 | 9.4E-03 |
| Mo | 7.5E-03 | 7.5E-03 | 8.0E-03 | 1.2E-01 |
| Tc | 2.5E-02 | 2.5E-02 | 4.0E-01 | 2.5E-01 |
| Ru | 1.0E-06 | 1.0E-06 | 4.0E-01 | 5.0E-02 |
| Rh | 1.0E-02 | 1.0E-02 | 1.5E-03 | 1.3E+01 |
| Ag | 5.0E-02 | 5.0E-02 | 1.7E-02 | 1.5E-01 |
| Te | 1.0E-03 | 1.0E-03 | 7.7E-02 | 1.3E-00 |
| I | 6.0E-03 | 6.0E-02 | 2.9E-03 | 2.0E-02 |
| Cs | 1.2E-02 | 3.0E-01 | 4.0E-03 | 1.0E-02 |
| Ba | 4.0E-04 | 4.0E-04 | 3.2E-03 | 5.0E-03 |
| La | 5.0E-06 | 5.0E-06 | 2.0E-04 | 2.5E-03 |
| Ce | 1.0E-04 | 1.0E-04 | 1.2E-03 | 2.5E-03 |
| Pr | 5.0E-06 | 5.0E-06 | 4.7E-03 | 2.5E-03 |
| Nd | 5.0E-06 | 5.0E-06 | 3.3E-03 | 2.4E-03 |
| W | 5.0E-04 | 5.0E-04 | 1.3E-03 | 1.8E-02 |
| Np | 5.0E-06 | 5.0E-06 | 2.0E-04 | 2.5E-03 |

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TABLE 1.7

| INFANT INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|---|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| H3* | 0. | 4.62E-07 | 4.62E-07 | 4.62E-07 | 4.62E-07 | 4.62E-07 | 4.62E-07 |
| BE10 | 9.49E-04 | 1.25E-04 | 2.65E-05 | 0. | 0. | 1.49E-03 | 1.73E-05 |
| C14 | 1.89E-05 | 3.79E-06 | 3.79E-06 | 3.79E-06 | 3.79E-06 | 3.79E-06 | 3.79E-06 |
| N13 | 4.39E-08 | 4.39E-08 | 4.39E-08 | 4.39E-08 | 4.39E-08 | 4.39E-08 | 4.39E-08 |
| F18 | 3.92E-06 | 0. | 3.33E-07 | 0. | 0. | 0. | 6.10E-07 |
| NA22 | 7.37E-05 | 7.37E-05 | 7.37E-05 | 7.37E-05 | 7.37E-05 | 7.37E-05 | 7.37E-05 |
| NA24 | 7.54E-06 | 7.54E-06 | 7.54E-06 | 7.54E-06 | 7.54E-06 | 7.54E-06 | 7.54E-06 |
| P32 | 1.45E-03 | 8.03E-05 | 5.53E-05 | 0. | 0. | 0. | 1.15E-05 |
| AR39 | 0. | 0. | 0. | 0. | 0. | 1.00E-08 | 0. |
| AR41 | 0. | 0. | 0. | 0. | 0. | 3.14E-08 | 0. |
| CA41 | 7.48E-05 | 0. | 8.16E-06 | 0. | 0. | 6.94E-02 | 2.96E-07 |
| SC46 | 3.75E-04 | 5.41E-04 | 1.69E-04 | 0. | 3.56E-04 | 0. | 2.19E-05 |
| CR51 | 0. | 0. | 6.39E-08 | 4.11E-08 | 9.45E-09 | 9.17E-06 | 2.55E-07 |
| MN54 | 0. | 1.81E-05 | 3.56E-06 | 0. | 3.56E-06 | 7.14E-04 | 5.04E-06 |
| MN56 | 0. | 1.10E-09 | 1.58E-10 | 0. | 7.86E-10 | 8.95E-06 | 5.12E-05 |
| FE55 | 1.41E-05 | 8.39E-06 | 2.38E-06 | 0. | 0. | 6.21E-05 | 7.82E-07 |
| FE59 | 9.69E-06 | 1.68E-05 | 6.77E-06 | 0. | 0. | 7.25E-04 | 1.77E-05 |
| CO57 | 0. | 4.65E-07 | 4.58E-07 | 0. | 0. | 2.71E-04 | 3.47E-06 |
| CO58 | 0. | 8.71E-07 | 1.30E-06 | 0. | 0. | 5.55E-04 | 7.95E-06 |
| CO60 | 0. | 5.73E-06 | 8.41E-06 | 0. | 0. | 3.22E-03 | 2.28E-05 |
| NI59 | 1.81E-05 | 5.44E-06 | 3.10E-06 | 0. | 0. | 5.48E-05 | 6.34E-07 |
| NI63 | 2.42E-04 | 1.46E-05 | 8.29E-06 | 0. | 0. | 1.49E-04 | 1.73E-06 |
| NI65 | 1.71E-09 | 2.03E-10 | 8.79E-11 | 0. | 0. | 5.80E-06 | 3.58E-05 |
| CU64 | 0. | 1.34E-09 | 5.53E-10 | 0. | 2.84E-09 | 6.64E-06 | 1.07E-05 |
| ZN65 | 1.38E-05 | 4.47E-05 | 2.22E-05 | 0. | 2.32E-05 | 4.62E-04 | 3.67E-05 |
| ZN69M + D | 8.98E-09 | 1.84E-08 | 1.67E-09 | 0. | 7.45E-09 | 1.91E-05 | 2.92E-05 |
| ZN69 | 3.85E-11 | 6.91E-11 | 5.13E-12 | 0. | 2.87E-11 | 1.05E-06 | 9.44E-06 |
| SE79 | 0. | 2.25E-06 | 4.20E-07 | 0. | 2.47E-06 | 2.99E-04 | 3.46E-06 |
| BR82 | 0. | 0. | 9.49E-06 | 0. | 0. | 0. | 0. |
| BR83 + D | 0. | 0. | 2.72E-07 | 0. | 0. | 0. | 0. |
| BR84 | 0. | 0. | 2.86E-07 | 0. | 0. | 0. | 0. |
| BR85 | 0. | 0. | 1.46E-08 | 0. | 0. | 0. | 0. |
| KR83M | 0. | 0. | 0. | 0. | 0. | 2.50E-09 | 0. |
| KR85M | 0. | 0. | 0. | 0. | 0. | 1.31E-08 | 0. |
| KR85 | 0. | 0. | 0. | 0. | 0. | 1.16E-08 | 0. |
| KR87 | 0. | 0. | 0. | 0. | 0. | 6.59E-08 | 0. |
| KR88 + D | 0. | 0. | 0. | 0. | 0. | 1.38E-07 | 0. |
| KR89 | 0. | 0. | 0. | 0. | 0. | 8.67E-08 | 0. |
| RB86 | 0. | 1.36E-04 | 6.30E-05 | 0. | 0. | 0. | 2.17E-06 |
| RB87 | 0. | 7.11E-05 | 2.64E-05 | 0. | 0. | 0. | 2.99E-07 |
| RB88 | 0. | 3.98E-07 | 2.05E-07 | 0. | 0. | 0. | 2.42E-07 |
| RB89 + D | 0. | 2.29E-07 | 1.47E-07 | 0. | 0. | 0. | 4.87E-08 |
| SR89 + D | 2.84E-04 | 0. | 8.15E-06 | 0. | 0. | 1.45E-03 | 4.57E-05 |
| SR90 + D | 2.92E-02 | 0. | 1.85E-03 | 0. | 0. | 8.03E-03 | 9.36E-05 |
| SR91 + D | 6.83E-08 | 0. | 2.47E-09 | 0. | 0. | 3.76E-05 | 5.24E-05 |
| SR92 + D | 7.50E-09 | 0. | 2.79E-10 | 0. | 0. | 1.70E-05 | 1.00E-04 |

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Includes a 50% increase to account for percutaneous transpiration.

**PALISADES NUCLEAR PLANT
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TABLE 1.7 (continued)

| INFANT INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|---|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| Y90 | 2.35E-06 | 0. | 6.30E-08 | 0. | 0. | 1.92E-04 | 7.43E-05 |
| Y91M+D | 2.91E-10 | 0. | 9.90E-12 | 0. | 0. | 1.99E-06 | 1.68E-06 |
| Y91 | 4.20E-04 | 0. | 1.12E-05 | 0. | 0. | 1.75E-03 | 5.02E-05 |
| Y92 | 1.17E-08 | 0. | 3.29E-10 | 0. | 0. | 1.75E-05 | 9.04E-05 |
| Y93 | 1.07E-07 | 0. | 2.91E-09 | 0. | 0. | 5.46E-05 | 1.19E-04 |
| ZR93+D | 2.24E-04 | 9.51E-05 | 6.18E-05 | 0. | 3.19E-04 | 1.37E-03 | 1.48E-05 |
| ZR95+D | 8.24E-05 | 1.99E-05 | 1.45E-05 | 0. | 2.22E-05 | 1.25E-03 | 1.55E-05 |
| ZR97+D | 1.07E-07 | 1.83E-08 | 8.36E-09 | 0. | 1.85E-08 | 7.88E-05 | 1.00E-04 |
| NB93M | 1.38E-04 | 3.59E-05 | 1.15E-05 | 0. | 3.68E-05 | 2.09E-04 | 2.47E-06 |
| NB95 | 1.12E-05 | 4.59E-06 | 2.70E-06 | 0. | 3.37E-06 | 3.42E-04 | 9.05E-06 |
| NB97 | 2.44E-10 | 5.21E-11 | 1.88E-11 | 0. | 4.07E-11 | 2.37E-06 | 1.92E-05 |
| MO93 | 0. | 6.46E-06 | 2.22E-07 | 0. | 1.54E-06 | 3.40E-04 | 3.76E-06 |
| MO99+D | 0. | 1.18E-07 | 2.31E-08 | 0. | 1.89E-07 | 9.63E-05 | 3.48E-05 |
| TC99M | 9.98E-13 | 2.06E-12 | 2.66E-11 | 0. | 2.22E-11 | 5.79E-07 | 1.45E-06 |
| TC99 | 2.09E-07 | 2.68E-07 | 8.85E-08 | 0. | 2.49E-06 | 6.77E-04 | 7.82E-06 |
| TC101 | 4.65E-14 | 5.88E-14 | 5.80E-13 | 0. | 6.99E-13 | 4.17E-07 | 6.03E-07 |
| RU103+D | 1.44E-06 | 0. | 4.85E-07 | 0. | 3.03E-06 | 3.94E-04 | 1.15E-05 |
| RU105+D | 8.74E-10 | 0. | 2.93E-10 | 0. | 6.42E-10 | 1.12E-05 | 3.46E-05 |
| RU106+D | 6.20E-05 | 0. | 7.77E-06 | 0. | 7.61E-05 | 8.26E-03 | 1.17E-04 |
| RH105 | 8.26E-09 | 5.41E-09 | 3.63E-09 | 0. | 1.50E-08 | 2.08E-05 | 1.37E-05 |
| PD107 | 0. | 4.92E-07 | 4.11E-08 | 0. | 2.75E-06 | 6.34E-05 | 7.33E-07 |
| PD109 | 0. | 3.92E-09 | 1.05E-09 | 0. | 1.28E-08 | 1.68E-05 | 2.85E-05 |
| AG110M+D | 7.13E-06 | 5.16E-06 | 3.57E-06 | 0. | 7.80E-06 | 2.62E-03 | 2.36E-05 |
| AG111 | 3.75E-07 | 1.45E-07 | 7.75E-08 | 0. | 3.05E-07 | 2.06E-04 | 3.02E-05 |
| CD113M | 0. | 6.67E-04 | 2.64E-05 | 0. | 5.80E-04 | 1.40E-03 | 1.65E-05 |
| CD115M | 0. | 1.73E-04 | 6.19E-06 | 0. | 9.41E-05 | 1.47E-03 | 5.02E-05 |
| SN123 | 2.09E-04 | 4.21E-06 | 7.28E-06 | 4.27E-06 | 0. | 2.22E-03 | 4.08E-05 |
| SN125+D | 1.01E-05 | 2.51E-07 | 6.00E-07 | 2.47E-07 | 0. | 6.43E-04 | 7.26E-05 |
| SN126+D | 8.30E-04 | 1.44E-05 | 3.52E-05 | 3.84E-06 | 0. | 4.93E-03 | 1.65E-05 |
| SB124 | 2.71E-05 | 3.97E-07 | 8.56E-06 | 7.18E-08 | 0. | 1.89E-03 | 4.22E-05 |
| SB125+D | 3.69E-05 | 3.41E-07 | 7.78E-06 | 4.45E-08 | 0. | 1.17E-03 | 1.05E-05 |
| SB126 | 3.08E-06 | 6.01E-08 | 1.11E-06 | 2.35E-08 | 0. | 6.88E-04 | 5.33E-05 |
| SB127 | 2.82E-07 | 5.04E-09 | 8.76E-08 | 3.60E-09 | 0. | 1.54E-04 | 3.78E-05 |
| TE125M | 3.40E-06 | 1.42E-06 | 4.70E-07 | 1.16E-06 | 0. | 3.19E-04 | 9.22E-06 |
| TE127M+D | 1.19E-05 | 4.93E-06 | 1.48E-06 | 3.48E-06 | 2.68E-05 | 9.37E-04 | 1.95E-05 |
| TE127 | 1.59E-09 | 6.81E-10 | 3.49E-10 | 1.32E-09 | 3.47E-09 | 7.39E-06 | 1.74E-05 |
| TE129M+D | 1.01E-05 | 4.35E-06 | 1.59E-06 | 3.91E-06 | 2.27E-05 | 1.20E-03 | 4.93E-05 |
| TE129 | 5.63E-11 | 2.48E-11 | 1.34E-11 | 4.82E-11 | 1.25E-10 | 2.14E-06 | 1.88E-05 |
| TE131M+D | 7.62E-08 | 3.93E-08 | 2.59E-08 | 6.38E-08 | 1.89E-07 | 1.42E-04 | 8.51E-05 |
| TE131+D | 1.24E-11 | 5.87E-12 | 3.57E-12 | 1.13E-11 | 2.85E-11 | 1.47E-06 | 5.87E-06 |
| TE132+D | 2.66E-07 | 1.69E-07 | 1.26E-07 | 1.99E-07 | 7.39E-07 | 2.43E-04 | 3.15E-05 |
| TE133M+D | 6.13E-11 | 3.59E-11 | 2.74E-11 | 5.52E-11 | 1.72E-10 | 3.92E-06 | 1.59E-05 |
| TE134+D | 3.18E-11 | 2.04E-11 | 1.68E-11 | 2.91E-11 | 9.59E-11 | 2.93E-06 | 2.53E-06 |
| I129 | 2.16E-05 | 1.59E-05 | 1.16E-05 | 1.04E-02 | 1.88E-05 | 0. | 2.12E-07 |
| I130 | 4.54E-06 | 9.91E-06 | 3.98E-06 | 1.14E-03 | 1.09E-05 | 0. | 1.42E-06 |
| I131+D | 2.71E-05 | 3.17E-05 | 1.40E-05 | 1.06E-02 | 3.70E-05 | 0. | 7.56E-07 |

PALISADES NUCLEAR PLANT
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Revision 16

TABLE 1.7 (continued)

| INFANT INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|---|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| I132 | 1.21E-06 | 2.53E-06 | 8.99E-07 | 1.21E-04 | 2.82E-06 | 0. | 1.36E-06 |
| I133+D | 9.46E-06 | 1.37E-05 | 4.00E-06 | 2.54E-03 | 1.60E-05 | 0. | 1.54E-06 |
| I134 | 6.58E-07 | 1.34E-06 | 4.75E-07 | 3.18E-05 | 1.49E-06 | 0. | 9.21E-07 |
| I135+D | 2.76E-06 | 5.43E-06 | 1.98E-06 | 4.97E-04 | 6.05E-06 | 0. | 1.31E-06 |
| XE131M | 0. | 0. | 0. | 0. | 0. | 6.77E-09 | 0. |
| XE133M | 0. | 0. | 0. | 0. | 0. | 8.89E-09 | 0. |
| XE133 | 0. | 0. | 0. | 0. | 0. | 7.41E-09 | 0. |
| XE135M | 0. | 0. | 0. | 0. | 0. | 8.05E-09 | 0. |
| XE135 | 0. | 0. | 0. | 0. | 0. | 1.80E-08 | 0. |
| XE137 | 0. | 0. | 0. | 0. | 0. | 8.30E-08 | 0. |
| XE138+D | 0. | 0. | 0. | 0. | 0. | 9.78E-08 | 0. |
| CS134M+D | 1.32E-07 | 2.10E-07 | 1.11E-07 | 0. | 8.50E-08 | 2.00E-08 | 1.16E-07 |
| CS134 | 2.83E-04 | 5.02E-04 | 5.32E-05 | 0. | 1.36E-04 | 5.69E-05 | 9.53E-07 |
| CS135 | 1.00E-04 | 8.66E-05 | 4.73E-06 | 0. | 2.58E-05 | 1.01E-05 | 2.18E-07 |
| CS136 | 3.45E-05 | 9.61E-05 | 3.78E-05 | 0. | 4.03E-05 | 8.40E-06 | 1.02E-06 |
| CS137+D | 3.92E-04 | 4.37E-04 | 3.25E-05 | 0. | 1.23E-04 | 5.09E-05 | 9.53E-07 |
| CS138 | 3.61E-07 | 5.58E-07 | 2.84E-07 | 0. | 2.93E-07 | 4.67E-08 | 6.26E-07 |
| CS139+D | 2.32E-07 | 3.03E-07 | 1.22E-07 | 0. | 1.65E-07 | 2.53E-08 | 1.33E-08 |
| BA139 | 1.06E-09 | 7.03E-13 | 3.07E-11 | 0. | 4.23E-13 | 4.25E-06 | 3.64E-05 |
| BA140+D | 4.00E-05 | 4.00E-08 | 2.07E-06 | 0. | 9.59E-09 | 1.14E-03 | 2.74E-05 |
| BA141+D | 1.12E-10 | 7.70E-14 | 3.55E-12 | 0. | 4.64E-14 | 2.12E-06 | 3.39E-06 |
| BA142+D | 2.84E-11 | 2.36E-14 | 1.40E-12 | 0. | 1.36E-14 | 1.11E-06 | 4.95E-07 |
| LA140 | 3.61E-07 | 1.43E-07 | 3.68E-08 | 0. | 0. | 1.20E-04 | 6.06E-05 |
| LA141 | 4.85E-09 | 1.40E-09 | 2.45E-10 | 0. | 0. | 1.22E-05 | 5.96E-05 |
| LA142 | 7.36E-10 | 2.69E-10 | 6.46E-11 | 0. | 0. | 5.87E-06 | 4.25E-05 |
| CE141 | 1.98E-05 | 1.19E-05 | 1.42E-06 | 0. | 3.75E-06 | 3.69E-04 | 1.54E-05 |
| CE143+D | 2.09E-07 | 1.38E-07 | 1.58E-08 | 0. | 4.03E-08 | 8.30E-05 | 3.55E-05 |
| CE144+D | 2.28E-03 | 8.65E-04 | 1.26E-04 | 0. | 3.84E-04 | 7.03E-03 | 1.06E-04 |
| PR143 | 1.00E-05 | 3.74E-06 | 4.99E-07 | 0. | 1.41E-06 | 3.09E-04 | 2.66E-05 |
| PR144 | 3.42E-11 | 1.32E-11 | 1.72E-12 | 0. | 4.80E-12 | 1.15E-06 | 3.06E-06 |
| ND147+D | 5.67E-06 | 5.81E-06 | 3.57E-07 | 0. | 2.25E-06 | 2.30E-04 | 2.23E-05 |
| PM147 | 3.91E-04 | 3.07E-05 | 1.56E-05 | 0. | 4.93E-05 | 4.55E-04 | 5.75E-06 |
| PM148M+D | 5.00E-05 | 1.24E-05 | 9.94E-06 | 0. | 1.45E-05 | 1.22E-03 | 3.37E-05 |
| PM148 | 3.34E-06 | 4.82E-07 | 2.44E-07 | 0. | 5.76E-07 | 3.20E-04 | 6.04E-05 |
| PM149 | 3.10E-07 | 4.08E-08 | 1.78E-08 | 0. | 4.96E-08 | 6.50E-05 | 3.01E-05 |
| PM151 | 7.52E-08 | 1.10E-08 | 5.55E-09 | 0. | 1.30E-08 | 3.25E-05 | 2.58E-05 |
| SM151 | 3.38E-04 | 6.45E-05 | 1.63E-05 | 0. | 5.24E-05 | 2.98E-04 | 3.46E-06 |
| SM153 | 1.53E-07 | 1.18E-07 | 9.06E-09 | 0. | 2.47E-08 | 3.70E-05 | 1.93E-05 |
| EU152 | 7.83E-04 | 1.77E-04 | 1.72E-04 | 0. | 5.94E-04 | 1.48E-03 | 9.88E-06 |
| EU154 | 2.96E-03 | 3.46E-04 | 2.45E-04 | 0. | 1.14E-03 | 3.05E-03 | 2.84E-05 |
| EU155 | 5.97E-04 | 5.72E-05 | 3.46E-05 | 0. | 1.58E-04 | 5.20E-04 | 5.19E-05 |
| EU156 | 1.56E-05 | 9.59E-06 | 1.54E-06 | 0. | 4.48E-06 | 6.12E-04 | 4.14E-05 |
| TB160 | 1.12E-04 | 0. | 1.40E-05 | 0. | 3.20E-05 | 1.11E-03 | 2.14E-05 |
| HO166M | 1.45E-03 | 3.07E-04 | 2.51E-04 | 0. | 4.22E-04 | 2.05E-03 | 1.65E-05 |
| W181 | 4.86E-08 | 1.46E-08 | 1.67E-09 | 0. | 0. | 1.33E-05 | 2.63E-07 |
| W185 | 1.57E-06 | 4.83E-07 | 5.58E-08 | 0. | 0. | 4.48E-04 | 1.12E-05 |
| W187 | 9.26E-09 | 6.44E-09 | 2.23E-09 | 0. | 0. | 2.83E-05 | 2.54E-05 |

**PALISADES NUCLEAR PLANT
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Revision 16

TABLE 1.7 (continued)

| INFANT INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|---|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| PB210 +D | 8.62E-02 | 2.02E-02 | 3.43E-03 | 0. | 6.85E-02 | 1.76E-01 | 3.79E-05 |
| BI210 +D | 0. | 1.33E-05 | 1.18E-06 | 0. | 1.03E-04 | 9.96E-03 | 3.27E-05 |
| PO210 | 2.98E-03 | 5.63E-03 | 7.12E-04 | 0. | 1.30E-02 | 2.40E-01 | 4.36E-05 |
| RN222 +D | 0. | 0. | 0. | 0. | 0. | 9.88E-06 | 0. |
| RA223 +D | 1.56E-03 | 2.26E-06 | 3.12E-04 | 0. | 4.16E-05 | 2.25E-01 | 3.04E-04 |
| RA224 +D | 1.77E-04 | 4.00E-07 | 3.54E-05 | 0. | 7.30E-06 | 7.91E-02 | 3.42E-04 |
| RA225 +D | 2.57E-03 | 2.88E-06 | 5.13E-04 | 0. | 5.31E-05 | 2.57E-01 | 2.87E-04 |
| RA226 +D | 2.48E-01 | 1.46E-05 | 2.05E-01 | 0. | 2.94E-04 | 7.83E-01 | 3.05E-04 |
| RA228 +D | 1.60E-01 | 7.61E-06 | 1.80E-01 | 0. | 1.53E-04 | 1.09E-00 | 5.19E-05 |
| AC225 | 3.69E-03 | 4.72E-03 | 2.48E-04 | 0. | 3.49E-04 | 1.96E-01 | 2.71E-04 |
| AC227 +D | 5.29E+00 | 8.76E-01 | 3.28E-01 | 0. | 1.86E-01 | 1.62E+00 | 5.27E-05 |
| TH227 +D | 1.82E-03 | 3.03E-05 | 5.24E-05 | 0. | 1.13E-04 | 3.27E-01 | 3.53E-04 |
| TH228 +D | 8.46E-01 | 1.10E-02 | 2.86E-02 | 0. | 5.61E-02 | 4.65E+00 | 3.62E-04 |
| TH229 | 1.34E+01 | 1.82E-01 | 6.62E-01 | 0. | 8.99E-01 | 1.22E+01 | 3.29E-04 |
| TH230 | 3.46E+00 | 1.79E-01 | 9.65E-02 | 0. | 8.82E-01 | 2.18E+00 | 3.87E-05 |
| TH232 +D | 3.86E+00 | 1.53E-01 | 2.29E-01 | 0. | 7.54E-01 | 2.09E+00 | 3.29E-05 |
| TH234 | 1.33E-05 | 7.17E-07 | 3.84E-07 | 0. | 2.70E-06 | 1.62E-03 | 7.40E-05 |
| PA231 +D | 9.10E+00 | 3.00E-01 | 3.62E-01 | 0. | 1.62E+00 | 3.85E-01 | 4.61E-05 |
| PA233 | 6.84E-06 | 1.32E-06 | 1.19E-06 | 0. | 3.68E-06 | 2.19E-04 | 9.04E-06 |
| U232 +D | 2.57E-01 | 0. | 2.13E-02 | 0. | 2.40E-02 | 1.49E+00 | 4.36E-05 |
| U233 +D | 5.44E-02 | 0. | 3.83E-03 | 0. | 1.09E-02 | 3.56E-01 | 4.03E-05 |
| U234 | 5.22E-02 | 0. | 3.75E-03 | 0. | 1.07E-02 | 3.49E-01 | 3.95E-05 |
| U235 +D | 5.01E-02 | 0. | 3.52E-03 | 0. | 1.01E-02 | 3.28E-01 | 5.02E-05 |
| U236 | 5.01E-02 | 0. | 3.60E-03 | 0. | 1.03E-02 | 3.35E-01 | 3.71E-05 |
| U237 | 3.25E-07 | 0. | 8.65E-08 | 0. | 8.08E-07 | 9.13E-05 | 1.31E-05 |
| U238 +D | 4.79E-02 | 0. | 3.29E-03 | 0. | 9.40E-03 | 3.06E-01 | 3.54E-05 |
| NP237 +D | 3.03E+00 | 2.32E-01 | 1.26E-01 | 0. | 7.69E-01 | 3.49E-01 | 5.10E-05 |
| NP238 | 2.67E-06 | 6.73E-08 | 4.16E-08 | 0. | 1.47E-07 | 9.19E-05 | 2.58E-05 |
| NP239 | 2.65E-07 | 2.37E-08 | 1.34E-08 | 0. | 4.73E-08 | 4.25E-05 | 1.78E-05 |
| PU238 | 5.02E+00 | 6.33E-01 | 1.27E-01 | 0. | 4.64E-01 | 9.03E-01 | 4.69E-05 |
| PU239 | 5.50E+00 | 6.72E-01 | 1.34E-01 | 0. | 4.95E-01 | 8.47E-01 | 4.28E-05 |
| PU240 | 6.49E+00 | 6.71E-01 | 1.34E-01 | 0. | 4.94E-01 | 8.47E-01 | 4.36E-05 |
| PU241 +D | 1.55E-01 | 6.69E-03 | 3.11E-03 | 0. | 1.15E-02 | 7.62E-04 | 8.97E-07 |
| PU242 | 5.09E+00 | 6.47E-01 | 1.29E-01 | 0. | 4.77E-01 | 8.15E-01 | 4.20E-05 |
| PU244 | 5.95E+00 | 7.40E-01 | 1.48E-01 | 0. | 5.46E-01 | 9.33E-01 | 6.26E-05 |
| AM241 | 1.84E+00 | 8.44E-01 | 1.31E-01 | 0. | 7.94E-01 | 4.06E-01 | 4.78E-05 |
| AM242M | 1.90E+00 | 8.24E-01 | 1.35E-01 | 0. | 8.03E-01 | 1.64E-01 | 6.01E-05 |
| AM243 | 1.82E+00 | 8.10E-01 | 1.27E-01 | 0. | 7.72E-01 | 3.85E-01 | 5.60E-05 |
| CM242 | 8.58E-02 | 7.44E-02 | 5.70E-03 | 0. | 1.69E-02 | 2.97E-01 | 5.10E-05 |
| CM243 | 1.73E+00 | 7.94E-01 | 1.06E-01 | 0. | 3.91E-01 | 4.24E-01 | 5.02E-05 |
| CM244 | 1.43E+00 | 7.04E-01 | 8.89E-02 | 0. | 3.21E-01 | 4.08E-01 | 4.86E-05 |
| CM245 | 2.26E+00 | 8.80E-01 | 1.36E-01 | 0. | 5.23E-01 | 3.92E-01 | 4.53E-05 |
| CM246 | 2.24E+00 | 8.79E-01 | 1.36E-01 | 0. | 5.23E-01 | 3.99E-01 | 4.45E-05 |
| CM247 +D | 2.18E+00 | 8.64E-01 | 1.33E-01 | 0. | 5.15E-01 | 3.92E-01 | 5.85E-05 |
| CM248 | 1.82E+01 | 7.12E+00 | 1.10E+00 | 0. | 4.24E+00 | 3.23E+00 | 9.43E-04 |
| CF252 | 4.26E+00 | 0. | 1.01E-01 | 0. | 0. | 1.37E+00 | 1.85E-04 |

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TABLE 1.7 (continued)

| CHILD INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|--|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| H3* | 0. | 3.04E-07 | 3.04E-07 | 3.04E-07 | 3.04E-07 | 3.04E-07 | 3.04E-07 |
| BE10 | 8.43E-04 | 9.83E-05 | 2.12E-05 | 0. | 0. | 7.41E-04 | 1.72E-05 |
| C14 | 9.70E-06 | 1.82E-06 | 1.82E-06 | 1.82E-06 | 1.82E-06 | 1.82E-06 | 1.82E-06 |
| N13 | 2.33E-08 | 2.33E-08 | 2.33E-08 | 2.33E-08 | 2.33E-08 | 2.33E-08 | 2.33E-08 |
| F18 | 1.88E-06 | 0. | 1.85E-07 | 0. | 0. | 0. | 3.37E-07 |
| NA22 | 4.41E-05 | 4.41E-05 | 4.41E-05 | 4.41E-05 | 4.41E-05 | 4.41E-05 | 4.41E-05 |
| NA24 | 4.35E-06 | 4.35E-06 | 4.35E-06 | 4.35E-06 | 4.35E-06 | 4.35E-06 | 4.35E-06 |
| P32 | 7.04E-04 | 3.09E-05 | 2.67E-05 | 0. | 0. | 0. | 1.14E-05 |
| AR39 | 0. | 0. | 0. | 0. | 0. | 4.89E-09 | 0. |
| AR41 | 0. | 0. | 0. | 0. | 0. | 1.68E-08 | 0. |
| CA41 | 7.06E-05 | 0. | 7.70E-06 | 0. | 0. | 7.21E-02 | 2.94E-07 |
| SC46 | 1.97E-04 | 2.70E-04 | 1.04E-04 | 0. | 2.39E-04 | 0. | 2.45E-05 |
| CR51 | 0. | 0. | 4.17E-08 | 2.31E-08 | 6.57E-09 | 4.59E-06 | 2.93E-07 |
| MN54 | 0. | 1.16E-05 | 2.57E-06 | 0. | 2.71E-06 | 4.26E-04 | 6.19E-06 |
| MN56 | 0. | 4.48E-10 | 8.43E-11 | 0. | 4.52E-10 | 3.55E-06 | 3.33E-05 |
| FE55 | 1.28E-05 | 6.80E-06 | 2.10E-06 | 0. | 0. | 3.00E-05 | 7.75E-07 |
| FE59 | 5.59E-06 | 9.04E-06 | 4.51E-06 | 0. | 0. | 3.43E-04 | 1.91E-05 |
| CO57 | 0. | 2.44E-07 | 2.88E-07 | 0. | 0. | 1.37E-04 | 3.58E-06 |
| CO58 | 0. | 4.79E-07 | 8.55E-07 | 0. | 0. | 2.99E-04 | 9.29E-06 |
| CO60 | 0. | 3.55E-06 | 6.12E-06 | 0. | 0. | 1.91E-03 | 2.60E-05 |
| NI59 | 1.66E-05 | 4.67E-06 | 2.83E-06 | 0. | 0. | 2.73E-05 | 6.29E-07 |
| NI63 | 2.22E-04 | 1.25E-05 | 7.56E-06 | 0. | 0. | 7.43E-05 | 1.71E-06 |
| NI65 | 8.08E-10 | 7.99E-11 | 4.44E-11 | 0. | 0. | 2.21E-06 | 2.27E-05 |
| CU64 | 0. | 5.39E-10 | 2.90E-10 | 0. | 1.63E-09 | 2.59E-06 | 9.92E-06 |
| ZN65 | 1.15E-05 | 3.06E-05 | 1.90E-05 | 0. | 1.93E-05 | 2.69E-04 | 4.41E-06 |
| ZN69M + D | 4.26E-09 | 7.28E-09 | 8.59E-10 | 0. | 4.22E-09 | 7.36E-06 | 2.71E-05 |
| ZN69 | 1.81E-11 | 2.61E-11 | 2.41E-12 | 0. | 1.58E-11 | 3.84E-07 | 2.75E-06 |
| SE79 | 0. | 1.23E-06 | 2.60E-07 | 0. | 1.71E-06 | 1.49E-04 | 3.43E-06 |
| BR82 | 0. | 0. | 5.66E-06 | 0. | 0. | 0. | 0. |
| BR83 + D | 0. | 0. | 1.28E-07 | 0. | 0. | 0. | 0. |
| BR84 | 0. | 0. | 1.48E-07 | 0. | 0. | 0. | 0. |
| BR85 | 0. | 0. | 6.84E-09 | 0. | 0. | 0. | 0. |
| KR83M | 0. | 0. | 0. | 0. | 0. | 1.22E-09 | 0. |
| KR85M | 0. | 0. | 0. | 0. | 0. | 6.58E-09 | 0. |
| KR85 | 0. | 0. | 0. | 0. | 0. | 5.66E-09 | 0. |
| KR87 | 0. | 0. | 0. | 0. | 0. | 3.38E-08 | 0. |
| KR88 + D | 0. | 0. | 0. | 0. | 0. | 6.99E-08 | 0. |
| KR89 | 0. | 0. | 0. | 0. | 0. | 4.55E-08 | 0. |
| RB86 | 0. | 5.36E-05 | 3.09E-05 | 0. | 0. | 0. | 2.16E-06 |
| RB87 | 0. | 3.16E-05 | 1.37E-05 | 0. | 0. | 0. | 2.96E-07 |
| RB88 | 0. | 1.52E-07 | 9.90E-08 | 0. | 0. | 0. | 4.66E-09 |
| RB89 + D | 0. | 9.33E-08 | 7.83E-08 | 0. | 0. | 0. | 5.11E-10 |
| SR89 + D | 1.62E-04 | 0. | 4.66E-06 | 0. | 0. | 5.83E-04 | 4.52E-05 |
| SR90 + D | 2.73E-02 | 0. | 1.74E-03 | 0. | 0. | 3.99E-03 | 9.28E-05 |
| SR91 + D | 3.28E-08 | 0. | 1.24E-09 | 0. | 0. | 1.44E-05 | 4.70E-05 |
| SR92 + D | 3.54E-09 | 0. | 1.42E-10 | 0. | 0. | 6.49E-06 | 6.55E-05 |

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*Includes a 50% increase to account for percutaneous transpiration.

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Revision 16

TABLE 1.7 (continued)

| CHILD INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|--|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| Y90 | 1.11E-06 | 0. | 2.99E-08 | 0. | 0. | 7.07E-05 | 7.24E-05 |
| Y91M+D | 1.37E-10 | 0. | 4.98E-12 | 0. | 0. | 7.60E-07 | 4.64E-07 |
| Y91 | 2.47E-04 | 0. | 6.59E-06 | 0. | 0. | 7.10E-04 | 4.97E-05 |
| Y92 | 5.50E-09 | 0. | 1.57E-10 | 0. | 0. | 6.46E-06 | 6.46E-05 |
| Y93 | 5.04E-08 | 0. | 1.38E-09 | 0. | 0. | 2.01E-05 | 1.05E-04 |
| ZR93+D | 2.07E-04 | 7.80E-05 | 5.55E-05 | 0. | 3.00E-04 | 7.10E-04 | 1.47E-05 |
| ZR95+D | 5.13E-05 | 1.13E-05 | 1.00E-05 | 0. | 1.61E-05 | 6.03E-04 | 1.65E-05 |
| ZR97+D | 5.07E-08 | 7.34E-09 | 4.32E-09 | 0. | 1.05E-08 | 3.06E-05 | 9.49E-05 |
| NB93M | 1.27E-04 | 3.17E-05 | 1.04E-05 | 0. | 3.44E-05 | 1.04E-04 | 2.45E-06 |
| NB95 | 6.35E-06 | 2.48E-06 | 1.77E-06 | 0. | 2.33E-06 | 1.66E-04 | 1.00E-05 |
| NB97 | 1.16E-10 | 2.08E-11 | 9.74E-12 | 0. | 2.31E-11 | 9.23E-07 | 7.52E-06 |
| MO93 | 0. | 3.76E-06 | 1.35E-07 | 0. | 1.06E-06 | 1.70E-04 | 3.78E-06 |
| MO99+D | 0. | 4.66E-08 | 1.15E-08 | 0. | 1.06E-07 | 3.66E-05 | 3.42E-05 |
| TC99M | 4.81E-13 | 9.41E-13 | 1.56E-11 | 0. | 1.37E-11 | 2.57E-07 | 1.30E-06 |
| TC99 | 1.34E-07 | 1.49E-07 | 5.35E-08 | 0. | 1.75E-06 | 3.37E-04 | 7.75E-06 |
| TC101 | 2.19E-14 | 2.30E-14 | 2.91E-13 | 0. | 3.92E-13 | 1.58E-07 | 4.41E-09 |
| RU103+D | 7.55E-07 | 0. | 2.90E-07 | 0. | 1.90E-06 | 1.79E-04 | 1.21E-05 |
| RU105+D | 4.13E-10 | 0. | 1.50E-10 | 0. | 3.63E-10 | 4.30E-06 | 2.69E-05 |
| RU106+D | 3.68E-05 | 0. | 4.57E-06 | 0. | 4.97E-05 | 3.87E-03 | 1.16E-04 |
| RH105 | 3.91E-09 | 2.10E-09 | 1.79E-09 | 0. | 8.39E-09 | 7.82E-06 | 1.33E-05 |
| PD107 | 0. | 2.65E-07 | 2.51E-08 | 0. | 1.97E-06 | 3.16E-05 | 7.26E-07 |
| PD109 | 0. | 1.48E-09 | 4.95E-10 | 0. | 7.06E-09 | 6.16E-06 | 2.59E-05 |
| AG110M+D | 4.56E-06 | 3.08E-06 | 2.47E-06 | 0. | 5.74E-06 | 1.48E-03 | 2.71E-05 |
| AG111 | 1.81E-07 | 5.68E-08 | 3.75E-08 | 0. | 1.71E-07 | 7.73E-05 | 2.98E-05 |
| CD113M | 0. | 4.93E-04 | 2.12E-05 | 0. | 5.13E-04 | 6.94E-04 | 1.63E-05 |
| CD115M | 0. | 7.88E-05 | 3.39E-06 | 0. | 5.93E-05 | 5.86E-04 | 4.97E-05 |
| SN123 | 1.29E-04 | 2.14E-06 | 4.19E-06 | 2.27E-06 | 0. | 9.59E-04 | 4.05E-05 |
| SN125+D | 4.95E-06 | 9.94E-08 | 2.95E-07 | 1.03E-07 | 0. | 2.43E-04 | 7.17E-05 |
| SN126+D | 6.23E-04 | 1.04E-05 | 2.36E-05 | 2.84E-06 | 0. | 3.02E-03 | 1.63E-05 |
| SB124 | 1.55E-05 | 2.00E-07 | 5.41E-06 | 3.41E-08 | 0. | 8.76E-04 | 4.43E-05 |
| SB125+D | 2.66E-05 | 2.05E-07 | 5.59E-06 | 2.46E-08 | 0. | 6.27E-04 | 1.09E-05 |
| SB126 | 1.72E-06 | 2.62E-08 | 6.16E-07 | 1.00E-08 | 0. | 2.86E-04 | 5.67E-05 |
| SB127 | 1.36E-07 | 2.09E-09 | 4.70E-08 | 1.51E-09 | 0. | 6.17E-05 | 3.82E-05 |
| TE125M | 1.82E-06 | 6.29E-07 | 2.47E-07 | 5.20E-07 | 0. | 1.29E-04 | 9.13E-06 |
| TE127M+D | 6.72E-06 | 2.31E-06 | 8.16E-07 | 1.64E-06 | 1.72E-05 | 4.00E-04 | 1.93E-05 |
| TE127 | 7.49E-10 | 2.57E-10 | 1.65E-10 | 5.30E-10 | 1.91E-09 | 2.71E-06 | 1.52E-05 |
| TE129M+D | 5.19E-06 | 1.85E-06 | 8.22E-07 | 1.71E-06 | 1.36E-05 | 4.76E-04 | 4.91E-05 |
| TE129 | 2.64E-11 | 9.45E-12 | 6.44E-12 | 1.93E-11 | 6.94E-11 | 7.93E-07 | 6.89E-06 |
| TE131M+D | 3.63E-08 | 1.60E-08 | 1.37E-08 | 2.64E-08 | 1.08E-07 | 5.56E-05 | 8.32E-05 |
| TE131+D | 5.87E-12 | 2.28E-12 | 1.78E-12 | 4.59E-12 | 1.59E-11 | 5.55E-07 | 3.60E-07 |
| TE132+D | 1.30E-07 | 7.36E-08 | 7.12E-08 | 8.58E-08 | 4.79E-07 | 1.02E-04 | 3.72E-05 |
| TE133M+D | 2.93E-11 | 1.51E-11 | 1.50E-11 | 2.32E-11 | 1.01E-10 | 1.60E-06 | 4.77E-06 |
| TE134+D | 1.53E-11 | 8.81E-12 | 9.40E-12 | 1.24E-11 | 5.71E-11 | 1.23E-06 | 4.87E-07 |
| I129 | 1.05E-05 | 6.40E-06 | 5.71E-06 | 4.28E-03 | 1.08E-05 | 0. | 2.15E-07 |
| I130 | 2.21E-06 | 4.43E-06 | 2.28E-06 | 4.99E-04 | 6.61E-06 | 0. | 1.38E-06 |
| I131+D | 1.30E-05 | 1.30E-05 | 7.37E-06 | 4.39E-03 | 2.13E-05 | 0. | 7.68E-07 |

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Revision 16

TABLE 1.7 (continued)

| CHILD INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|--|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| I132 | 5.72E-07 | 1.10E-06 | 5.07E-07 | 5.23E-05 | 1.69E-06 | 0. | 8.65E-07 |
| I133 + D | 4.48E-06 | 5.49E-06 | 2.08E-06 | 1.04E-03 | 9.13E-06 | 0. | 1.48E-06 |
| I134 | 3.17E-07 | 5.84E-07 | 2.69E-07 | 1.37E-05 | 8.92E-07 | 0. | 2.58E-07 |
| I135 + D | 1.33E-06 | 2.36E-06 | 1.12E-06 | 2.14E-04 | 3.62E-06 | 0. | 1.20E-06 |
| XE131M | 0. | 0. | 0. | 0. | 0. | 3.30E-09 | 0. |
| XE133M | 0. | 0. | 0. | 0. | 0. | 4.36E-09 | 0. |
| XE133 | 0. | 0. | 0. | 0. | 0. | 3.66E-09 | 0. |
| XE135M | 0. | 0. | 0. | 0. | 0. | 4.48E-09 | 0. |
| XE135 | 0. | 0. | 0. | 0. | 0. | 9.09E-09 | 0. |
| XE137 | 0. | 0. | 0. | 0. | 0. | 4.07E-08 | 0. |
| XE138 + D | 0. | 0. | 0. | 0. | 0. | 5.17E-08 | 0. |
| CS134M + D | 6.33E-08 | 8.92E-08 | 6.12E-08 | 0. | 4.94E-08 | 8.35E-09 | 7.92E-08 |
| CS134 | 1.76E-04 | 2.74E-04 | 6.07E-05 | 0. | 8.93E-05 | 3.27E-05 | 1.04E-06 |
| CS135 | 6.23E-05 | 4.13E-05 | 4.45E-06 | 0. | 1.53E-05 | 5.22E-06 | 2.17E-07 |
| CS136 | 1.76E-05 | 4.62E-05 | 3.14E-05 | 0. | 2.58E-05 | 3.93E-06 | 1.13E-06 |
| CS137 + D | 2.45E-04 | 2.23E-04 | 3.47E-05 | 0. | 7.63E-05 | 2.81E-05 | 9.78E-07 |
| CS138 | 1.71E-07 | 2.27E-07 | 1.50E-07 | 0. | 1.68E-07 | 1.84E-08 | 7.29E-08 |
| CS139 + D | 1.09E-07 | 1.15E-07 | 5.80E-08 | 0. | 9.08E-08 | 9.36E-09 | 7.23E-12 |
| BA139 | 4.98E-10 | 2.66E-13 | 1.45E-11 | 0. | 2.33E-13 | 1.56E-06 | 1.56E-05 |
| BA140 + D | 2.00E-05 | 1.75E-08 | 1.17E-06 | 0. | 5.71E-09 | 4.71E-04 | 2.75E-05 |
| BA141 + D | 5.29E-11 | 2.95E-14 | 1.72E-12 | 0. | 2.56E-14 | 7.89E-07 | 7.44E-08 |
| BA142 + D | 1.35E-11 | 9.73E-15 | 7.54E-13 | 0. | 7.87E-15 | 4.44E-07 | 7.41E-10 |
| LA140 | 1.74E-07 | 6.08E-08 | 2.04E-08 | 0. | 0. | 4.94E-05 | 6.10E-05 |
| LA141 | 2.28E-09 | 5.31E-10 | 1.15E-10 | 0. | 0. | 4.48E-06 | 4.37E-05 |
| LA142 | 3.50E-10 | 1.11E-10 | 3.49E-11 | 0. | 0. | 2.35E-06 | 2.05E-05 |
| CE141 | 1.06E-05 | 5.28E-06 | 7.83E-07 | 0. | 2.31E-06 | 1.47E-04 | 1.53E-05 |
| CE143 + D | 9.89E-08 | 5.37E-08 | 7.77E-09 | 0. | 2.26E-08 | 3.12E-05 | 3.44E-05 |
| CE144 + D | 1.83E-03 | 5.72E-04 | 9.77E-05 | 0. | 3.17E-04 | 3.23E-03 | 1.05E-04 |
| PR143 | 4.99E-06 | 1.50E-06 | 2.47E-07 | 0. | 8.11E-07 | 1.17E-04 | 2.63E-05 |
| PR144 | 1.61E-11 | 4.99E-12 | 8.10E-13 | 0. | 2.64E-12 | 4.23E-07 | 5.32E-08 |
| ND147 + D | 2.92E-06 | 2.36E-06 | 1.84E-07 | 0. | 1.30E-06 | 8.87E-05 | 2.22E-05 |
| PM147 | 3.52E-04 | 2.52E-05 | 1.36E-05 | 0. | 4.45E-05 | 2.20E-04 | 5.70E-06 |
| PM148M + D | 3.31E-05 | 6.55E-06 | 6.55E-06 | 0. | 9.74E-06 | 5.72E-04 | 3.58E-05 |
| PM148 | 1.61E-06 | 1.94E-07 | 1.25E-07 | 0. | 3.30E-07 | 1.24E-04 | 6.01E-05 |
| PM149 | 1.47E-07 | 1.56E-08 | 8.45E-09 | 0. | 2.75E-08 | 2.40E-05 | 2.92E-05 |
| PM151 | 3.57E-08 | 4.33E-09 | 2.82E-09 | 0. | 7.35E-09 | 1.24E-05 | 2.50E-05 |
| SM151 | 3.14E-04 | 4.75E-05 | 1.49E-05 | 0. | 4.89E-05 | 1.48E-04 | 3.43E-06 |
| SM153 | 7.24E-08 | 4.51E-08 | 4.35E-09 | 0. | 1.37E-08 | 1.37E-05 | 1.87E-05 |
| EU152 | 7.42E-04 | 1.37E-04 | 1.61E-04 | 0. | 5.73E-04 | 9.00E-04 | 1.14E-05 |
| EU154 | 2.74E-03 | 2.49E-04 | 2.27E-04 | 0. | 1.09E-03 | 1.66E-03 | 2.98E-05 |
| EU155 | 5.60E-04 | 4.05E-05 | 3.18E-05 | 0. | 1.51E-04 | 2.79E-04 | 5.39E-05 |
| EU156 | 7.89E-06 | 4.23E-06 | 8.75E-07 | 0. | 2.72E-06 | 2.54E-04 | 4.24E-05 |
| TB160 | 7.79E-05 | 0. | 9.67E-06 | 0. | 2.32E-05 | 5.34E-04 | 2.28E-05 |
| HO166M | 1.34E-03 | 2.81E-04 | 2.37E-04 | 0. | 4.01E-04 | 1.13E-03 | 1.63E-05 |
| W181 | 2.66E-08 | 6.52E-09 | 8.99E-10 | 0. | 0. | 5.71E-06 | 2.61E-07 |
| W185 | 8.31E-07 | 2.08E-07 | 2.91E-08 | 0. | 0. | 1.86E-04 | 1.11E-05 |
| W187 | 4.41E-09 | 2.61E-09 | 1.17E-09 | 0. | 0. | 1.11E-05 | 2.46E-05 |

**PALISADES NUCLEAR PLANT
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Revision 16

TABLE 1.7 (continued)

| CHILD INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|--|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| PB210 + D | 8.03E-02 | 1.85E-02 | 3.18E-03 | 0. | 6.31E-02 | 8.74E-02 | 3.75E-05 |
| BI210 + D | 0. | 5.11E-06 | 5.65E-07 | 0. | 5.76E-05 | 3.70E-03 | 3.21E-05 |
| PO210 | 1.70E-03 | 2.76E-03 | 4.09E-04 | 0. | 8.85E-03 | 1.05E-01 | 4.32E-05 |
| RN222 + D | 0. | 0. | 0. | 0. | 0. | 4.82E-06 | 0. |
| RA223 + D | 7.69E-04 | 8.89E-07 | 1.54E-04 | 0. | 2.36E-05 | 8.48E-02 | 3.00E-04 |
| RA224 + D | 8.44E-05 | 1.53E-07 | 1.69E-05 | 0. | 4.06E-06 | 2.92E-02 | 3.34E-04 |
| RA225 + D | 1.28E-03 | 1.14E-06 | 2.56E-04 | 0. | 3.02E-05 | 9.74E-02 | 2.84E-04 |
| RA226 + D | 2.34E-01 | 7.66E-06 | 1.92E-01 | 0. | 2.03E-04 | 3.90E-01 | 3.02E-04 |
| RA228 + D | 1.49E-01 | 3.94E-06 | 1.68E-01 | 0. | 1.04E-04 | 5.37E-01 | 5.14E-05 |
| AC225 | 1.81E-03 | 1.87E-03 | 1.21E-04 | 0. | 1.99E-04 | 7.37E-02 | 2.67E-04 |
| AC227 + D | 4.96E+00 | 8.05E-01 | 3.07E-01 | 0. | 1.77E-01 | 8.04E-01 | 5.22E-05 |
| TH227 + D | 9.24E-04 | 1.26E-05 | 2.67E-05 | 0. | 6.67E-05 | 1.26E-01 | 3.49E-04 |
| TH228 + D | 8.06E-01 | 1.04E-02 | 2.72E-02 | 0. | 5.41E-02 | 3.34E+00 | 3.59E-04 |
| TH229 | 1.28E+01 | 1.76E-01 | 6.31E-01 | 0. | 8.68E-01 | 1.04E+01 | 3.27E-04 |
| TH230 | 3.30E+00 | 1.73E-01 | 9.20E-02 | 0. | 8.52E-01 | 1.85E+00 | 3.84E-05 |
| TH232 + D | 3.68E+00 | 1.47E-01 | 1.28E-01 | 0. | 7.28E-01 | 1.77E+00 | 3.27E-05 |
| TH234 | 6.94E-06 | 3.07E-07 | 2.00E-07 | 0. | 1.62E-06 | 6.31E-04 | 7.32E-05 |
| PA231 + D | 8.62E+00 | 2.86E-01 | 3.43E-01 | 0. | 1.56E+00 | 1.92E-01 | 4.57E-05 |
| PA233 | 4.14E-06 | 6.48E-07 | 7.25E-07 | 0. | 2.38E-06 | 9.77E-05 | 8.95E-06 |
| U232 + D | 2.19E-01 | 0. | 1.56E-02 | 0. | 1.67E-02 | 7.42E-01 | 4.33E-05 |
| U233 + D | 4.64E-02 | 0. | 2.82E-03 | 0. | 7.62E-03 | 1.77E-01 | 4.00E-05 |
| U234 | 4.46E-02 | 0. | 2.76E-03 | 0. | 7.47E-03 | 1.74E-01 | 3.92E-05 |
| U235 + D | 4.27E-02 | 0. | 2.59E-03 | 0. | 7.01E-03 | 1.63E-01 | 4.98E-05 |
| U236 | 4.27E-02 | 0. | 2.65E-03 | 0. | 7.16E-03 | 1.67E-01 | 3.67E-05 |
| U237 | 1.57E-07 | 0. | 4.17E-08 | 0. | 4.53E-07 | 3.40E-05 | 1.29E-05 |
| U238 + D | 4.09E-02 | 0. | 2.42E-03 | 0. | 6.55E-03 | 1.53E-01 | 3.51E-05 |
| NP237 + D | 2.88E+00 | 2.21E-01 | 1.19E-01 | 0. | 7.41E-01 | 1.74E-01 | 5.06E-05 |
| NP238 | 1.26E-06 | 2.56E-08 | 1.97E-08 | 0. | 8.16E-08 | 3.39E-05 | 2.50E-05 |
| NP239 | 1.26E-07 | 9.04E-09 | 6.35E-09 | 0. | 2.63E-08 | 1.57E-05 | 1.73E-05 |
| PU238 | 4.77E+00 | 6.05E-01 | 1.21E-01 | 0. | 4.47E-01 | 6.08E-01 | 4.65E-05 |
| PU239 | 5.24E+00 | 6.44E-01 | 1.28E-01 | 0. | 4.78E-01 | 5.72E-01 | 4.24E-05 |
| PU240 | 5.23E+00 | 6.43E-01 | 1.27E-01 | 0. | 4.77E-01 | 5.71E-01 | 4.33E-05 |
| PU241 + D | 1.46E-01 | 6.33E-03 | 2.93E-03 | 0. | 1.10E-02 | 5.06E-04 | 8.90E-07 |
| PU242 | 4.85E+00 | 6.20E-01 | 1.23E-01 | 0. | 4.60E-01 | 5.50E-01 | 4.16E-05 |
| PU244 | 5.67E+00 | 7.10E-01 | 1.41E-01 | 0. | 5.27E-01 | 6.30E-01 | 6.20E-05 |
| AM241 | 1.74E+00 | 7.85E-01 | 1.24E-01 | 0. | 7.63E-01 | 2.02E-01 | 4.73E-05 |
| AM242M | 1.79E+00 | 7.65E-01 | 1.27E-01 | 0. | 7.71E-01 | 8.14E-02 | 5.96E-05 |
| AM243 | 1.72E+00 | 7.53E-01 | 1.20E-01 | 0. | 7.42E-01 | 1.92E-01 | 5.55E-05 |
| CM242 | 6.33E-02 | 4.84E-02 | 4.20E-03 | 0. | 1.34E-02 | 1.31E-01 | 5.06E-05 |
| CM243 | 1.61E+00 | 7.33E-01 | 9.95E-02 | 0. | 3.74E-01 | 2.10E-01 | 4.98E-05 |
| CM244 | 1.33E+00 | 6.48E-01 | 8.31E-02 | 0. | 3.06E-01 | 2.02E-01 | 4.82E-05 |
| CM245 | 2.14E+00 | 8.16E-01 | 1.28E-01 | 0. | 5.03E-01 | 1.95E-01 | 4.49E-05 |
| CM246 | 2.13E+00 | 8.15E-01 | 1.28E-01 | 0. | 5.03E-01 | 1.99E-01 | 4.41E-05 |
| CM247 + D | 2.07E+00 | 8.02E-01 | 1.26E-01 | 0. | 4.95E-01 | 1.95E-01 | 5.80E-05 |
| CM248 | 1.72E+01 | 6.61E+00 | 1.04E+00 | 0. | 4.08E+00 | 1.61E+00 | 9.35E-04 |
| CF252 | 3.92E+00 | 0. | 9.33E-02 | 0. | 0. | 6.62E-01 | 1.84E-04 |

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TABLE 1.7 (continued)

| TEEN INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|---|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| H3* | 0. | 1.59E-07 | 1.59E-07 | 1.59E-07 | 1.59E-07 | 1.59E-07 | 1.59E-07 |
| BE10 | 2.78E-04 | 4.33E-05 | 7.09E-06 | 0. | 0. | 3.84E-04 | 1.77E-05 |
| C14 | 3.25E-06 | 6.09E-07 | 6.09E-07 | 6.09E-07 | 6.09E-07 | 6.09E-07 | 6.09E-07 |
| N13 | 8.65E-09 | 8.65E-09 | 8.65E-09 | 8.65E-09 | 8.65E-09 | 8.65E-09 | 8.65E-09 |
| F18 | 6.52E-07 | 0. | 7.10E-08 | 0. | 0. | 0. | 3.89E-08 |
| NA22 | 1.76E-05 | 1.76E-05 | 1.76E-05 | 1.76E-05 | 1.76E-05 | 1.76E-05 | 1.76E-05 |
| NA24 | 1.72E-06 | 1.72E-06 | 1.72E-06 | 1.72E-06 | 1.72E-06 | 1.72E-06 | 1.72E-06 |
| P32 | 2.36E-04 | 1.37E-05 | 8.95E-06 | 0. | 0. | 0. | 1.16E-05 |
| AR39 | 0. | 0. | 0. | 0. | 0. | 4.00E-09 | 0. |
| AR41 | 0. | 0. | 0. | 0. | 0. | 1.44E-08 | 0. |
| CA41 | 4.05E-05 | 0. | 4.38E-06 | 0. | 0. | 1.01E-01 | 3.03E-07 |
| SC46 | 7.24E-05 | 1.41E-04 | 4.18E-05 | 0. | 1.35E-04 | 0. | 2.98E-05 |
| CR51 | 0. | 0. | 1.69E-08 | 9.37E-09 | 3.84E-09 | 2.62E-06 | 3.75E-07 |
| MN54 | 0. | 6.39E-06 | 1.05E-06 | 0. | 1.59E-06 | 2.48E-04 | 8.35E-06 |
| MN56 | 0. | 2.12E-10 | 3.15E-11 | 0. | 2.24E-10 | 1.90E-06 | 7.18E-06 |
| FE55 | 4.18E-06 | 2.98E-06 | 6.93E-07 | 0. | 0. | 1.55E-05 | 7.99E-07 |
| FE59 | 1.99E-06 | 4.62E-06 | 1.79E-06 | 0. | 0. | 1.91E-04 | 2.23E-05 |
| CO57 | 0. | 1.18E-07 | 1.15E-07 | 0. | 0. | 7.33E-05 | 3.93E-06 |
| CO58 | 0. | 2.59E-07 | 3.47E-07 | 0. | 0. | 1.68E-04 | 1.19E-05 |
| CO60 | 0. | 1.89E-06 | 2.48E-06 | 0. | 0. | 1.09E-03 | 3.24E-05 |
| NI59 | 5.44E-06 | 2.02E-06 | 9.24E-07 | 0. | 0. | 1.41E-05 | 6.48E-07 |
| NI63 | 7.25E-05 | 5.43E-06 | 2.47E-06 | 0. | 0. | 3.84E-05 | 1.77E-06 |
| NI65 | 2.73E-10 | 3.66E-11 | 1.59E-11 | 0. | 0. | 1.17E-06 | 4.59E-06 |
| CU64 | 0. | 2.54E-10 | 1.06E-10 | 0. | 8.01E-10 | 1.39E-06 | 7.68E-06 |
| ZN65 | 4.82E-06 | 1.67E-05 | 7.80E-06 | 0. | 1.08E-05 | 1.55E-04 | 5.83E-06 |
| ZN69M + D | 1.44E-09 | 3.39E-09 | 3.11E-10 | 0. | 2.06E-09 | 3.92E-06 | 2.14E-05 |
| ZN69 | 6.04E-12 | 1.15E-11 | 8.07E-13 | 0. | 7.53E-12 | 1.98E-07 | 3.56E-08 |
| SE79 | 0. | 5.43E-07 | 8.71E-08 | 0. | 8.13E-07 | 7.71E-05 | 3.53E-06 |
| BR82 | 0. | 0. | 2.28E-06 | 0. | 0. | 0. | 0. |
| BR83 + D | 0. | 0. | 4.30E-08 | 0. | 0. | 0. | 0. |
| BR84 | 0. | 0. | 5.41E-08 | 0. | 0. | 0. | 0. |
| BR85 | 0. | 0. | 2.29E-09 | 0. | 0. | 0. | 0. |
| KR83M | 0. | 0. | 0. | 0. | 0. | 9.97E-10 | 0. |
| KR85M | 0. | 0. | 0. | 0. | 0. | 5.46E-09 | 0. |
| KR85 | 0. | 0. | 0. | 0. | 0. | 4.63E-09 | 0. |
| KR87 | 0. | 0. | 0. | 0. | 0. | 2.82E-08 | 0. |
| KR88 + D | 0. | 0. | 0. | 0. | 0. | 5.81E-08 | 0. |
| KR89 | 0. | 0. | 0. | 0. | 0. | 3.85E-08 | 0. |
| RB86 | 0. | 2.38E-05 | 1.05E-05 | 0. | 0. | 0. | 2.21E-06 |
| RB87 | 0. | 1.40E-05 | 4.58E-06 | 0. | 0. | 0. | 3.05E-07 |
| RB88 | 0. | 6.82E-08 | 3.40E-08 | 0. | 0. | 0. | 3.65E-15 |
| RB89 + D | 0. | 4.40E-08 | 2.91E-08 | 0. | 0. | 0. | 4.22E-17 |
| SR89 + D | 5.43E-05 | 0. | 1.56E-06 | 0. | 0. | 3.02E-04 | 4.64E-05 |
| SR90 + D | 1.35E-02 | 0. | 8.35E-04 | 0. | 0. | 2.06E-03 | 9.56E-05 |
| SR91 + D | 1.10E-08 | 0. | 4.39E-10 | 0. | 0. | 7.59E-06 | 3.24E-05 |
| SR92 + D | 1.19E-09 | 0. | 5.08E-11 | 0. | 0. | 3.43E-06 | 1.49E-05 |

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*Includes a 50% increase to account for percutaneous transpiration.

**PALISADES NUCLEAR PLANT
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Revision 16

TABLE 1.7 (continued)

| TEEN INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|---|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| Y90 | 3.73E-07 | 0. | 1.00E-08 | 0. | 0. | 3.66E-05 | 6.99E-05 |
| Y91M+D | 4.63E-11 | 0. | 1.77E-12 | 0. | 0. | 4.00E-07 | 3.77E-09 |
| Y91 | 8.26E-05 | 0. | 2.21E-06 | 0. | 0. | 3.67E-04 | 5.11E-05 |
| Y92 | 1.84E-09 | 0. | 5.36E-11 | 0. | 0. | 3.35E-06 | 2.06E-05 |
| Y93 | 1.69E-08 | 0. | 4.65E-10 | 0. | 0. | 1.04E-05 | 7.24E-05 |
| ZR93+D | 6.83E-05 | 3.38E-05 | 1.84E-05 | 0. | 1.16E-04 | 3.67E-04 | 1.60E-05 |
| ZR95+D | 1.82E-05 | 5.73E-06 | 3.94E-06 | 0. | 8.42E-06 | 3.36E-04 | 1.86E-05 |
| ZR97+D | 1.72E-08 | 3.40E-09 | 1.57E-09 | 0. | 5.15E-09 | 1.62E-05 | 7.88E-05 |
| NB93M | 4.14E-05 | 1.36E-05 | 3.41E-06 | 0. | 1.59E-05 | 5.36E-05 | 2.52E-06 |
| NB95 | 2.32E-06 | 1.29E-06 | 7.08E-07 | 0. | 1.25E-06 | 9.39E-05 | 1.21E-05 |
| NB97 | 3.92E-11 | 9.72E-12 | 3.55E-12 | 0. | 1.14E-11 | 4.91E-07 | 2.71E-07 |
| MO93 | 0. | 1.66E-06 | 4.52E-08 | 0. | 5.06E-07 | 8.81E-05 | 3.99E-06 |
| MO99+D | 0. | 2.11E-08 | 4.03E-09 | 0. | 5.14E-08 | 1.92E-05 | 3.36E-05 |
| TC99M | 1.73E-13 | 4.83E-13 | 6.24E-12 | 0. | 7.20E-12 | 1.44E-07 | 7.66E-07 |
| TC99 | 4.48E-08 | 6.58E-08 | 1.79E-08 | 0. | 8.35E-07 | 1.74E-04 | 7.99E-06 |
| TC101 | 7.40E-15 | 1.05E-14 | 1.03E-13 | 0. | 1.90E-13 | 8.34E-08 | 1.09E-16 |
| RU103+D | 2.63E-07 | 0. | 1.12E-07 | 0. | 9.29E-07 | 9.79E-05 | 1.36E-05 |
| RU105+D | 1.40E-10 | 0. | 5.42E-11 | 0. | 1.76E-10 | 2.27E-06 | 1.13E-05 |
| RU106+D | 1.23E-05 | 0. | 1.55E-06 | 0. | 2.38E-05 | 2.01E-03 | 1.20E-04 |
| RH105 | 1.32E-09 | 9.48E-10 | 6.24E-10 | 0. | 4.04E-09 | 4.09E-06 | 1.23E-05 |
| PD107 | 0. | 1.17E-07 | 8.39E-09 | 0. | 9.39E-07 | 1.63E-05 | 7.49E-07 |
| PD109 | 0. | 6.56E-10 | 1.66E-10 | 0. | 3.36E-09 | 3.19E-06 | 1.96E-05 |
| AG110M+D | 1.73E-06 | 1.64E-06 | 9.99E-07 | 0. | 3.13E-06 | 8.44E-04 | 3.41E-05 |
| AG111 | 6.07E-08 | 2.52E-08 | 1.26E-08 | 0. | 8.17E-08 | 4.00E-05 | 3.00E-05 |
| CD113M | 0. | 2.17E-04 | 7.10E-06 | 0. | 2.43E-04 | 3.59E-04 | 1.68E-05 |
| CD115M | 0. | 3.48E-05 | 1.14E-06 | 0. | 2.82E-05 | 3.03E-04 | 5.10E-05 |
| SN123 | 4.31E-05 | 9.44E-07 | 1.40E-06 | 7.55E-07 | 0. | 4.96E-04 | 4.16E-05 |
| SN125+D | 1.66E-06 | 4.42E-08 | 9.99E-08 | 3.45E-08 | 0. | 1.26E-04 | 7.29E-05 |
| SN126+D | 2.18E-04 | 5.39E-06 | 8.24E-06 | 1.42E-06 | 0. | 1.72E-03 | 1.68E-05 |
| SB124 | 5.38E-06 | 9.92E-08 | 2.10E-06 | 1.22E-08 | 0. | 4.81E-04 | 4.98E-05 |
| SB125+D | 9.23E-06 | 1.01E-07 | 2.15E-06 | 8.80E-09 | 0. | 3.42E-04 | 1.24E-05 |
| SB126 | 6.19E-07 | 1.27E-08 | 2.23E-07 | 3.50E-09 | 0. | 1.55E-04 | 6.01E-05 |
| SB127 | 4.64E-08 | 9.92E-10 | 1.75E-08 | 5.21E-10 | 0. | 3.31E-05 | 3.94E-05 |
| TE125M | 6.10E-07 | 2.80E-07 | 8.34E-08 | 1.75E-07 | 0. | 6.70E-05 | 9.38E-06 |
| TE127M+D | 2.25E-06 | 1.02E-06 | 2.73E-07 | 5.48E-07 | 8.17E-06 | 2.07E-04 | 1.99E-05 |
| TE127 | 2.51E-10 | 1.14E-10 | 5.52E-11 | 1.77E-10 | 9.10E-10 | 1.40E-06 | 1.01E-05 |
| TE129M+D | 1.74E-06 | 8.23E-07 | 2.81E-07 | 5.72E-07 | 6.49E-06 | 2.47E-04 | 5.06E-05 |
| TE129 | 8.87E-12 | 4.22E-12 | 2.20E-12 | 6.48E-12 | 3.32E-11 | 4.12E-07 | 2.02E-07 |
| TE131M+D | 1.23E-08 | 7.51E-09 | 5.03E-09 | 9.06E-09 | 5.49E-08 | 2.97E-05 | 7.76E-05 |
| TE131+D | 1.97E-12 | 1.04E-12 | 6.30E-13 | 1.55E-12 | 7.72E-12 | 2.92E-07 | 1.89E-09 |
| TE132+D | 4.50E-08 | 3.63E-08 | 2.74E-08 | 3.07E-08 | 2.44E-07 | 5.61E-05 | 5.79E-05 |
| TE133M+D | 1.01E-11 | 7.33E-12 | 5.71E-12 | 8.18E-12 | 5.07E-11 | 8.71E-07 | 1.23E-07 |
| TE134+D | 5.31E-12 | 4.35E-12 | 3.64E-12 | 4.46E-12 | 2.91E-11 | 6.75E-07 | 1.37E-09 |
| I129 | 3.53E-06 | 2.94E-06 | 4.90E-06 | 3.66E-03 | 5.26E-06 | 0. | 2.29E-07 |
| I130 | 7.80E-07 | 2.24E-06 | 8.96E-07 | 1.86E-04 | 3.44E-06 | 0. | 1.14E-06 |
| I131+D | 4.43E-06 | 6.14E-06 | 3.30E-06 | 1.83E-03 | 1.05E-05 | 0. | 8.11E-07 |

**PALISADES NUCLEAR PLANT
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Revision 16

TABLE 1.7 (continued)

| TEEN INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|---|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| I132 | 1.99E-07 | 5.47E-07 | 1.97E-07 | 1.89E-05 | 8.65E-07 | 0. | 1.59E-07 |
| I133+D | 1.52E-06 | 2.56E-06 | 7.78E-07 | 3.65E-04 | 4.49E-06 | 0. | 1.29E-06 |
| I134 | 1.11E-07 | 2.90E-07 | 1.05E-07 | 4.94E-06 | 4.58E-07 | 0. | 2.55E-09 |
| I135+D | 4.62E-07 | 1.18E-06 | 4.36E-07 | 7.76E-05 | 1.86E-06 | 0. | 8.69E-07 |
| XE131M | 0. | 0. | 0. | 0. | 0. | 2.70E-09 | 0. |
| XE133M | 0. | 0. | 0. | 0. | 0. | 3.59E-09 | 0. |
| XE133 | 0. | 0. | 0. | 0. | 0. | 2.99E-09 | 0. |
| XE135M | 0. | 0. | 0. | 0. | 0. | 3.88E-09 | 0. |
| XE135 | 0. | 0. | 0. | 0. | 0. | 7.55E-09 | 0. |
| XE137 | 0. | 0. | 0. | 0. | 0. | 3.33E-08 | 0. |
| XE138+D | 0. | 0. | 0. | 0. | 0. | 4.38E-08 | 0. |
| CS134M+D | 2.20E-08 | 4.35E-08 | 2.35E-08 | 0. | 2.54E-08 | 4.56E-09 | 2.02E-08 |
| CS134 | 6.28E-05 | 1.41E-04 | 6.86E-05 | 0. | 4.69E-05 | 1.83E-05 | 1.22E-06 |
| CS135 | 2.08E-05 | 1.82E-05 | 4.47E-06 | 0. | 7.30E-06 | 2.70E-06 | 2.23E-07 |
| CS136 | 6.44E-06 | 2.42E-05 | 1.71E-05 | 0. | 1.38E-05 | 2.22E-06 | 1.36E-06 |
| CS137+D | 8.38E-05 | 1.06E-04 | 3.89E-05 | 0. | 3.80E-05 | 1.51E-05 | 1.06E-06 |
| CS138 | 5.82E-08 | 1.07E-07 | 5.58E-08 | 0. | 8.28E-08 | 9.84E-09 | 3.38E-11 |
| CS139+D | 3.65E-08 | 5.12E-08 | 1.97E-08 | 0. | 4.34E-08 | 4.86E-09 | 1.66E-23 |
| BA139 | 1.67E-10 | 1.18E-13 | 4.87E-12 | 0. | 1.11E-13 | 8.08E-07 | 8.06E-07 |
| BA140+D | 6.84E-06 | 8.38E-09 | 4.40E-07 | 0. | 2.85E-09 | 2.54E-04 | 2.86E-05 |
| BA141+D | 1.78E-11 | 1.32E-14 | 5.93E-13 | 0. | 1.23E-14 | 4.11E-07 | 9.33E-14 |
| BA142+D | 4.62E-12 | 4.63E-15 | 2.84E-13 | 0. | 3.92E-15 | 2.39E-07 | 5.99E-20 |
| LA140 | 5.99E-08 | 2.95E-08 | 7.82E-09 | 0. | 0. | 2.68E-05 | 6.09E-05 |
| LA141 | 7.63E-10 | 2.35E-10 | 3.87E-11 | 0. | 0. | 2.31E-06 | 1.54E-05 |
| LA142 | 1.20E-10 | 5.31E-11 | 1.32E-11 | 0. | 0. | 1.27E-06 | 1.50E-06 |
| CE141 | 3.55E-06 | 2.37E-06 | 2.71E-07 | 0. | 1.11E-06 | 7.67E-05 | 1.58E-05 |
| CE143+D | 3.32E-08 | 2.42E-08 | 2.70E-09 | 0. | 1.08E-08 | 1.63E-05 | 3.19E-05 |
| CE144+D | 6.11E-04 | 2.53E-04 | 3.28E-05 | 0. | 1.51E-04 | 1.67E-03 | 1.08E-04 |
| PR143 | 1.67E-06 | 6.64E-07 | 8.28E-08 | 0. | 3.86E-07 | 6.04E-05 | 2.67E-05 |
| PR144 | 5.37E-12 | 2.20E-12 | 2.72E-13 | 0. | 1.26E-12 | 2.19E-07 | 2.94E-14 |
| ND147+D | 9.83E-07 | 1.07E-06 | 6.41E-08 | 0. | 6.28E-07 | 4.65E-05 | 2.28E-05 |
| PM147 | 1.15E-04 | 1.10E-05 | 4.50E-06 | 0. | 2.10E-05 | 1.14E-04 | 5.87E-06 |
| PM148M+D | 1.32E-05 | 3.35E-06 | 2.62E-06 | 0. | 5.07E-06 | 3.20E-04 | 4.10E-05 |
| PM148 | 5.44E-07 | 8.88E-08 | 4.48E-08 | 0. | 1.60E-07 | 6.52E-05 | 6.14E-05 |
| PM149 | 4.91E-08 | 6.89E-09 | 2.84E-09 | 0. | 1.31E-08 | 1.24E-05 | 2.79E-05 |
| PM151 | 1.20E-08 | 1.99E-09 | 1.01E-09 | 0. | 3.57E-09 | 6.56E-06 | 2.27E-05 |
| SM151 | 1.07E-04 | 2.10E-05 | 4.86E-06 | 0. | 2.27E-05 | 7.68E-05 | 3.53E-06 |
| SM153 | 2.43E-08 | 2.01E-08 | 1.47E-09 | 0. | 6.56E-09 | 7.11E-06 | 1.77E-05 |
| EU152 | 2.96E-04 | 7.19E-05 | 6.30E-05 | 0. | 3.34E-04 | 5.01E-04 | 1.35E-05 |
| EU154 | 9.43E-04 | 1.23E-04 | 8.60E-05 | 0. | 5.44E-04 | 9.12E-04 | 3.34E-05 |
| EU155 | 2.00E-04 | 1.96E-05 | 1.21E-05 | 0. | 7.65E-05 | 1.51E-03 | 5.97E-05 |
| EU156 | 2.70E-06 | 2.03E-06 | 3.30E-07 | 0. | 1.36E-06 | 1.37E-04 | 4.56E-05 |
| TB160 | 3.04E-05 | 0. | 3.79E-06 | 0. | 1.20E-05 | 2.97E-04 | 2.60E-05 |
| HO166M | 4.40E-04 | 1.36E-04 | 9.87E-05 | 0. | 2.00E-04 | 6.24E-04 | 1.68E-05 |
| W181 | 8.90E-09 | 2.88E-09 | 3.01E-10 | 0. | 0. | 2.95E-06 | 2.69E-07 |
| W185 | 2.78E-07 | 9.17E-08 | 9.73E-09 | 0. | 0. | 9.60E-05 | 1.14E-05 |
| W187 | 1.50E-09 | 1.22E-09 | 4.29E-10 | 0. | 0. | 5.92E-06 | 2.21E-05 |

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Revision 16

TABLE 1.7 (continued)

| TEEN INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|---|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| PB210 +D | 3.09E-02 | 8.28E-03 | 1.07E-03 | 0. | 2.95E-02 | 4.52E-02 | 3.87E-05 |
| BI210 +D | 0. | 2.26E-06 | 1.89E-07 | 0. | 2.74E-05 | 1.91E-03 | 3.19E-05 |
| PO210 | 5.68E-04 | 1.22E-03 | 1.37E-04 | 0. | 4.21E-03 | 5.41E-02 | 4.45E-05 |
| RN222 +D | 0. | 0. | 0. | 0. | 0. | 3.94E-06 | 0. |
| RA223 +D | 2.57E-04 | 3.93E-07 | 5.14E-05 | 0. | 1.12E-05 | 4.39E-02 | 3.04E-04 |
| RA224 +D | 2.83E-05 | 6.77E-08 | 5.65E-06 | 0. | 1.93E-06 | 1.51E-02 | 3.29E-04 |
| RA225 +D | 4.28E-04 | 5.04E-07 | 8.56E-05 | 0. | 1.44E-05 | 5.04E-02 | 2.89E-04 |
| RA226 +D | 1.33E-01 | 3.38E-06 | 9.87E-02 | 0. | 9.67E-05 | 2.02E-01 | 3.11E-04 |
| RA228 +D | 5.34E-02 | 1.74E-06 | 5.88E-02 | 0. | 4.97E-05 | 2.78E-01 | 5.30E-05 |
| AC225 | 6.04E-04 | 8.25E-04 | 4.06E-05 | 0. | 9.47E-05 | 3.81E-02 | 2.70E-04 |
| AC227 +D | 2.49E+00 | 3.69E-01 | 1.48E-01 | 0. | 1.07E-01 | 4.16E-01 | 5.38E-05 |
| TH227 +D | 3.09E-04 | 5.56E-06 | 8.93E-06 | 0. | 3.18E-05 | 6.50E-02 | 3.57E-04 |
| TH228 +D | 2.60E-01 | 4.37E-03 | 8.78E-03 | 0. | 2.45E-02 | 1.69E+00 | 3.70E-04 |
| TH229 | 9.06E+00 | 1.36E-01 | 4.45E-01 | 0. | 6.67E-01 | 5.05E+00 | 3.36E-04 |
| TH230 | 2.34E+00 | 1.34E-01 | 6.49E-02 | 0. | 6.55E-01 | 8.98E-01 | 3.95E-05 |
| TH232 +D | 2.61E+00 | 1.14E-01 | 9.21E-02 | 0. | 5.60E-01 | 8.60E-01 | 3.36E-05 |
| TH234 | 2.32E-06 | 1.35E-07 | 6.71E-08 | 0. | 7.73E-07 | 3.26E-04 | 7.49E-05 |
| PA231 +D | 5.32E+00 | 2.00E-01 | 2.07E-01 | 0. | 1.12E+00 | 9.91E-02 | 4.71E-05 |
| PA233 | 1.68E-06 | 3.24E-07 | 2.89E-07 | 0. | 1.22E-06 | 5.39E-05 | 1.00E-05 |
| U232 +D | 7.31E-02 | 0. | 5.23E-03 | 0. | 7.94E-03 | 3.84E-01 | 4.46E-05 |
| U233 +D | 1.55E-02 | 0. | 9.42E-04 | 0. | 3.63E-03 | 9.18E-02 | 4.12E-05 |
| U234 | 1.48E-02 | 0. | 9.23E-04 | 0. | 3.55E-03 | 8.99E-02 | 4.04E-05 |
| U235 +D | 1.42E-02 | 0. | 8.67E-04 | 0. | 3.34E-03 | 8.44E-02 | 5.13E-05 |
| U236 | 1.42E-02 | 0. | 8.86E-04 | 0. | 3.41E-03 | 8.62E-02 | 3.79E-05 |
| U237 | 5.25E-08 | 0. | 1.40E-08 | 0. | 2.16E-07 | 1.76E-05 | 1.29E-05 |
| U238 +D | 1.36E-02 | 0. | 8.10E-04 | 0. | 3.12E-03 | 7.89E-02 | 3.62E-05 |
| NP237 +D | 1.77E+00 | 1.54E-01 | 7.21E-02 | 0. | 5.35E-01 | 8.99E-02 | 5.22E-05 |
| NP238 | 4.23E-07 | 1.13E-08 | 6.59E-09 | 0. | 3.88E-08 | 1.75E-05 | 2.38E-05 |
| NP239 | 4.23E-08 | 3.99E-09 | 2.21E-09 | 0. | 1.25E-08 | 8.11E-06 | 1.65E-05 |
| PU238 | 2.86E+00 | 4.06E-01 | 7.22E-02 | 0. | 3.10E-01 | 3.12E-01 | 4.79E-05 |
| PU239 | 3.31E+00 | 4.50E-01 | 8.05E-02 | 0. | 3.44E-01 | 2.93E-01 | 4.37E-05 |
| PU240 | 3.31E+00 | 4.49E-01 | 8.04E-02 | 0. | 3.43E-01 | 2.93E-01 | 4.46E-05 |
| PU241 +D | 6.97E-02 | 3.57E-03 | 1.40E-03 | 0. | 6.47E-03 | 2.60E-04 | 9.17E-07 |
| PU242 | 3.07E+00 | 4.33E-01 | 7.75E-02 | 0. | 3.31E-01 | 2.82E-01 | 4.29E-05 |
| PU244 | 3.59E+00 | 4.96E-01 | 8.88E-02 | 0. | 3.79E-01 | 3.23E-01 | 6.39E-05 |
| AM241 | 1.06E+00 | 4.07E-01 | 7.10E-02 | 0. | 5.32E-01 | 1.05E-01 | 4.88E-05 |
| AM242M | 1.07E+00 | 3.93E-01 | 7.15E-02 | 0. | 5.30E-01 | 4.21E-02 | 6.14E-05 |
| AM243 | 1.06E+00 | 3.92E-01 | 6.95E-02 | 0. | 5.21E-01 | 9.91E-02 | 5.72E-05 |
| CM242 | 2.12E-02 | 2.14E-02 | 1.41E-03 | 0. | 6.40E-03 | 6.76E-02 | 5.21E-05 |
| CM243 | 8.45E-01 | 3.50E-01 | 5.00E-02 | 0. | 2.34E-01 | 1.09E-01 | 5.13E-05 |
| CM244 | 6.46E-01 | 3.03E-01 | 3.88E-02 | 0. | 1.81E-01 | 1.05E-01 | 4.96E-05 |
| CM245 | 1.32E+00 | 4.11E-01 | 7.53E-02 | 0. | 3.52E-01 | 1.01E-01 | 4.63E-05 |
| CM246 | 1.31E+00 | 4.11E-01 | 7.52E-02 | 0. | 3.51E-01 | 1.03E-01 | 4.54E-05 |
| CM247 +D | 1.28E+00 | 4.04E-01 | 7.41E-02 | 0. | 3.46E-01 | 1.01E-01 | 5.97E-05 |
| CM248 | 1.06E+01 | 3.33E+00 | 6.11E-01 | 0. | 2.85E+00 | 8.32E-01 | 9.63E-04 |
| CF252 | 1.29E+00 | 0. | 3.07E-02 | 0. | 0. | 3.43E-01 | 1.89E-04 |

PALISADES NUCLEAR PLANT
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Revision 16

TABLE 1.7 (continued)

| ADULT INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|--|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| H3* | 0. | 1.58E-07 | 1.58E-07 | 1.58E-07 | 1.58E-07 | 1.58E-07 | 1.58E-07 |
| BE10 | 1.98E-04 | 3.06E-05 | 4.96E-06 | 0. | 0. | 2.22E-04 | 1.67E-05 |
| C14 | 2.27E-06 | 4.26E-07 | 4.26E-07 | 4.26E-07 | 4.26E-07 | 4.26E-07 | 4.26E-07 |
| N13 | 6.27E-09 | 6.27E-09 | 6.27E-09 | 6.27E-09 | 6.27E-09 | 6.27E-09 | 6.27E-09 |
| F18 | 4.71E-07 | 0. | 5.19E-08 | 0. | 0. | 0. | 9.24E-09 |
| NA22 | 1.30E-05 | 1.30E-05 | 1.30E-05 | 1.30E-05 | 1.30E-05 | 1.30E-05 | 1.30E-05 |
| NA24 | 1.28E-06 | 1.28E-06 | 1.28E-06 | 1.28E-06 | 1.28E-06 | 1.28E-06 | 1.28E-06 |
| P32 | 1.65E-04 | 9.64E-06 | 6.26E-06 | 0. | 0. | 0. | 1.08E-05 |
| AR39 | 0. | 0. | 0. | 0. | 0. | 2.08E-09 | 0. |
| AR41 | 0. | 0. | 0. | 0. | 0. | 8.06E-09 | 0. |
| CA41 | 3.83E-05 | 0. | 4.13E-06 | 0. | 0. | 3.83E-06 | 2.86E-07 |
| SC46 | 5.51E-05 | 1.07E-04 | 3.11E-05 | 0. | 9.99E-05 | 0. | 3.23E-05 |
| CR51 | 0. | 0. | 1.25E-08 | 7.44E-09 | 2.85E-09 | 1.80E-06 | 4.15E-07 |
| MN54 | 0. | 4.95E-06 | 7.87E-07 | 0. | 1.23E-06 | 1.75E-04 | 9.67E-06 |
| MN56 | 0. | 1.55E-10 | 2.29E-11 | 0. | 1.63E-10 | 1.18E-06 | 2.53E-06 |
| FE55 | 3.07E-06 | 2.12E-06 | 4.93E-07 | 0. | 0. | 9.01E-06 | 7.54E-07 |
| FE59 | 1.47E-06 | 3.47E-06 | 1.32E-06 | 0. | 0. | 1.27E-04 | 2.35E-05 |
| CO57 | 0. | 8.65E-08 | 8.39E-08 | 0. | 0. | 4.62E-05 | 3.93E-06 |
| CO58 | 0. | 1.98E-07 | 2.59E-07 | 0. | 0. | 1.16E-04 | 1.33E-05 |
| CO60 | 0. | 1.44E-06 | 1.85E-06 | 0. | 0. | 7.46E-04 | 3.56E-05 |
| NI59 | 4.06E-06 | 1.46E-06 | 6.77E-07 | 0. | 0. | 8.20E-06 | 6.11E-07 |
| NI63 | 5.40E-05 | 3.93E-06 | 1.81E-06 | 0. | 0. | 2.23E-05 | 1.67E-06 |
| NI65 | 1.92E-10 | 2.62E-11 | 1.14E-11 | 0. | 0. | 7.00E-07 | 1.54E-06 |
| CU64 | 0. | 1.83E-10 | 7.69E-11 | 0. | 5.78E-10 | 8.48E-07 | 6.12E-06 |
| ZN65 | 4.05E-06 | 1.29E-05 | 5.82E-06 | 0. | 8.62E-06 | 1.08E-04 | 6.68E-06 |
| ZN69M + D | 1.02E-09 | 2.45E-09 | 2.24E-10 | 0. | 1.48E-09 | 2.38E-06 | 1.71E-05 |
| ZN69 | 4.23E-12 | 8.14E-12 | 5.65E-13 | 0. | 5.27E-12 | 1.15E-07 | 2.04E-09 |
| SE79 | 0. | 3.83E-07 | 6.09E-08 | 0. | 5.69E-07 | 4.47E-05 | 3.33E-06 |
| BR82 | 0. | 0. | 1.69E-06 | 0. | 0. | 0. | 1.30E-06 |
| BR83 + D | 0. | 0. | 3.01E-08 | 0. | 0. | 0. | 2.90E-08 |
| BR84 | 0. | 0. | 3.91E-08 | 0. | 0. | 0. | 2.05E-13 |
| BR85 | 0. | 0. | 1.60E-09 | 0. | 0. | 0. | 0. |
| KR83M | 0. | 0. | 0. | 0. | 0. | 5.19E-10 | 0. |
| KR85M | 0. | 0. | 0. | 0. | 0. | 2.91E-09 | 0. |
| KR85 | 0. | 0. | 0. | 0. | 0. | 2.41E-09 | 0. |
| KR87 | 0. | 0. | 0. | 0. | 0. | 1.53E-08 | 0. |
| KR88 + D | 0. | 0. | 0. | 0. | 0. | 3.13E-08 | 0. |
| KR89 | 0. | 0. | 0. | 0. | 0. | 2.13E-08 | 0. |
| RB86 | 0. | 1.69E-05 | 7.37E-06 | 0. | 0. | 0. | 2.08E-06 |
| RB87 | 0. | 9.86E-06 | 3.21E-06 | 0. | 0. | 0. | 2.88E-07 |
| RB88 | 0. | 4.84E-08 | 2.41E-08 | 0. | 0. | 0. | 4.18E-19 |
| RB89 + D | 0. | 3.20E-08 | 2.12E-08 | 0. | 0. | 0. | 1.16E-21 |
| SR89 + D | 3.80E-05 | 0. | 1.09E-06 | 0. | 0. | 1.75E-04 | 4.37E-05 |
| SR90 + D | 1.24E-02 | 0. | 7.62E-04 | 0. | 0. | 1.20E-03 | 9.02E-05 |
| SR91 + D | 7.74E-09 | 0. | 3.13E-10 | 0. | 0. | 4.56E-06 | 2.39E-05 |
| SR92 + D | 8.43E-10 | 0. | 3.64E-11 | 0. | 0. | 2.06E-06 | 5.38E-06 |

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*Includes a 50% increase to account for percutaneous transpiration.

**PALISADES NUCLEAR PLANT
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Revision 16

TABLE 1.7 (continued)

| ADULT INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|--|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| Y90 | 2.61E-07 | 0. | 7.01E-09 | 0. | 0. | 2.12E-05 | 6.32E-05 |
| Y91M+D | 3.26E-11 | 0. | 1.27E-12 | 0. | 0. | 2.40E-07 | 1.66E-10 |
| Y91 | 5.78E-05 | 0. | 1.55E-06 | 0. | 0. | 2.13E-04 | 4.81E-05 |
| Y92 | 1.29E-09 | 0. | 3.77E-11 | 0. | 0. | 1.96E-06 | 9.19E-06 |
| Y93 | 1.18E-08 | 0. | 3.26E-10 | 0. | 0. | 6.06E-06 | 5.27E-05 |
| ZR93+D | 5.22E-05 | 2.92E-06 | 1.37E-06 | 0. | 1.11E-05 | 2.13E-05 | 1.51E-06 |
| ZR95+D | 1.34E-05 | 4.30E-06 | 2.91E-06 | 0. | 6.77E-06 | 2.21E-04 | 1.88E-05 |
| ZR97+D | 1.21E-08 | 2.45E-09 | 1.13E-09 | 0. | 3.71E-09 | 9.84E-06 | 6.54E-05 |
| NB93M | 3.10E-05 | 1.01E-05 | 2.49E-06 | 0. | 1.16E-05 | 3.11E-05 | 2.38E-06 |
| NB95 | 1.76E-06 | 9.77E-07 | 5.26E-07 | 0. | 9.67E-07 | 6.31E-05 | 1.30E-05 |
| NB97 | 2.78E-11 | 7.03E-12 | 2.56E-12 | 0. | 8.18E-12 | 3.00E-07 | 3.02E-08 |
| MO93 | 0. | 1.17E-06 | 3.17E-08 | 0. | 3.55E-07 | 5.11E-05 | 3.79E-06 |
| MO99+D | 0. | 1.51E-08 | 2.87E-09 | 0. | 3.64E-08 | 1.14E-05 | 3.10E-05 |
| TC99M | 1.29E-13 | 3.64E-13 | 4.63E-12 | 0. | 5.52E-12 | 9.55E-08 | 5.20E-07 |
| TC99 | 3.13E-08 | 4.64E-08 | 1.25E-08 | 0. | 5.85E-07 | 1.01E-04 | 7.54E-06 |
| TC101 | 5.22E-15 | 7.52E-15 | 7.38E-14 | 0. | 1.35E-13 | 4.99E-08 | 1.36E-21 |
| RU103+D | 1.91E-07 | 0. | 8.23E-08 | 0. | 7.29E-07 | 6.31E-05 | 1.38E-05 |
| RU105+D | 9.88E-11 | 0. | 3.89E-11 | 0. | 1.27E-10 | 1.37E-06 | 6.02E-06 |
| RU106+D | 8.64E-06 | 0. | 1.09E-06 | 0. | 1.67E-05 | 1.17E-03 | 1.14E-04 |
| RH105 | 9.24E-10 | 6.73E-10 | 4.43E-10 | 0. | 2.86E-09 | 2.41E-06 | 1.09E-05 |
| PD107 | 0. | 8.27E-08 | 5.87E-09 | 0. | 6.57E-07 | 9.47E-06 | 7.06E-07 |
| PD109 | 0. | 4.63E-10 | 1.16E-10 | 0. | 2.35E-09 | 1.85E-06 | 1.52E-05 |
| AG110M+D | 1.35E-06 | 1.25E-06 | 7.43E-07 | 0. | 2.46E-06 | 5.79E-04 | 3.78E-05 |
| AG111 | 4.25E-08 | 1.78E-08 | 8.87E-09 | 0. | 5.74E-08 | 2.33E-05 | 2.79E-05 |
| CD113M | 0. | 1.54E-04 | 4.97E-06 | 0. | 1.71E-04 | 2.08E-04 | 1.59E-05 |
| CD115M | 0. | 2.46E-05 | 7.95E-07 | 0. | 1.98E-05 | 1.76E-04 | 4.80E-05 |
| SN123 | 3.02E-05 | 6.67E-07 | 9.82E-07 | 5.67E-07 | 0. | 2.88E-04 | 3.92E-05 |
| SN125+D | 1.16E-06 | 3.12E-08 | 7.03E-08 | 2.59E-08 | 0. | 7.37E-05 | 6.81E-05 |
| SN126+D | 1.58E-04 | 4.18E-06 | 6.00E-06 | 1.23E-06 | 0. | 1.17E-03 | 1.59E-05 |
| SB124 | 3.90E-06 | 7.36E-08 | 1.55E-06 | 9.44E-09 | 0. | 3.10E-04 | 5.08E-05 |
| SB125+D | 6.67E-06 | 7.44E-08 | 1.58E-06 | 6.75E-09 | 0. | 2.18E-04 | 1.26E-05 |
| SB126 | 4.50E-07 | 9.13E-09 | 1.62E-07 | 2.75E-09 | 0. | 9.57E-05 | 6.01E-05 |
| SB127 | 3.30E-08 | 7.22E-10 | 1.27E-08 | 3.97E-10 | 0. | 2.05E-05 | 3.77E-05 |
| TE125M | 4.27E-07 | 1.98E-07 | 5.84E-08 | 1.31E-07 | 1.55E-06 | 3.92E-05 | 8.83E-06 |
| TE127M+D | 1.58E-06 | 7.21E-07 | 1.96E-07 | 4.11E-07 | 5.72E-06 | 1.20E-04 | 1.87E-05 |
| TE127 | 1.75E-10 | 8.03E-11 | 3.87E-11 | 1.32E-10 | 6.37E-10 | 8.14E-07 | 7.17E-06 |
| TE129M+D | 1.22E-06 | 5.84E-07 | 1.98E-07 | 4.30E-07 | 4.57E-06 | 1.45E-04 | 4.79E-05 |
| TE129 | 6.22E-12 | 2.99E-12 | 1.55E-12 | 4.87E-12 | 2.34E-11 | 2.42E-07 | 1.96E-08 |
| TE131M+D | 8.74E-09 | 5.45E-09 | 3.63E-09 | 6.88E-09 | 3.86E-08 | 1.82E-05 | 6.95E-05 |
| TE131+D | 1.39E-12 | 7.44E-13 | 4.49E-13 | 1.17E-12 | 5.46E-12 | 1.74E-07 | 2.30E-09 |
| TE132+D | 3.25E-08 | 2.69E-08 | 2.02E-08 | 2.37E-08 | 1.82E-07 | 3.60E-05 | 6.37E-05 |
| TE133M+D | 7.24E-12 | 5.40E-12 | 4.17E-12 | 6.27E-12 | 3.74E-11 | 5.51E-07 | 5.49E-08 |
| TE134+D | 3.84E-12 | 3.22E-12 | 1.57E-12 | 3.44E-12 | 2.18E-11 | 4.343-07 | 2.97E-11 |
| I129 | 2.48E-06 | 2.11E-06 | 6.91E-06 | 5.54E-03 | 4.53E-06 | 0. | 2.22E-07 |
| I130 | 5.72E-07 | 1.68E-06 | 6.60E-07 | 1.42E-04 | 2.61E-06 | 0. | 9.61E-07 |
| I131+D | 3.15E-06 | 4.47E-06 | 2.56E-06 | 1.49E-03 | 7.66E-06 | 0. | 7.85E-07 |

**PALISADES NUCLEAR PLANT
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Revision 16

TABLE 1.7 (continued)

| ADULT INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|--|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| I132 | 1.45E-07 | 4.07E-07 | 1.45E-07 | 1.43E-05 | 6.48E-07 | 0. | 5.08E-08 |
| I133+D | 1.08E-06 | 1.85E-06 | 5.65E-07 | 2.69E-04 | 3.23E-06 | 0. | 1.11E-06 |
| I134 | 8.05E-08 | 2.16E-07 | 7.69E-08 | 3.73E-06 | 3.44E-07 | 0. | 1.26E-10 |
| I135+D | 3.35E-07 | 8.73E-07 | 3.21E-07 | 5.60E-05 | 1.39E-06 | 0. | 6.56E-07 |
| XE131M | 0. | 0. | 0. | 0. | 0. | 1.40E-09 | 0. |
| XE133M | 0. | 0. | 0. | 0. | 0. | 1.89E-09 | 0. |
| XE133 | 0. | 0. | 0. | 0. | 0. | 1.57E-09 | 0. |
| XE135M | 0. | 0. | 0. | 0. | 0. | 2.22E-09 | 0. |
| XE135 | 0. | 0. | 0. | 0. | 0. | 4.05E-09 | 0. |
| XE137 | 0. | 0. | 0. | 0. | 0. | 1.74E-08 | 0. |
| XE138+D | 0. | 0. | 0. | 0. | 0. | 2.44E-08 | 0. |
| CS134M+D | 1.59E-08 | 3.20E-08 | 1.72E-08 | 0. | 1.83E-08 | 2.93E-09 | 7.92E-09 |
| CS134 | 4.66E-05 | 1.06E-04 | 9.10E-05 | 0. | 3.59E-05 | 1.22E-05 | 1.30E-06 |
| CS135 | 1.46E-05 | 1.29E-05 | 5.99E-06 | 0. | 5.11E-06 | 1.57E-06 | 2.11E-07 |
| CS136 | 4.88E-06 | 1.83E-05 | 1.38E-05 | 0. | 1.07E-05 | 1.50E-06 | 1.46E-06 |
| CS137+D | 5.98E-05 | 7.76E-05 | 5.35E-05 | 0. | 2.78E-05 | 9.40E-06 | 1.05E-06 |
| CS138 | 4.14E-08 | 7.76E-08 | 4.05E-08 | 0. | 6.00E-08 | 6.07E-09 | 2.33E-13 |
| CS139+D | 2.56E-08 | 3.63E-08 | 1.39E-08 | 0. | 3.05E-08 | 2.84E-09 | 5.49E-31 |
| BA139 | 1.17E-10 | 8.32E-14 | 3.42E-12 | 0. | 7.78E-14 | 4.70E-07 | 1.12E-07 |
| BA140+D | 4.88E-06 | 6.13E-09 | 3.21E-07 | 0. | 2.09E-09 | 1.59E-04 | 2.73E-05 |
| BA141+D | 1.25E-11 | 9.41E-15 | 4.20E-13 | 0. | 8.75E-15 | 2.42E-07 | 1.45E-17 |
| BA142+D | 3.29E-12 | 3.38E-15 | 2.07E-13 | 0. | 2.86E-15 | 1.49E-07 | 1.96E-26 |
| LA140 | 4.30E-08 | 2.17E-08 | 5.73E-09 | 0. | 0. | 1.70E-05 | 5.73E-05 |
| LA141 | 5.34E-10 | 1.66E-10 | 2.71E-11 | 0. | 0. | 1.35E-06 | 7.31E-06 |
| LA142 | 8.54E-11 | 3.88E-11 | 9.65E-12 | 0. | 0. | 7.91E-07 | 2.64E-07 |
| CE141 | 2.49E-06 | 1.69E-06 | 1.91E-07 | 0. | 7.83E-07 | 4.52E-05 | 1.50E-05 |
| CE143+D | 2.33E-08 | 1.72E-08 | 1.91E-09 | 0. | 7.60E-09 | 9.97E-06 | 2.83E-05 |
| CE144+D | 4.29E-04 | 1.79E-04 | 2.30E-05 | 0. | 1.06E-04 | 9.72E-04 | 1.02E-04 |
| PR143 | 1.17E-06 | 4.69E-07 | 5.80E-08 | 0. | 2.70E-07 | 3.51E-05 | 2.50E-05 |
| PR144 | 3.76E-12 | 1.56E-12 | 1.91E-13 | 0. | 8.81E-13 | 1.27E-07 | 2.69E-18 |
| ND147+D | 6.59E-07 | 7.62E-07 | 4.56E-08 | 0. | 4.45E-07 | 2.76E-05 | 2.16E-05 |
| PM147 | 8.37E-05 | 7.87E-06 | 3.19E-06 | 0. | 1.49E-05 | 6.60E-05 | 5.54E-06 |
| PM148M+D | 9.82E-06 | 2.54E-06 | 1.94E-06 | 0. | 3.85E-06 | 2.14E-04 | 4.18E-05 |
| PM148 | 3.84E-07 | 6.37E-08 | 3.20E-08 | 0. | 1.20E-07 | 3.91E-05 | 5.80E-05 |
| PM149 | 3.44E-08 | 4.87E-09 | 1.99E-09 | 0. | 9.19E-09 | 7.21E-06 | 2.50E-05 |
| PM151 | 8.50E-09 | 1.42E-09 | 7.21E-10 | 0. | 2.55E-09 | 3.94E-06 | 2.00E-05 |
| SM151 | 8.59E-05 | 1.48E-05 | 3.55E-06 | 0. | 1.66E-05 | 4.45E-05 | 3.25E-06 |
| SM153 | 1.70E-08 | 1.42E-08 | 1.04E-09 | 0. | 4.59E-09 | 4.14E-06 | 1.58E-05 |
| EU152 | 2.38E-04 | 5.41E-05 | 4.76E-05 | 0. | 3.35E-04 | 3.43E-04 | 1.59E-05 |
| EU154 | 7.40E-04 | 9.10E-05 | 6.48E-05 | 0. | 4.36E-04 | 5.84E-04 | 3.40E-05 |
| EU155 | 1.01E-04 | 1.43E-05 | 9.21E-06 | 0. | 6.59E-05 | 9.46E-05 | 5.95E-06 |
| EU156 | 1.93E-06 | 1.48E-06 | 2.40E-07 | 0. | 9.95E-07 | 8.56E-05 | 4.50E-05 |
| TB160 | 2.21E-05 | 0. | 2.75E-06 | 0. | 9.10E-06 | 1.92E-04 | 2.68E-05 |
| HO166M | 3.37E-04 | 1.05E-04 | 8.00E-05 | 0. | 1.57E-04 | 3.94E-04 | 1.59E-05 |
| W181 | 6.23E-09 | 2.03E-09 | 2.17E-10 | 0. | 0. | 1.71E-06 | 2.53E-07 |
| W185 | 1.95E-07 | 6.47E-08 | 6.81E-09 | 0. | 0. | 5.57E-05 | 1.07E-05 |
| W187 | 1.06E-09 | 8.85E-10 | 3.10E-10 | 0. | 0. | 3.63E-06 | 1.94E-05 |

**PALISADES NUCLEAR PLANT
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Revision 16

TABLE 1.7 (continued)

| ADULT INHALATION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INHALED IN FIRST YR) | | | | | | | |
|--|-------------|--------------|-------------------|----------------|---------------|-------------|---------------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| PB210 +D | 2.64E-02 | 6.73E-03 | 8.37E-04 | 0. | 2.12E-02 | 2.62E-02 | 3.65E-05 |
| BI210 +D | 0. | 1.59E-06 | 1.32E-07 | 0. | 1.92E-05 | 1.11E-03 | 2.95E-05 |
| PO210 | 3.97E-04 | 8.60E-04 | 9.58E-05 | 0. | 2.95E-03 | 3.14E-02 | 4.19E-05 |
| RN222 +D | 0. | 0. | 0. | 0. | 0. | 2.05E-06 | 0. |
| RA223 +D | 1.80E-04 | 2.77E-07 | 3.60E-05 | 0. | 7.85E-06 | 2.55E-02 | 2.84E-04 |
| RA224 +D | 1.98E-05 | 4.78E-08 | 3.96E-06 | 0. | 1.35E-06 | 8.77E-03 | 3.01E-04 |
| RA225 +D | 3.00E-04 | 3.56E-07 | 5.99E-05 | 0. | 1.01E-05 | 2.92E-02 | 2.71E-04 |
| RA226 +D | 1.25E-01 | 2.39E-06 | 9.14E-02 | 0. | 6.77E-05 | 1.17E-01 | 2.94E-04 |
| RA228 +D | 4.41E-02 | 1.23E-06 | 4.78E-02 | 0. | 3.48E-05 | 1.61E-01 | 5.00E-05 |
| AC225 | 4.23E-04 | 5.82E-04 | 2.84E-05 | 0. | 6.63E-05 | 2.21E-02 | 2.52E-04 |
| AC227 +D | 2.30E+00 | 3.05E-01 | 1.36E-01 | 0. | 9.82E-02 | 2.41E-01 | 5.08E-05 |
| TH227 +D | 2.17E-04 | 3.92E-06 | 6.25E-06 | 0. | 2.22E-05 | 3.77E-02 | 3.34E-04 |
| TH226 +D | 2.00E-01 | 3.39E-03 | 6.77E-03 | 0. | 1.89E-02 | 1.01E+00 | 3.49E-04 |
| TH229 | 8.88E+00 | 1.33E-01 | 4.36E-01 | 0. | 6.52E-01 | 3.49E+00 | 3.17E-04 |
| TH230 | 2.29E+00 | 1.31E-01 | 6.36E-02 | 0. | 6.40E-01 | 6.21E-01 | 3.73E-05 |
| TH232 +D | 2.56E+00 | 1.12E-01 | 9.04E-02 | 0. | 5.47E-01 | 5.96E-01 | 3.17E-05 |
| TH234 | 1.63E-06 | 9.56E-08 | 4.70E-08 | 0. | 5.41E-07 | 1.89E-04 | 7.03E-05 |
| PA231 +D | 5.08E+00 | 1.91E-01 | 1.98E-01 | 0. | 1.07E+00 | 5.75E-02 | 4.44E-05 |
| PA233 | 1.21E-06 | 2.42E-07 | 2.09E-07 | 0. | 9.15E-07 | 3.52E-05 | 1.02E-05 |
| U232 +D | 5.14E-02 | 0. | 3.66E-03 | 0. | 5.56E-03 | 2.22E-01 | 4.21E-05 |
| U233 +D | 1.09E-02 | 0. | 6.60E-04 | 0. | 2.54E-03 | 5.32E-02 | 3.89E-05 |
| U234 | 1.04E-02 | 0. | 6.46E-04 | 0. | 2.49E-03 | 5.22E-02 | 3.81E-05 |
| U235 +D | 1.00E-02 | 0. | 6.07E-04 | 0. | 2.34E-03 | 4.90E-02 | 4.84E-05 |
| U236 | 1.00E-02 | 0. | 6.20E-04 | 0. | 2.39E-03 | 5.00E-02 | 3.57E-05 |
| U237 | 3.67E-08 | 0. | 9.77E-09 | 0. | 1.51E-07 | 1.02E-05 | 1.20E-05 |
| U238 +D | 9.58E-03 | 0. | 5.67E-04 | 0. | 2.18E-03 | 4.58E-02 | 3.41E-05 |
| NP237 +D | 1.69E+00 | 1.47E-01 | 6.87E-02 | 0. | 5.10E-01 | 5.22E-02 | 4.92E-05 |
| NP238 | 2.96E-07 | 8.00E-09 | 4.61E-09 | 0. | 2.72E-08 | 1.02E-05 | 2.13E-05 |
| NP239 | 2.87E-08 | 2.82E-09 | 1.55E-09 | 0. | 8.75E-09 | 4.70E-06 | 1.49E-05 |
| PU238 | 2.74E+00 | 3.87E-01 | 6.90E-02 | 0. | 2.96E-01 | 1.82E-01 | 4.52E-05 |
| PU239 | 3.19E+00 | 4.31E-01 | 7.75E-02 | 0. | 3.30E-01 | 1.72E-01 | 4.13E-05 |
| PU240 | 3.18E+00 | 4.30E-01 | 7.73E-02 | 0. | 3.29E-01 | 1.72E-01 | 4.21E-05 |
| PU241 +D | 6.41E-02 | 3.28E-03 | 1.29E-03 | 0. | 5.93E-03 | 1.52E-04 | 8.65E-07 |
| PU242 | 2.95E+00 | 4.15E-01 | 7.46E-02 | 0. | 3.17E-01 | 1.65E-01 | 4.05E-05 |
| PU244 | 3.45E+00 | 4.76E-01 | 8.54E-02 | 0. | 3.64E-01 | 1.89E-01 | 6.03E-05 |
| AM241 | 1.01E+00 | 3.59E-01 | 6.71E-02 | 0. | 5.04E-01 | 6.06E-02 | 4.60E-05 |
| AM242M | 1.02E+00 | 3.46E-01 | 6.73E-02 | 0. | 5.01E-01 | 2.44E-02 | 5.79E-05 |
| AM243 | 1.01E+00 | 3.47E-01 | 6.57E-02 | 0. | 4.95E-01 | 5.75E-02 | 5.40E-05 |
| CM242 | 1.48E-02 | 1.51E-02 | 9.84E-04 | 0. | 4.48E-03 | 3.92E-02 | 4.91E-05 |
| CM243 | 7.86E-01 | 2.97E-01 | 4.61E-02 | 0. | 2.15E-01 | 6.31E-02 | 4.84E-05 |
| CM244 | 5.90E-01 | 2.54E-01 | 3.51E-02 | 0. | 1.64E-01 | 6.06E-02 | 4.68E-05 |
| CM245 | 1.26E+00 | 3.59E-01 | 7.14E-02 | 0. | 3.33E-01 | 5.85E-02 | 4.36E-05 |
| CM246 | 1.25E+00 | 3.59E-01 | 7.13E-02 | 0. | 3.33E-01 | 5.96E-02 | 4.29E-05 |
| CM247 +D | 1.22E+00 | 3.53E-01 | 7.03E-02 | 0. | 3.28E-01 | 5.85E-02 | 5.63E-05 |
| CM248 | 1.01E+01 | 2.91E+00 | 5.79E-01 | 0. | 2.70E+00 | 4.82E-01 | 9.09E-04 |
| CF252 | 9.78E-01 | 0. | 2.33E-02 | 0. | 0. | 1.99E-01 | 1.78E-04 |

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TABLE 1.8
EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATION GROUND (DFG)
(MREM/HR PER PCI/M²)

| <u>ELEMENT</u> | <u>TOTAL BODY</u> | <u>SKIN</u> |
|----------------|-------------------|-------------|
| H-3 | 0.0 | 0.0 |
| C-14 | 0.0 | 0.0 |
| Na-24 | 2.50E-08 | 2.90E-08 |
| P-32 | 0.0 | 0.0 |
| Cr-51 | 2.20E-10 | 2.60E-10 |
| Mn-54 | 5.80E-09 | 6.80E-09 |
| Mn-56 | 1.10E-08 | 1.30E-08 |
| Fe-55 | 0.0 | 0.0 |
| Fe-59 | 8.00E-09 | 9.40E-09 |
| Co-58 | 7.00E-09 | 8.20E-09 |
| Co-60 | 1.70E-08 | 2.00E-08 |
| Ni-63 | 0.0 | 0.0 |
| Ni-65 | 3.70E-09 | 4.30E-09 |
| Cu-64 | 1.50E-09 | 1.70E-09 |
| Zn-65 | 4.00E-09 | 4.60E-09 |
| Zn-69 | 0.0 | 0.0 |
| Br-83 | 6.40E-11 | 9.30E-11 |
| Br-84 | 1.20E-08 | 1.40E-08 |
| Br-85 | 0.0 | 0.0 |
| Rb-86 | 6.30E-10 | 7.20E-10 |
| Rb-88 | 3.50E-09 | 4.00E-09 |
| Rb-89 | 1.50E-08 | 1.80E-08 |
| Sr-89 | 5.60E-13 | 6.50E-13 |
| Sr-91 | 7.10E-09 | 8.30E-09 |
| Sr-92 | 9.00E-09 | 1.00E-08 |
| Y-90 | 2.20E-12 | 2.60E-12 |
| Y-91m | 3.80E-09 | 4.40E-09 |
| Y-91 | 2.40E-11 | 2.70E-11 |
| Y-92 | 1.60E-09 | 1.90E-09 |
| Y-93 | 5.70E-10 | 7.80E-10 |
| Zr-95 | 5.00E-09 | 5.80E-09 |
| Zr-97 | 5.50E-09 | 6.40E-09 |
| Nb-95 | 5.10E-09 | 6.00E-09 |
| Mo-99 | 1.90E-09 | 2.20E-09 |
| Tc-99m | 9.60E-10 | 1.10E-09 |
| Tc-101 | 2.70E-09 | 3.00E-09 |

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TABLE 1.8 (continued)
EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATION GROUND (DFG)
(MREM/HR PER PCI/M²)

| <u>ELEMENT</u> | <u>TOTAL BODY</u> | <u>SKIN</u> |
|----------------|-------------------|-------------|
| Ru-103 | 3.60E-09 | 4.20E-09 |
| Ru-105 | 4.50E-09 | 5.10E-09 |
| Ru-106 | 1.50E-09 | 1.80E-09 |
| Ag-110m | 1.80E-08 | 2.10E-08 |
| Te-125m | 3.50E-11 | 4.80E-11 |
| Te-127m | 1.10E-12 | 1.30E-12 |
| Te-127 | 1.00E-11 | 1.10E-11 |
| Te-129m | 7.70E-10 | 9.00E-10 |
| Te-129 | 7.10E-10 | 8.40E-10 |
| Te-131m | 8.40E-09 | 9.90E-09 |
| Te-131 | 2.20E-09 | 2.60E-06 |
| Te-132 | 1.70E-09 | 2.00E-09 |
| I-130 | 1.40E-08 | 1.70E-08 |
| I-131 | 2.80E-09 | 3.40E-09 |
| I-132 | 1.70E-08 | 2.00E-08 |
| I-133 | 3.70E-09 | 4.50E-09 |
| I-134 | 1.60E-08 | 1.90E-08 |
| I-135 | 1.20E-08 | 1.40E-08 |
| Cs-134 | 1.20E-08 | 1.40E-08 |
| Cs-136 | 1.50E-08 | 1.70E-08 |
| Cs-137 | 4.20E-09 | 4.90E-09 |
| Cs-138 | 2.10E-08 | 2.40E-08 |
| Ba-139 | 2.40E-09 | 2.70E-09 |
| Ba-140 | 2.10E-09 | 2.40E-09 |
| Ba-141 | 4.30E-09 | 4.90E-09 |
| Ba-142 | 7.90E-09 | 9.00E-09 |
| La-140 | 1.50E-08 | 1.70E-08 |
| La-142 | 1.50E-08 | 1.80E-08 |
| Ce-141 | 5.50E-10 | 6.20E-10 |
| Ce-143 | 2.20E-09 | 2.50E-09 |
| Ce-144 | 3.20E-10 | 3.70E-10 |
| Pr-143 | 0.0 | 0.0 |
| Pr-144 | 2.00E-10 | 2.30E-10 |
| Nd-147 | 1.00E-09 | 1.20E-09 |
| W-187 | 3.10E-09 | 3.60E-09 |
| Np-239 | 9.50E-10 | 1.10E-09 |

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TABLE 1.9
2001 PALISADES GASEOUS DESIGN
OBJECTIVE ANNUAL QUANTITIES

| <u>Nuclide</u> | <u>Organ</u> | <u>Dose Factor</u> <u>Mrem/Ci</u> | <u>Design Objective</u> <u>Annual Quantity</u> <u>Ci</u> |
|----------------|--------------|--------------------------------------|--|
| Ag-110m | GI-Tract-T | 2.13E + 00 | 7.04E + 00 |
| Ar-41 | Total Body | 3.64E - 04 | 1.37E + 04 |
| Ba-139 | GI Tract-C | 2.97E - 03 | 5.05E + 03 |
| Ba-140 | Lung-T | 1.26E - 01 | 1.19E + 02 |
| Br-82 | total Body-C | 4.97E - 03 | 1.01E + 03 |
| C-14 | Bone-C | 1.48E - 01 | 1.01E + 02 |
| Ce-141 | GI Tract-T | 1.34E - 01 | 1.12E + 02 |
| Ce-144 | GI Tract-T | 3.37E + 00 | 4.45E + 00 |
| Co-57 | GI Tract-T | 8.53E - 02 | 1.76E + 02 |
| Co-58 | GI Tract-T | 2.59E - 01 | 5.79E + 01 |
| Co-60 | GI Tract-T | 6.86E + 00 | 2.19E + 00 |
| Cr-51 | GI Tract-A | 3.75E - 03 | 1.33E + 03 |
| Cs-134 | Liver-C | 8.77E + 00 | 1.71E + 00 |
| Cs-136 | Liver-I | 5.32E-01 | 2.82E + 01 |
| Cs-137 | Bone-C | 9.58E + 00 | 1.57E + 00 |
| Cs-138 | Total body-C | 1.00E - 01 | 5.00E + 01 |
| Fe-55 | Bone-C | 2.06E - 01 | 7.28E + 01 |
| Fe-59 | GI Tract-T | 3.20E - 01 | 4.69E + 01 |
| H-3 | Total Body-C | 2.19E - 04 | 2.28E + 04 |
| I-129 | Thyroid-A | 3.66E + 02 | 4.10E - 02 |
| I-131 | Thyroid-I | 1.97E + 01 | 7.61E - 01 |
| I-132 | Thyroid-C | 1.12E - 02 | 1.34E + 03 |
| I-133 | Thyroid-C | 2.46E - 01 | 6.11E + 01 |
| I-134 | Thyroid-C | 2.45E - 03 | 6.12E + 03 |
| I-135 | Thyroid-C | 4.93E - 02 | 3.04E + 02 |

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TABLE 1.9
2001 PALISADES GASEOUS DESIGN
OBJECTIVE ANNUAL QUANTITIES

| <u>Nuclide</u> | <u>Organ</u> | <u>Dose Factor</u> <u>Mrem/Ci</u> | <u>Design Objective</u> <u>Annual Quantity</u> <u>Ci</u> |
|----------------|--------------|--------------------------------------|--|
| Kr-83m | Skin | 8.82E - 07 | 1.70E + 07 |
| Kr-85 | Skin | 9.14E - 05 | 1.64E + 05 |
| Kr-85m | Total Body | 5.22E - 05 | 9.58E + 04 |
| Kr-87 | Skin | 8.03E - 04 | 1.87E + 04 |
| Kr-88 | Total Body | 6.35E - 04 | 7.87E + 03 |
| Kr-89 | Total Body | 5.08E - 04 | 9.84E + 03 |
| La-140 | GI Tract-T | 3.04E - 02 | 4.93E + 02 |
| Mn-54 | GI Tract-T | 6.29E - 01 | 2.38E + 01 |
| Mn-56 | GI Tract-C | 6.91E - 03 | 2.17E + 03 |
| Mo-99 | GI Tract-T | 1.66E - 02 | 9.04E + 02 |
| N-13 | Total Body-C | 3.44E - 06 | 1.45E + 06 |
| Na-24 | Total Body-C | 4.02E - 03 | 1.24E + 03 |
| Nb-95 | GI Tract-A | 1.92E - 01 | 7.81E + 01 |
| Ni-63 | Bone-C | 1.21E + 01 | 1.24E + 00 |
| Ni-65 | GI Tract-C | 4.70E - 03 | 3.19E + 03 |
| Np-239 | GI Tract-T | 8.13E - 03 | 1.84E + 03 |
| Rb-88 | Total Body-C | 2.38E - 05 | 2.10E + 05 |
| Ru-103 | GI Tract-A | 2.93E - 01 | 5.12E + 01 |
| Ru-105 | GI Tract-C | 5.82E - 03 | 2.58E + 03 |
| Sb-124 | GI Tract-T | 9.47E - 01 | 1.58E + 01 |
| Sb-125 | GI Tract-T | 4.35E - 01 | 3.45E + 01 |
| Sr-89 | Bone-C | 8.98E + 00 | 1.67E + 00 |
| Sr-90 | Bone-C | 3.73E + 02 | 4.02E - 02 |
| Sr-91 | Bone-I | 2.46E + 00 | 6.10E + 00 |
| Sr-92 | GI Tract-C | 1.37E - 02 | 1.09E + 03 |

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TABLE 1.9
2001 PALISADES GASEOUS DESIGN
OBJECTIVE ANNUAL QUANTITIES

| <u>Nuclide</u> | <u>Organ</u> | <u>Dose Factor Mrem/Ci</u> | <u>Design Objective Annual Quantity Ci</u> |
|----------------|--------------|--------------------------------|--|
| Tc-99 | GI Tract-T | 5.85E - 01 | 2.62E + 01 |
| Tc-99m | GI Tract-T | 3.64E - 04 | 4.12E + 04 |
| Tc-101 | GI Tract-T | 8.33E - 05 | 1.80E + 05 |
| Te-127 | GI Tract-T | 4.87E - 03 | 3.08E + 03 |
| Xe-131m | Skin | 4.03E - 05 | 3.72E + 05 |
| Xe-133 | Total Body | 1.39E - 05 | 3.60E + 05 |
| Xe-133m | Skin | 8.39E - 05 | 1.79E + 05 |
| Xe-135 | Total Body | 8.32E - 05 | 6.01E + 04 |
| Xe-135m | Total Body | 9.55E - 05 | 5.24E + 04 |
| Xe-137 | Skin | 5.85E - 04 | 2.56E + 04 |
| Xe-138 | Total body | 2.70E - 04 | 1.85E + 04 |
| Zn-65 | Liver-C | 9.38E - 01 | 1.60E + 01 |
| Zr-95 | GI Tract-T | 3.90E - 01 | 3.85E + 01 |
| Pu-238 | Bone-T | 1.42E + 03 | 1.06E - 02 |
| Pu-239 | Bone-T | 1.64E + 03 | 9.15E - 03 |
| Pu-241 | Bone-T | 3.45E + 01 | 4.35E - 01 |
| Am-241 | Bone-T | 5.25E + 02 | 2.86E - 02 |
| Cm-242 | Lung-T | 3.35E + 01 | 4.48E - 01 |
| Cm-244 | Bone-T | 3.20E + 02 | 4.69E - 02 |

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II. **LIQUID EFFLUENTS**

A. **CONCENTRATION**

1. **Requirements**

Appendix A, Section III.G requires that the concentration of radioactive material released at any time from the site to unrestricted areas shall be limited to ten times the Effluent Concentration (EC) specified in 10 CFR 20, Appendix B, Table 2, Column 2 for nuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2E-04 $\mu\text{Ci/ml}$ total activity. To ensure compliance, the following approach will be used for each release.

2. **Prerelease Analysis**

Most tanks will be recirculated through two volume changes prior to sampling for release to the environment to ensure that a representative sample is obtained. The appropriate recirculation time for those tanks too large to provide two volume changes will be the time that the suspended particulate concentration reaches steady state. Either a one-time test, or prior sampling data, may be used to determine appropriate recirculation time.

Prior to release, a grab sample will be analyzed for each release, and the concentration of each radionuclide determined.

$$C = \sum_{i=1}^n C_i \quad (2.1)$$

where:

C = Total concentration in the liquid effluent at the release point, $\mu\text{Ci/ml}$.

C_i = Concentration of a single radionuclide i , $\mu\text{Ci/ml}$.

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3. **Effluent Concentration (EC) - Sum of the Ratios**

The EC-Fraction (R_j) for each release point will be calculated by the relationship defined by Note 4 of Appendix B, 10 CFR 20:

$$R_j = \sum_i \frac{C_i}{EC_i} \leq 10.0 \quad (2.2)$$

where:

C_i = Effluent concentration of radionuclide i , $\mu\text{Ci/ml}$.

EC_i = The EC of radionuclide i , 10 CFR 20, Appendix B, Table 2, Column 2 - $\mu\text{Ci/ml}$.

R_j = The Total EC-Fraction for the release point.

The sum of the ratios at the discharge to the lake must be ≤ 10 due to the releases from any or all concurrent releases. The following relationship will assure this criterion is met:

$$f_1(R_1-1) + f_2(R_2-1) + f_3(R_3-1) \leq F \quad (2.3)$$

where:

f_1, f_2, f_3 = The effluent flow rate (gallons/minute) for the respective releases, determined by Plant personnel.

R_1, R_2, R_3 = The Total EC-Fractions for the respective releases as determined by Equation 2.2.

F = Minimum required dilution flow rate. Normally, a conservatively high dilution flow rate is used, that is, flow rate used = $(b_i)(F)$ where b_i is a conservative factor greater than 1.0.

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B. INSTRUMENT SETPOINTS

1. Setpoint Determination

Appendix A, Section III.F requires alarm setpoints for each liquid effluent monitor will be established using Plant instructions to ensure the requirements of Appendix A, Section III.G are not exceeded. Concentration, flow rate, dilution, principal gamma emitter, geometry, and detector efficiency are combined to give an equivalent setpoint in counts per minute (cpm). The identification number for each liquid effluent radiation detector is contained in Figure 2-2.

The respective alarm/trip setpoints at each release point will be set such that the sum of the ratios at each point, as calculated by Equation 2.2, will not be exceeded. The value of R is directly related to the total concentration calculated by Equation 2.1. An increase in the concentration would indicate an increase in the value of R. A large increase would cause the limits specified in Section 2.1.1 to be exceeded. The minimum alarm/trip setpoint value is equal to the release concentration, but for ease of operation it may be desired that the setpoint (S) be set above the effluent concentration (C) by the same factor (b) utilized in setting dilution flow. That is:

$$S = b \times C \tag{2.4}$$

Liquid effluent flow paths and release points are indicated in Figure 2.1.

2. Composite Samplers

Effluent pathways, Turbine Sump and Service Water, are equipped with continuous compositors to meet the requirements of Appendix A, Table D-1. These compositors are adjustable and normally set in a time mode and collect three to six samples hourly, 24 hours a day with a total collection of approximately one gallon per day. A representative sample is collected daily from the compositor and saved for the weekly, monthly analysis requirements of Appendix A, Table D-1. In the event that a compositor is not operational, effluent releases via this pathway may continue provided that grab samples are collected and analyzed for gross beta or gamma radioactivity at least once per 24 hours per Appendix A, Table C-1, Action 3.

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3. **Post-Release Analysis**

A post-release analysis will be done using actual release data to ensure that the limits specified in Section 1 were not exceeded.

A composite list on concentrations (C_i), by isotope, will be used with the actual liquid radwaste (f) and dilution (F) flow rates (or volumes) during the release. The data will be substituted into Equation 2.3 to demonstrate compliance with the limits in Section 1. This data and setpoints will be recorded in auditable records by Plant personnel.

C. **DOSE**

1. **RETS Requirement**

Appendix A, Section III.H.1 requires that the quantity of radionuclides released be limited such that the dose or dose commitment to an individual from radioactive materials in liquid effluents released to unrestricted areas from the reactor (see Figure 2-1) will not exceed:

- a. During any calendar quarter, 1.5 mrem to the total body and 5 mrem to any organ, and
- b. During any calendar year, 3 mrem to the total body and 10 mrem to any organ.

To ensure compliance, quantities of activity of each radionuclide released will be summed for each release and accumulated for each quarter as follows in Section 2.

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2. **Release Analysis**

Calculations shall be performed for each batch release, and weekly for continuous releases according to the formula:

$$A_i / C_i \leq 0.5 \tag{2.5}$$

where:

A_i = Cumulative quarterly activity of nuclide i identified in liquid release (C_i).

C_i = Design objective annual quantity of radionuclide i from Table 2.2.

The design basis quantities are derived in such a conservative manner that doses may be greatly overestimated by this technique. As a consequence of this conservatism, and in light of historically consistent operations with releases well below annual design basis quantities, the Appendix A, effluent requirements do not require monthly dose projections. Instead, if at any time, calculations by Equation (2.5) results in values greater than 0.5 for a given quarter or 1.0 for year-to-date, the NRC LADTAP code will be run to ensure that Appendix A, Section III.H.1 has been met.

Values for the design basis quantities (C_i), and the dose per Curie (Dc/Cc) $_i$ for each nuclide i shown in Table 2.2, were calculated as follows in Sections 2.1 and 2.2.

a. **Water Ingestion**

The dose to an individual from ingestion of radioactivity from any source as described by the following equation:

$$D_j = \sum_{i=1}^i (DCF)_{ij} \times I_i \tag{2.6}$$

where:

D_j = Dose for the j th organ from radionuclides releases, mrem.

j = The organ of interest.

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$(DCF)_{ij}$ = Ingestion dose commitment factor for the j th organ from the i^{th} radionuclide mrem/pCi, see Table 2.1.

I_i = Activity ingested of the i^{th} radionuclide, pCi.

I_i is described by:

$$I_i = \frac{(A_i)(V)(365)}{(1000)(d)} (1E06) \quad (2.7)$$

where:

365 = Days per year.

A_i = Annual activity released of i^{th} radionuclide, μCi .

V = Average rate of water consumption
(2000 ml/d - adult, 1400 ml/d - teen and child,
900 ml/d - infant, ICRP 23, p 358).

d = Dilution water flow for year, ml.

1000 = Dispersion factor from discharge to nearest drinking water supply.

1E06 = Conversion μCi to pCi.

The dose equation then becomes:

$$D_j = \frac{(3.65E05)(V)}{d} \sum_{i=1}^i (DCF)_{ij} \times A_i \text{ mrem} \quad (2.8)$$

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b. Fish Ingestion

The dose to an individual from the consumption of fish is described by Equation 2.10. In this case, the activity ingested of the i^{th} radionuclide (I_i) is described by:

$$I_i = \frac{A_i B_i F (1E09)}{15d} = \text{pCi} \quad (2.9)$$

where:

A_i = Annual released of i^{th} radionuclide, μCi .

B_i = Fish concentration factor of i^{th} radionuclide $\frac{\mu\text{Ci/gm}}{\mu\text{Ci/ml}}$
 (see Table 2.0).

F = Amount of fish eaten per year (21 kg adult, 16 kg teen, 6.9 kg child, none infant).

15 = Dispersion factor from discharge to fish exposure point.

d = Dilution water flow for year, ml.

1E09 = Conversion of μCi and Kgm to gross.

Substitution of Equation 2.9 into Equation 2.6 gives:

$$D_j = \frac{(6.7E07)F}{d} \sum_{i=1}^i A_i \times B_i \times \text{DCF}_i \text{ mrem} \quad (2.10)$$

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c. Annual Analysis

A complete analysis utilizing the NRC computer code LADTAP with the total source release will be done annually in conjunction with the annual environmental report. This analysis will provide estimates of dose to the total body and various organs in addition to the dose limiting organs considered in the method of Section 2. The following approach is utilized on LADTAP. The dose to the j^{th} organ from m radionuclides, D_j , is described by:

$$D_j = \sum_{i=1}^m D_{ij} \text{ mrem} \tag{2.11}$$

$$= \sum_{i=1}^m (\text{DCF})_{ij} \times I_i \text{ mrem}$$

where:

- D_j = Dose to the j^{th} organ from the i^{th} radionuclide, mrem.
- j = The organ of interest (bone, GI tract, thyroid, liver, kidney, lung, or total body).
- $(\text{DCF})_{ij}$ = Adult ingestion dose commitment factor for the j^{th} organ from the i^{th} radionuclide, mrem/pCi (see Table 2.1).
- I_i = Activity ingested of the i^{th} radionuclide, μCi .

I_i for water ingestion is described by:

$$I_i = \frac{A_i V_r}{v d} \mu\text{Ci} \tag{2.13}$$

and for fish ingestion I_i is described by:

$$I_i = \frac{A_i B_i F_r}{v d} \mu\text{Ci}$$

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where:

- A_j = Activity release of j^{th} radionuclide during the year, μCi .
- V = Average rate of water consumption (2000 ml/d).
- Γ = Number of days during the year (365 d).
- v = Dispersion factor from point of discharge to point of exposure.
- d = Dilution water volume (ml).
- B_i = Fish concentration factor of the i^{th} radionuclide,
Table 2.0, $\frac{\mu\text{Ci/gm}}{\mu\text{Ci/ml}}$
- F = Amount of fish eaten per day (57.5 gm/d).

D. OPERABILITY OF LIQUID RADWASTE EQUIPMENT

The Palisades liquid radwaste system is designed to reduce the radioactive materials in liquid wastes prior to their discharge (by recycle or shipment for disposal) so that radioactivity in liquid effluent releases to unrestricted areas (see Figure 2-1) will not exceed the limits of Appendix A, III.H.1. Maintaining the cumulative fraction if allowable release for each batch release and weekly for continuous releases assures compliance with this requirement. In addition, 13 years of operating experience (to the date this ODCM was first adopted) has shown that design basis quantities never have been exceeded.

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E. RELEASE RATE FOR OFFSITE EC (50 mRem/yr)

10 CFR 20.1302 requires radioactive effluent releases to unrestricted areas be less than the limits specified in Appendix B, Table 2 when averaged over a period not to exceed one year. Concentrations at this Effluent Concentration (EC) level, if ingested for one year, will result in a dose of 50 millirem to the total body. In addition, 10 CFR 50.36a requires that the release of radioactive materials be kept as low as is reasonably achievable. Appendix I to 10 CFR 50 provides the numerical guidelines on limiting conditions for operations to meet the as low as is reasonably achievable requirement.

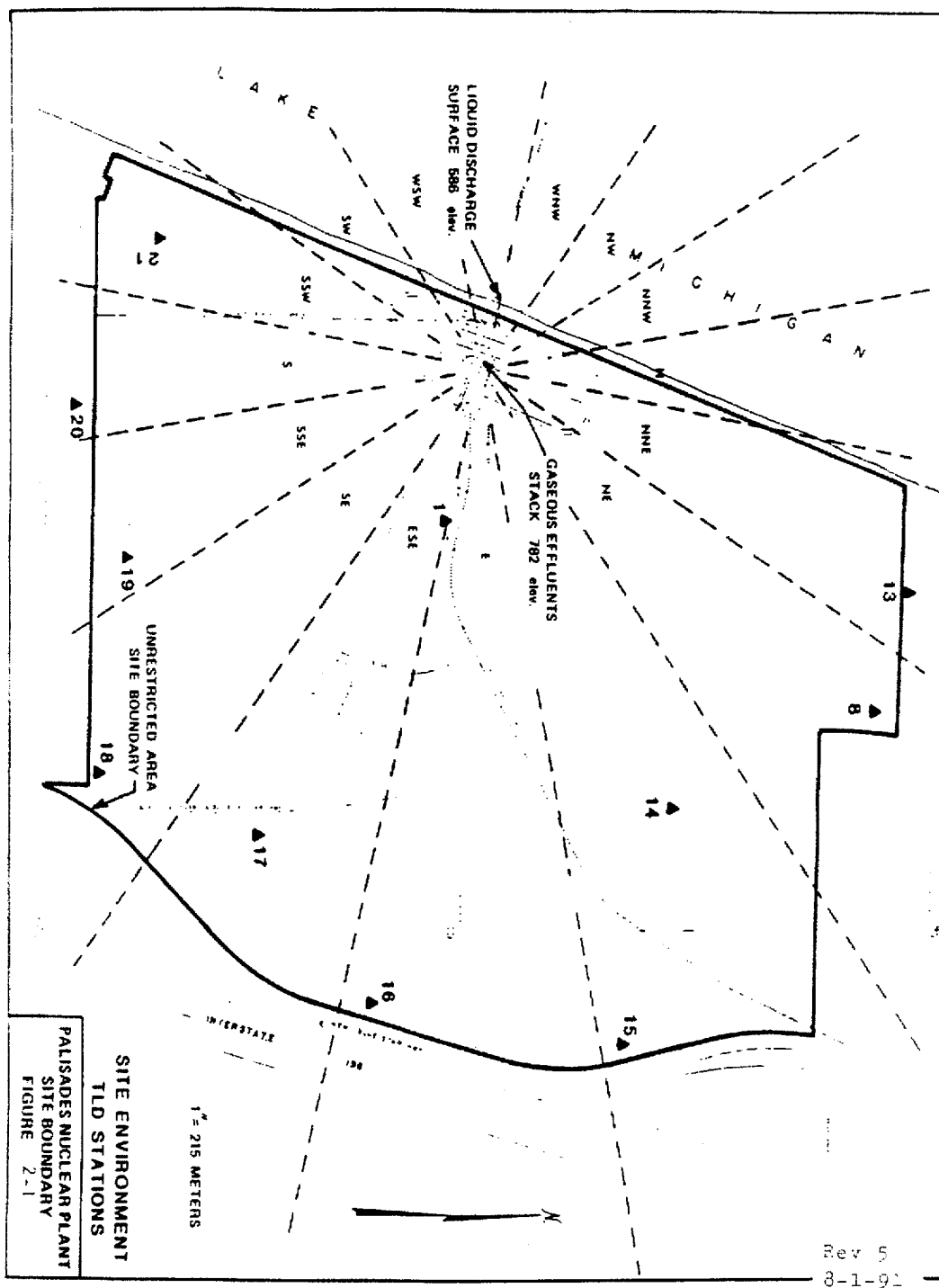
The LADTAP code has been run to determine the dose due to drinking water at Plant discharge concentration (1,000 x nearest drinking water intake concentration). The nominal average source term used is given in Table 1.1. Dose to the most limiting organ of the person hypothetically drinking this water is 3.88E-03 mrem. This is only 0.13% of the more conservative 50 mrem/yr total body value.

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F. FIGURES AND TABLES

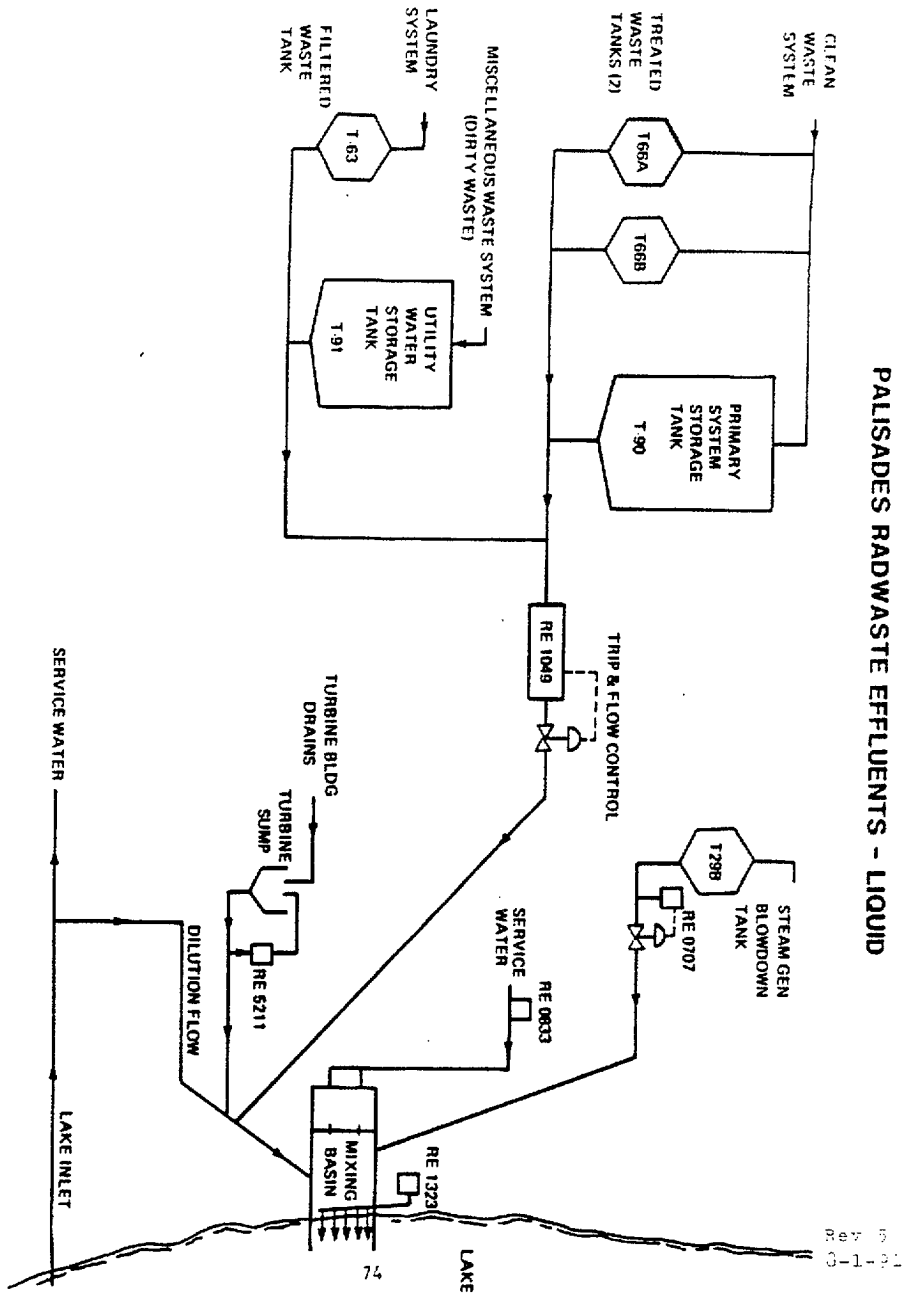
Figure 2-1



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Figure 2-2



PALISADES NUCLEAR PLANT
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TABLE 2.0

BIOACCUMULATION FACTORS
 $\mu\text{Ci/gm}$ per $\mu\text{Ci/ml}$

| <u>ELEMENT</u> | <u>FRESHWATER FISH</u> |
|----------------|----------------------------|
| H | 9.0E-01 |
| C | 4.6E 03 |
| NA | 1.0E 02 |
| P | 1.0E 05 |
| CR | 2.0E 02 |
| MN | 4.0E 02 |
| FE | 1.0E 02 |
| CO | 5.0E 01 |
| NI | 1.0E 02 |
| CU | 5.0E 01 |
| ZN | 2.0E 03 |
| BR | 4.2E 02 |
| RB | 2.0E 03 |
| SR | 3.0E 01 |
| Y | 2.5E 01 |
| ZR | 3.3E 00 |
| NB | 3.0E 04 |
| MO | 1.0E 01 |
| TC | 1.5E 01 |
| RU | 1.0E 01 |
| RH | 1.0E 01 |
| TE | 4.0E 02 |
| I | 1.5E 01 |
| CS | 2.0E 03 |
| BA | 4.0E 00 |
| LA | 2.5E 01 |
| CE | 1.0E 00 |
| PR | 2.5E 01 |
| ND | 2.5E 01 |
| W | 1.2E 03 |
| NP | 1.0E 01 |

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TABLE 2.1

INFANT INGESTION DOSE COMMITMENT FACTORS (MREM/50YR PER PCI INGESTED IN FIRST YR)

| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
|-----------|----------|----------|------------|-----------|----------|----------|----------|
| H3 | 0. | 3.08E-07 | 3.08E-07 | 3.08E-07 | 3.08E-07 | 3.08E-07 | 3.08E-07 |
| BE10 | 1.71E-05 | 2.49E-06 | 5.16E-07 | 0. | 1.64E-06 | 0. | 2.78E-05 |
| C14 | 2.37E-05 | 5.06E-06 | 5.06E-06 | 5.06E-06 | 5.06E-06 | 5.06E-06 | 5.06E-06 |
| N13 | 5.85E-08 | 5.85E-08 | 5.85E-08 | 5.835E-08 | 5.85E-08 | 5.85E-08 | 5.85E-08 |
| F18 | 5.19E-06 | 0. | 4.43E-07 | 0. | 0. | 0. | 1.22E-06 |
| NA22 | 9.83E-05 | 9.83E-05 | 9.83E-05 | 9.83E-05 | 9.83E-05 | 9.83E-05 | 9.83E-05 |
| NA24 | 1.01E-05 | 1.01E-05 | 1.01E-05 | 1.01E-05 | 1.01E-05 | 1.01E-05 | 1.01E-05 |
| P32 | 1.70E-03 | 1.00E-04 | 6.59E-05 | 0. | 0. | 0. | 2.30E-05 |
| AR39 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| AR41 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| CA41 | 3.74E-04 | 0. | 4.08E-05 | 0. | 0. | 0. | 1.91E-07 |
| SC46 | 3.75E-08 | 5.41E-08 | 1.69E-08 | 0. | 3.56E-08 | 0. | 3.53E-05 |
| CR51 | 0. | 0. | 1.41E-08 | 9.20E-09 | 2.01E-09 | 1.79E-08 | 4.11E-07 |
| MN54 | 0. | 1.99E-05 | 4.51E-06 | 0. | 4.41E-06 | 0. | 7.31E-06 |
| MN56 | 0. | 8.18E-07 | 1.41E-07 | 0. | 7.03E-07 | 0. | 7.43E-05 |
| FE55 | 1.39E-05 | 8.98E-06 | 2.40E-06 | 0. | 0. | 4.39E-06 | 1.14E-06 |
| FE59 | 3.08E-05 | 5.38E-05 | 2.12E-05 | 0. | 0. | 1.59E-05 | 2.57E-05 |
| CO57 | 0. | 1.15E-06 | 1.87E-06 | 0. | 0. | 0. | 3.92E-06 |
| CO58 | 0. | 3.60E-06 | 8.98E-06 | 0. | 0. | 0. | 8.97E-06 |
| CO60 | 0. | 1.08E-05 | 2.55E-05 | 0. | 0. | 0. | 2.57E-05 |
| NI59 | 4.78E-05 | 1.45E-05 | 8.17E-06 | 0. | 0. | 0. | 7.16E-07 |
| NI63 | 6.34E-04 | 3.92E-05 | 2.20E-05 | 0. | 0. | 0. | 1.95E-06 |
| NI65 | 4.70E-06 | 5.32E-07 | 2.42E-07 | 0. | 0. | 0. | 4.05E-05 |
| CU64 | 0. | 6.09E-07 | 2.82E-07 | 0. | 1.03E-06 | 0. | 1.25E-05 |
| ZN65 | 1.84E-05 | 6.31E-05 | 2.91E-05 | 0. | 3.06E-05 | 0. | 5.33E-05 |
| ZN69M + D | 1.50E-06 | 3.06E-06 | 2.79E-07 | 0. | 1.24E-06 | 0. | 4.24E-05 |
| ZN69 | 9.33E-08 | 1.68E-07 | 1.25E-08 | 0. | 6.98E-08 | 0. | 1.37E-05 |
| SE79 | 0. | 2.10E-05 | 3.90E-06 | 0. | 2.43E-05 | 0. | 5.58E-07 |
| BR82 | 0. | 0. | 1.27E-05 | 0. | 0. | 0. | 0. |
| BR83 + D | 0. | 0. | 3.63E-07 | 0. | 0. | 0. | 0. |
| BR84 | 0. | 0. | 3.82E-07 | 0. | 0. | 0. | 0. |
| BR85 | 0. | 0. | 1.94E-08 | 0. | 0. | 0. | 0. |
| KR83M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR85M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR85 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR87 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR88 + D | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR89 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| RB86 | 0. | 1.70E-04 | 8.40E-05 | 0. | 0. | 0. | 4.35E-06 |
| RB87 | 0. | 8.88E-05 | 3.52E-05 | 0. | 0. | 0. | 5.98E-07 |
| RB88 | 0. | 4.98E-07 | 2.73E-07 | 0. | 0. | 0. | 4.85E-07 |
| RB89 + D | 0. | 2.86E-07 | 1.97E-07 | 0. | 0. | 0. | 9.74E-08 |
| SR89 + D | 2.51E-03 | 0. | 7.20E-05 | 0. | 0. | 0. | 5.16E-05 |
| SR90 + D | 1.85E-02 | 0. | 4.71E-03 | 0. | 0. | 0. | 2.31E-04 |
| SR91 + D | 5.00E-05 | 0. | 1.81E-06 | 0. | 0. | 0. | 5.92E-05 |
| SR92 + D | 1.92E-05 | 0. | 7.13E-07 | 0. | 0. | 0. | 2.07E-04 |

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TABLE 2.1

INFANT INGESTION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INGESTED IN FIRST YR)

| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LI |
|------------|----------|----------|------------|----------|----------|----------|----------|
| Y90 | 8.69E-08 | 0. | 2.33E-09 | 0. | 0. | 0. | 1.20E-04 |
| Y91M+D | 8.10E-10 | 0. | 2.76E-11 | 0. | 0. | 0. | 2.70E-06 |
| Y91 | 1.13E-06 | 0. | 3.01E-08 | 0. | 0. | 0. | 8.10E-05 |
| Y92 | 7.65E-09 | 0. | 2.15E-10 | 0. | 0. | 0. | 1.46E-04 |
| Y93 | 2.43E-08 | 0. | 6.62E-10 | 0. | 0. | 0. | 1.92E-04 |
| ZR93 + D | 1.93E-07 | 9.18E-08 | 5.54E-08 | 0. | 2.71E-07 | 0. | 2.39E-05 |
| ZR95 + D | 2.06E-07 | 5.02E-08 | 3.56E-08 | 0. | 5.41E-08 | 0. | 2.50E-05 |
| ZR97 + D | 1.48E-08 | 2.54E-09 | 1.16E-09 | 0. | 2.56E-09 | 0. | 1.62E-04 |
| NB93M | 1.23E-07 | 3.33E-08 | 1.04E-08 | 0. | 3.25E-08 | 0. | 3.98E-06 |
| NB95 | 4.20E-08 | 1.73E-08 | 1.00E-08 | 0. | 1.24E-08 | 0. | 1.46E-05 |
| NB97 | 4.59E-10 | 9.79E-11 | 3.53E-11 | 0. | 7.65E-11 | 0. | 3.09E-05 |
| MO93 | 0. | 5.65E-05 | 1.82E-06 | 0. | 1.13E-05 | 0. | 1.21E-06 |
| MO99 + D | 0. | 3.40E-05 | 6.63E-06 | 0. | 5.08E-05 | 0. | 1.12E-05 |
| TC99M | 1.92E-09 | 3.96E-09 | 5.10E-08 | 0. | 4.26E-08 | 2.07E-09 | 1.15E-06 |
| TC99 | 1.08E-06 | 1.46E-06 | 4.55E-07 | 0. | 1.23E-05 | 1.42E-07 | 6.31E-06 |
| TC101 | 2.27E-09 | 2.86E-09 | 2.83E-08 | 0. | 3.40E-08 | 1.56E-09 | 4.86E-07 |
| RU103 + D | 1.48E-06 | 0. | 4.95E-07 | 0. | 3.08E-06 | 0. | 1.80E-05 |
| RU105 + D | 1.36E-07 | 0. | 4.58E-08 | 0. | 1.00E-06 | 0. | 5.41E-05 |
| RU106 + D | 2.41E-05 | 0. | 3.01E-06 | 0. | 2.85E-05 | 0. | 1.83E-04 |
| RH105 | 1.09E-06 | 7.13E-07 | 4.79E-07 | 0. | 1.98E-06 | 0. | 1.77E-05 |
| PD107 | 0. | 1.19E-06 | 8.45E-08 | 0. | 6.79E-06 | 0. | 9.46E-07 |
| PD109 | 0. | 1.50E-06 | 3.62E-07 | 0. | 5.51E-06 | 0. | 3.68E-05 |
| AG110M + D | 9.96E-07 | 7.27E-07 | 4.81E-07 | 0. | 1.04E-06 | 0. | 3.77E-05 |
| AG111 | 5.20E-07 | 2.02E-07 | 1.07E-07 | 0. | 4.22E-07 | 0. | 4.82E-05 |
| CD113M | 0. | 1.77E-05 | 6.52E-07 | 0. | 1.34E-05 | 0. | 2.66E-05 |
| CD115M | 0. | 1.42E-05 | 4.93E-07 | 0. | 7.41E-06 | 0. | 8.09E-05 |
| SN123 | 2.49E-04 | 3.89E-06 | 6.50E-06 | 3.91E-06 | 0. | 0. | 6.58E-05 |
| SN125 + D | 7.41E-05 | 1.38E-06 | 3.29E-06 | 1.36E-06 | 0. | 0. | 1.11E-04 |
| SN126 + D | 5.53E-04 | 7.26E-06 | 1.80E-05 | 1.91E-06 | 0. | 0. | 2.52E-05 |
| SB124 | 2.14E-05 | 3.15E-07 | 6.63E-06 | 5.68E-08 | 0. | 1.34E-05 | 6.60E-05 |
| SB125 + D | 1.23E-05 | 1.19E-07 | 2.53E-06 | 1.54E-08 | 0. | 7.72E-06 | 1.64E-05 |
| SB126 | 8.06E-06 | 1.58E-07 | 2.91E-06 | 6.19E-08 | 0. | 5.07E-06 | 8.35E-05 |
| SB127 | 2.23E-06 | 3.98E-08 | 6.90E-07 | 2.84E-08 | 0. | 1.15E-06 | 5.91E-05 |
| TE125M | 2.33E-05 | 7.79E-06 | 3.15E-06 | 7.84E-06 | 0. | 0. | 1.11E-05 |
| TE127M + D | 5.85E-05 | 1.94E-05 | 7.08E-06 | 1.69E-05 | 1.44E-04 | 0. | 2.36E-05 |
| TE127 | 1.00E-06 | 3.35E-07 | 2.15E-07 | 8.14E-07 | 2.44E-06 | 0. | 2.10E-05 |
| TE129M + D | 1.00E-04 | 3.43E-05 | 1.54E-05 | 3.84E-05 | 2.50E-04 | 0. | 5.97E-05 |
| TE129 | 2.84E-07 | 9.79E-08 | 6.63E-08 | 2.38E-07 | 7.07E-07 | 0. | 2.27E-05 |
| TE131M + D | 1.52E-05 | 6.12E-06 | 5.05E-06 | 1.24E-05 | 4.21E-05 | 0. | 1.03E-04 |
| TE131 + D | 1.76E-07 | 6.50E-08 | 4.94E-08 | 1.57E-07 | 4.50E-07 | 0. | 7.11E-06 |
| TE132 + D | 2.08E-05 | 1.03E-05 | 9.61E-06 | 1.52E-05 | 6.44E-05 | 0. | 3.81E-05 |
| TE133M + D | 3.91E-07 | 1.79E-07 | 1.71E-07 | 3.45E-07 | 1.22E-06 | 0. | 1.93E-05 |
| TE134 + D | 2.67E-07 | 1.34E-07 | 1.38E-07 | 2.39E-07 | 9.03E-07 | 0. | 3.06E-06 |
| I129 | 2.86E-05 | 2.12E-05 | 1.55E-05 | 1.36E-02 | 2.51E-05 | 0. | 4.24E-07 |
| I130 | 6.00E-06 | 1.32E-05 | 5.30E-06 | 1.48E-03 | 1.45E-05 | 0. | 2.83E-06 |
| I131 + D | 3.59E-05 | 4.23E-05 | 1.86E-05 | 1.39E-02 | 4.94E-05 | 0. | 1.51E-06 |

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TABLE 2.1

INFANT INGESTION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INGESTED IN FIRST YR)

| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
|------------|----------|----------|------------|----------|----------|----------|----------|
| I132 | 1.66E-06 | 3.37E-06 | 1.20E-06 | 1.58E-04 | 3.76E-06 | 0. | 2.73E-06 |
| I133 + D | 1.25E-05 | 1.82E-05 | 5.33E-06 | 3.31E-03 | 2.14E-05 | 0. | 3.08E-06 |
| I134 | 8.69E-07 | 1.78E-06 | 6.33E-07 | 4.15E-05 | 1.99E-06 | 0. | 1.84E-06 |
| I135 + D | 3.64E-06 | 7.24E-06 | 2.64E-06 | 6.49E-04 | 8.07E-06 | 0. | 2.62E-06 |
| XE131M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE133M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE133 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE135M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE135 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE137 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE138 + D | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| CS134M + D | 1.76E-07 | 2.93E-07 | 1.48E-07 | 0. | 1.13E-07 | 2.60E-08 | 2.32E-07 |
| CS134 | 3.77E-04 | 7.03E-04 | 7.10E-05 | 0. | 1.81E-04 | 7.42E-05 | 1.91E-06 |
| CS135 | 1.33E-04 | 1.21E-04 | 6.30E-06 | 0. | 3.44E-05 | 1.31E-05 | 4.37E-07 |
| CS136 | 4.59E-05 | 1.35E-04 | 5.04E-05 | 0. | 5.38E-05 | 1.10E-05 | 2.05E-06 |
| CS137 + D | 5.22E-04 | 6.11E-04 | 4.33E-05 | 0. | 1.64E-04 | 6.64E-05 | 1.91E-06 |
| CS138 | 4.81E-07 | 7.82E-07 | 3.79E-07 | 0. | 3.90E-07 | 6.09E-08 | 1.25E-06 |
| CS139 + D | 3.10E-07 | 4.24E-07 | 1.62E-07 | 0. | 2.19E-07 | 3.30E-08 | 2.66E-08 |
| BA139 | 8.81E-07 | 5.84E-10 | 2.55E-08 | 0. | 3.51E-10 | 3.54E-10 | 5.58E-05 |
| BA140 + D | 1.71E-04 | 1.71E-07 | 8.81E-06 | 0. | 4.06E-08 | 1.05E-07 | 4.20E-05 |
| BA141 + D | 4.25E-07 | 2.91E-10 | 1.34E-08 | 0. | 1.75E-10 | 1.77E-10 | 5.19E-06 |
| BA142 + D | 1.84E-07 | 1.53E-10 | 9.06E-09 | 0. | 8.81E-11 | 9.26E-11 | 7.59E-07 |
| LA140 | 2.11E-08 | 8.32E-09 | 2.14E-09 | 0. | 0. | 0. | 9.77E-05 |
| LA141 | 2.89E-09 | 8.38E-10 | 1.46E-10 | 0. | 0. | 0. | 9.61E-05 |
| LA142 | 1.10E-09 | 4.04E-10 | 9.67E-11 | 0. | 0. | 0. | 6.86E-05 |
| CE141 | 7.87E-08 | 4.80E-08 | 5.65E-09 | 0. | 1.48E-08 | 0. | 2.48E-05 |
| CE143 + D | 1.48E-08 | 9.82E-06 | 1.12E-09 | 0. | 2.86E-09 | 0. | 5.73E-05 |
| CE144 + D | 2.98E-06 | 1.22E-06 | 1.67E-07 | 0. | 4.93E-07 | 0. | 1.71E-04 |
| PR143 | 8.18E-08 | 3.04E-08 | 4.03E-09 | 0. | 1.13E-08 | 0. | 4.29E-05 |
| PR144 | 2.74E-10 | 1.06E-10 | 1.38E-11 | 0. | 3.84E-11 | 0. | 4.93E-06 |
| ND147 + D | 5.53E-08 | 5.68E-08 | 3.48E-09 | 0. | 2.19E-08 | 0. | 3.60E-05 |
| PM147 | 3.88E-07 | 3.27E-08 | 1.59E-08 | 0. | 4.88E-08 | 0. | 9.27E-06 |
| PM148M + D | 1.65E-07 | 4.18E-08 | 3.28E-08 | 0. | 4.80E-08 | 0. | 5.443-05 |
| PM148 | 6.32E-08 | 9.13E-09 | 4.60E-09 | 0. | 1.09E-08 | 0. | 9.74E-05 |
| PM149 | 1.38E-08 | 1.81E-09 | 7.90E-10 | 0. | 2.20E-09 | 0. | 4.86E-05 |
| PM151 | 6.18E-09 | 9.01E-10 | 4.56E-10 | 0. | 1.07E-09 | 0. | 4.17E-05 |
| SM151 | 2.90E-07 | 6.67E-08 | 1.44E-08 | 0. | 4.53E-08 | 0. | 5.58E-06 |
| SM153 | 7.72E-09 | 5.97E-09 | 4.58E-10 | 0. | 1.25E-09 | 0. | 3.12E-05 |
| EU152 | 6.74E-07 | 1.79E-07 | 1.51E-07 | 0. | 5.02E-07 | 0. | 1.59E-05 |
| EU154 | 2.64E-06 | 3.67E-07 | 2.20E-07 | 0. | 9.95E-07 | 0. | 4.58E-05 |
| EU155 | 5.42E-07 | 6.25E-08 | 3.23E-08 | 0. | 1.40E-07 | 0. | 8.37E-05 |
| EU156 | 1.14E-07 | 7.06E-08 | 1.12E-08 | 0. | 3.26E-08 | 0. | 6.67E-05 |
| TB160 | 2.59E-07 | 0. | 3.24E-08 | 0. | 7.37E-08 | 0. | 3.45E-05 |
| HO166M | 1.25E-06 | 2.69E-07 | 2.13E-07 | 0. | 3.57E-07 | 0. | 0. |
| W181 | 8.85E-08 | 2.72E-08 | 3.04E-09 | 0. | 0. | 0. | 3.82E-07 |
| W185 | 3.62E-06 | 1.13E-06 | 1.29E-07 | 0. | 0. | 0. | 1.62E-05 |
| W187 | 9.03E-07 | 6.28E-07 | 2.17E-07 | 0. | 0. | 0. | 3.69E-05 |

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INFANT INGESTION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INGESTED IN FIRST YR)

| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
|----------|----------|----------|------------|---------|----------|------|----------|
| PB210 +D | 5.28E-02 | 1.42E-02 | 2.38E-03 | 0. | 4.33E-02 | 0. | 5.62E-05 |
| BI210 +D | 4.16E-06 | 2.68E-05 | 3.58E-07 | 0. | 2.08E-04 | 0. | 5.27E-05 |
| PO210 | 3.10E-03 | 5.93E-03 | 7.41E-04 | 0. | 1.26E-02 | 0. | 6.61E-05 |
| RN222 +D | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| RA223 +D | 4.41E-02 | 6.42E-05 | 8.82E-03 | 0. | 1.17E-03 | 0. | 3.43E-04 |
| RA224 +D | 1.46E-02 | 3.29E-05 | 2.91E-03 | 0. | 6.00E-04 | 0. | 3.86E-04 |
| RA225 +D | 5.78E-02 | 6.42E-05 | 1.15E-02 | 0. | 1.19E-03 | 0. | 3.24E-04 |
| RA226 +D | 6.20E-01 | 4.76E-05 | 5.14E-01 | 0. | 8.71E-04 | 0. | 3.44E-04 |
| RA228 +D | 4.32E-01 | 2.58E-05 | 4.86E-01 | 0. | 4.73E-04 | 0. | 5.86E-05 |
| AC225 | 3.92E-05 | 5.03E-05 | 2.63E-06 | 0. | 3.69E-06 | 0. | 4.36E-04 |
| AC227 +D | 4.49E-03 | 7.67E-04 | 2.79E-04 | 0. | 1.56E-04 | 0. | 8.50E-05 |
| TH227 +D | 1.20E-04 | 2.01E-06 | 3.45E-06 | 0. | 7.41E-06 | 0. | 5.70E-04 |
| TH228 +D | 2.47E-03 | 3.38E-05 | 8.36E-05 | 0. | 1.58E-04 | 0. | 5.84E-04 |
| TH229 | 1.48E-02 | 1.94E-04 | 7.29E-04 | 0. | 9.29E-04 | 0. | 5.31E-04 |
| TH230 | 3.80E-03 | 1.90E-04 | 1.06E-04 | 0. | 9.12E-04 | 0. | 6.24E-05 |
| TH232 +D | 4.24E-03 | 1.63E-04 | 1.65E-04 | 0. | 7.79E-04 | 0. | 5.31E-05 |
| TH234 | 6.92E-07 | 3.77E-08 | 2.00E-08 | 0. | 1.39E-07 | 0. | 1.19E-04 |
| PA231 +D | 7.57E-03 | 2.50E-04 | 3.02E-04 | 0. | 1.34E-03 | 0. | 7.44E-05 |
| PA233 | 3.11E-08 | 6.09E-09 | 5.43E-09 | 0. | 1.67E-08 | 0. | 1.46E-05 |
| U232 +D | 2.42E-02 | 0. | 2.16E-03 | 0. | 2.37E-03 | 0. | 7.04E-05 |
| U233 +D | 5.08E-03 | 0. | 3.87E-04 | 0. | 1.08E-03 | 0. | 6.51E-05 |
| U234 | 4.88E-03 | 0. | 3.80E-04 | 0. | 1.06E-03 | 0. | 6.37E-05 |
| U235 +D | 4.67E-03 | 0. | 3.56E-04 | 0. | 9.93E-04 | 0. | 8.10E-05 |
| U236 | 4.67E-03 | 0. | 3.64E-04 | 0. | 1.01E-03 | 0. | 5.98E-05 |
| U237 | 4.95E-07 | 0. | 1.32E-07 | 0. | 1.23E-06 | 0. | 2.11E-05 |
| U238 +D | 4.47E-03 | 0. | 3.33E-04 | 0. | 9.28E-04 | 0. | 5.71E-05 |
| NP237 +D | 2.53E-03 | 1.93E-04 | 1.05E-04 | 0. | 6.34E-04 | 0. | 8.23E-05 |
| NP238 | 1.24E-07 | 3.12E-09 | 1.92E-09 | 0. | 6.81E-09 | 0. | 4.17E-05 |
| NP239 | 1.11E-08 | 9.93E-10 | 5.61E-10 | 0. | 1.98E-09 | 0. | 2.87E-05 |
| PU238 | 1.34E-03 | 1.69E-04 | 3.40E-05 | 0. | 1.21E-04 | 0. | 7.57E-05 |
| PU239 | 1.45E-03 | 1.77E-04 | 3.54E-05 | 0. | 1.28E-04 | 0. | 6.91E-05 |
| PU240 | 1.45E-03 | 1.77E-04 | 3.54E-05 | 0. | 1.28E-04 | 0. | 7.04E-05 |
| PU241 +D | 4.38E-05 | 1.90E-06 | 8.82E-07 | 0. | 3.17E-06 | 0. | 1.45E-06 |
| PU242 | 1.35E-03 | 1.70E-04 | 3.41E-05 | 0. | 1.23E-04 | 0. | 6.77E-05 |
| PU244 | 1.57E-03 | 1.95E-04 | 3.91E-05 | 0. | 1.41E-04 | 0. | 1.01E-04 |
| AM241 | 1.53E-03 | 7.18E-04 | 1.09E-04 | 0. | 6.55E-04 | 0. | 7.70E-05 |
| AM242M | 1.58E-03 | 7.02E-04 | 1.13E-04 | 0. | 6.64E-04 | 0. | 9.69E-05 |
| AM243 | 1.51E-03 | 6.88E-04 | 1.06E-04 | 0. | 6.36E-04 | 0. | 9.03E-05 |
| CM242 | 1.37E-04 | 1.24E-04 | 9.10E-06 | 0. | 2.62E-05 | 0. | 8.23E-05 |
| CM243 | 1.45E-03 | 6.88E-04 | 8.98E-05 | 0. | 3.27E-04 | 0. | 8.10E-05 |
| CM244 | 1.22E-03 | 6.16E-04 | 7.59E-05 | 0. | 2.71E-04 | 0. | 7.84E-05 |
| CM245 | 1.88E-03 | 7.49E-04 | 1.13E-04 | 0. | 4.32E-04 | 0. | 7.30E-05 |
| CM246 | 1.87E-03 | 7.49E-04 | 1.13E-04 | 0. | 4.31E-04 | 0. | 7.17E-05 |
| CM247 +D | 1.82E-03 | 7.36E-04 | 1.11E-04 | 0. | 4.24E-04 | 0. | 9.43E-05 |
| CM248 | 1.51E-02 | 6.07E-03 | 9.16E-04 | 0. | 3.50E-03 | 0. | 1.52E-03 |
| CF252 | 1.24E-03 | 0. | 2.95E-05 | 0 | 0. | 0. | 2.99E-04 |

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| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
|-----------|----------|----------|------------|----------|----------|----------|----------|
| H3 | 0. | 2.03E-07 | 2.03E-07 | 2.03E-07 | 2.03E-07 | 2.03E-07 | 2.03E-07 |
| BE10 | 1.35E-05 | 1.57E-06 | 3.39E-07 | 0. | 1.11E-06 | 0. | 2.75E-05 |
| C14 | 1.21E-05 | 2.42E-06 | 2.42E-06 | 2.42E-06 | 2.42E-06 | 2.42E-06 | 2.42E-06 |
| N13 | 3.10E-08 | 3.10E-08 | 3.10E-08 | 3.10E-08 | 3.10E-08 | 3.10E-08 | 3.10E-08 |
| F18 | 2.49E-06 | 0. | 2.47E-07 | 0. | 0. | 0. | 6.74E-07 |
| NA22 | 5.88E-05 | 5.88E-05 | 5.88E-05 | 5.88E-05 | 5.88E-05 | 5.88E-05 | 5.88E-05 |
| NA24 | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 |
| P32 | 8.25E-04 | 3.86E-05 | 3.18E-05 | 0. | 0. | 0. | 2.28E-05 |
| AR39 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| AR41 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| CA41 | 3.47E-04 | 0. | 3.79E-05 | 0. | 0. | 0. | 1.90E-07 |
| SC46 | 1.97E-08 | 2.70E-08 | 1.04E-08 | 0. | 2.30E-08 | 0. | 3.95E-05 |
| CR51 | 0. | 0. | 8.90E-09 | 4.94E-09 | 1.35E-09 | 9.02E-09 | 4.72E-07 |
| MN54 | 0. | 1.07E-05 | 2.85E-06 | 0. | 3.00E-06 | 0. | 8.98E-06 |
| MN56 | 0. | 3.34E-07 | 7.54E-08 | 0. | 4.04E-07 | 0. | 4.84E-05 |
| FE55 | 1.15E-05 | 6.10E-06 | 1.89E-06 | 0. | 0. | 3.45E-06 | 1.13E-06 |
| FE59 | 1.65E-05 | 2.67E-05 | 1.33E-05 | 0. | 0. | 7.74E-06 | 2.78E-05 |
| CO57 | 0. | 4.93E-07 | 9.98E-07 | 0. | 0. | 0. | 4.04E-06 |
| CO58 | 0. | 1.80E-06 | 5.51E-06 | 0. | 0. | 0. | 1.05E-05 |
| CO60 | 0. | 5.29E-06 | 1.56E-05 | 0. | 0. | 0. | 2.93E-05 |
| NI59 | 4.02E-05 | 1.07E-05 | 6.82E-06 | 0. | 0. | 0. | 7.10E-07 |
| NI63 | 5.38E-04 | 2.88E-05 | 1.83E-05 | 0. | 0. | 0. | 1.94E-06 |
| NI65 | 2.22E-06 | 2.09E-07 | 1.22E-07 | 0. | 0. | 0. | 2.56E-05 |
| CU64 | 0. | 2.45E-07 | 1.48E-07 | 0. | 5.92E-07 | 0. | 1.15E-05 |
| ZN65 | 1.37E-05 | 3.65E-05 | 2.27E-05 | 0. | 2.30E-05 | 0. | 6.41E-06 |
| ZN69M + D | 7.10E-07 | 1.21E-06 | 1.43E-07 | 0. | 7.03E-07 | 0. | 3.94E-05 |
| ZN69 | 4.38E-08 | 6.33E-08 | 5.85E-09 | 0. | 3.84E-08 | 0. | 3.99E-06 |
| SE79 | 0. | 8.43E-06 | 1.87E-06 | 0. | 1.37E-05 | 0. | 5.53E-07 |
| BR82 | 0. | 0. | 7.55E-06 | 0. | 0. | 0. | 0. |
| BR83 + D | 0. | 0. | 1.71E-07 | 0. | 0. | 0. | 0. |
| BR84 | 0. | 0. | 1.98E-07 | 0. | 0. | 0. | 0. |
| BR85 | 0. | 0. | 9.12E-09 | 0. | 0. | 0. | 0. |
| KR83M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR85M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR85 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR87 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR88 + D | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR89 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| RB86 | 0. | 6.70E-05 | 4.12E-05 | 0. | 0. | 0. | 4.31E-06 |
| RB87 | 0. | 3.95E-05 | 1.83E-05 | 0. | 0. | 0. | 5.92E-07 |
| RB88 | 0. | 1.90E-07 | 1.32E-07 | 0. | 0. | 0. | 9.32E-09 |
| RB89 + D | 0. | 1.17E-07 | 1.04E-07 | 0. | 0. | 0. | 1.02E-09 |
| SR89 + D | 1.32E-03 | 0. | 3.77E-05 | 0. | 0. | 0. | 5.11E-05 |
| SR90 + D | 1.70E-02 | 0. | 4.31E-03 | 0. | 0. | 0. | 2.29E-04 |
| SR91 + D | 2.40E-05 | 0. | 9.06E-07 | 0. | 0. | 0. | 5.30E-05 |
| SR92 + D | 9.03E-06 | 0. | 3.62E-07 | 0. | 0. | 0. | 1.71E-04 |

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| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
|----------|----------|----------|------------|----------|----------|----------|----------|
| Y90 | 4.11E-08 | 0. | 1.10E-09 | 0. | 0. | 0. | 1.17E-04 |
| Y91M+D | 3.82E-10 | 0. | 1.39E-11 | 0. | 0. | 0. | 7.48E-07 |
| Y91 | 6.02E-07 | 0. | 1.61E-08 | 0. | 0. | 0. | 8.02E-05 |
| Y92 | 3.60E-09 | 0. | 1.03E-10 | 0. | 0. | 0. | 1.04E-04 |
| Y93 | 1.14E-08 | 0. | 3.13E-10 | 0. | 0. | 0. | 1.70E-04 |
| ZR93+D | 1.67E-07 | 6.25E-08 | 4.45E-08 | 0. | 2.42E-07 | 0. | 2.37E-05 |
| ZR95+D | 1.16E-07 | 2.55E-08 | 2.27E-08 | 0. | 3.65E-08 | 0. | 2.66E-05 |
| ZR97+D | 6.99E-09 | 1.01E-09 | 5.96E-10 | 0. | 1.45E-09 | 0. | 1.53E-04 |
| NB93M | 1.05E-07 | 2.62E-08 | 8.61E-09 | 0. | 2.83E-08 | 0. | 3.95E-06 |
| NB95 | 2.25E-08 | 8.76E-09 | 6.26E-09 | 0. | 8.23E-09 | 0. | 1.62E-05 |
| NB97 | 2.17E-10 | 3.92E-11 | 1.83E-11 | 0. | 4.35E-11 | 0. | 1.21E-05 |
| MO93 | 0. | 2.41E-05 | 8.65E-07 | 0. | 6.35E-06 | 0. | 1.22E-06 |
| MO99+D | 0. | 1.33E-05 | 3.29E-06 | 0. | 2.84E-05 | 0. | 1.10E-05 |
| TC99M | 9.23E-10 | 1.81E-09 | 3.00E-08 | 0. | 2.63E-08 | 9.19E-10 | 1.03E-06 |
| TC99 | 5.35E-07 | 5.96E-07 | 2.14E-07 | 0. | 7.02E-06 | 5.27E-08 | 6.25E-06 |
| TC101 | 1.07E-09 | 1.12E-09 | 1.42E-08 | 0. | 1.91E-08 | 5.92E-10 | 3.56E-09 |
| RU103+D | 7.31E-07 | 0. | 2.81E-07 | 0. | 1.84E-06 | 0. | 1.89E-05 |
| RU105+D | 6.45E-08 | 0. | 2.34E-08 | 0. | 5.67E-07 | 0. | 4.21E-05 |
| RU106+D | 1.17E-05 | 0. | 1.46E-06 | 0. | 1.58E-05 | 0. | 1.82E-04 |
| RH105 | 5.14E-07 | 2.76E-07 | 2.36E-07 | 0. | 1.10E-06 | 0. | 1.71E-05 |
| PD107 | 0. | 4.72E-07 | 4.01E-08 | 0. | 3.95E-06 | 0. | 9.37E-07 |
| PD109 | 0. | 5.67E-07 | 1.70E-07 | 0. | 3.04E-06 | 0. | 3.35E-05 |
| AG110M+D | 5.39E-07 | 3.64E-07 | 2.91E-07 | 0. | 6.78E-07 | 0. | 4.33E-05 |
| AG111 | 2.48E-07 | 7.76E-08 | 5.12E-08 | 0. | 2.34E-07 | 0. | 4.75E-05 |
| CD113M | 0. | 1.02E-05 | 4.34E-07 | 0. | 1.05E-05 | 0. | 2.63E-05 |
| CD115M | 0. | 5.89E-06 | 2.51E-07 | 0. | 4.38E-06 | 0. | 8.01E-05 |
| SN123 | 1.33E-04 | 1.65E-06 | 3.24E-06 | 1.75E-06 | 0. | 0. | 6.52E-05 |
| SN125+D | 3.55E-05 | 5.35E-07 | 1.59E-06 | 5.55E-07 | 0. | 0. | 1.10E-04 |
| SN126+D | 3.33E-04 | 4.15E-06 | 9.46E-06 | 1.14E-06 | 0. | 0. | 2.50E-05 |
| SB124 | 1.11E-05 | 1.44E-07 | 3.89E-06 | 2.45E-08 | 0. | 6.16E-06 | 6.94E-05 |
| SB125+D | 7.16E-06 | 5.52E-08 | 1.50E-06 | 6.63E-09 | 0. | 3.99E-06 | 1.71E-05 |
| SB126 | 4.40E-06 | 6.73E-08 | 1.58E-06 | 2.58E-08 | 0. | 2.10E-06 | 8.87E-05 |
| SB127 | 1.06E-06 | 1.64E-08 | 3.68E-07 | 1.18E-08 | 0. | 4.60E-07 | 5.97E-05 |
| TE125M | 1.14E-05 | 3.09E-06 | 1.52E-06 | 3.20E-06 | 0. | 0. | 1.10E-05 |
| TE127M+D | 2.89E-05 | 7.78E-06 | 3.43E-06 | 6.91E-06 | 8.24E-05 | 0. | 2.34E-05 |
| TE127 | 4.71E-07 | 1.27E-07 | 1.01E-07 | 3.26E-07 | 1.34E-06 | 0. | 1.84E-05 |
| TE129M+D | 4.87E-05 | 1.36E-05 | 7.56E-06 | 1.57E-05 | 1.43E-04 | 0. | 5.94E-05 |
| TE129 | 1.34E-07 | 3.74E-08 | 3.18E-08 | 9.56E-08 | 3.92E-07 | 0. | 8.34E-06 |
| TE131M+D | 7.20E-06 | 2.49E-06 | 2.65E-06 | 5.12E-06 | 2.41E-05 | 0. | 1.01E-04 |
| TE131+D | 8.30E-08 | 2.53E-08 | 2.47E-08 | 6.35E-08 | 2.51E-07 | 0. | 4.36E-07 |
| TE132+D | 1.01E-05 | 4.47E-06 | 5.40E-06 | 6.51E-06 | 4.15E-05 | 0. | 4.50E-05 |
| TE133M+D | 1.87E-07 | 7.56E-08 | 9.37E-08 | 1.45E-07 | 7.18E-07 | 0. | 5.77E-06 |
| TE134+D | 1.29E-07 | 5.80E-08 | 7.74E-08 | 1.02E-07 | 5.37E-07 | 0. | 5.89E-07 |
| I129 | 1.39E-05 | 8.53E-06 | 7.62E-06 | 5.58E-03 | 1.44E-05 | 0. | 4.29E-07 |
| I130 | 2.92E-06 | 5.90E-06 | 3.04E-06 | 6.50E-04 | 8.82E-06 | 0. | 2.76E-06 |
| I131+D | 1.72E-05 | 1.73E-05 | 9.83E-06 | 5.72E-03 | 2.84E-05 | 0. | 1.54E-06 |

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| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
|------------|----------|----------|------------|----------|----------|----------|----------|
| I132 | 8.00E-07 | 1.47E-06 | 6.76E-07 | 6.82E-05 | 2.25E-06 | 0. | 1.73E-06 |
| I133 + D | 5.92E-06 | 7.32E-06 | 2.77E-06 | 1.36E-03 | 1.22E-05 | 0. | 2.95E-06 |
| I134 | 4.19E-07 | 7.78E-07 | 3.58E-07 | 1.79E-05 | 1.19E-06 | 0. | 5.16E-07 |
| I135 + D | 1.75E-06 | 3.15E-06 | 1.49E-06 | 2.79E-04 | 4.83E-06 | 0. | 2.40E-06 |
| XE131M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE133M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE133 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE135M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE135 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE137 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE138 + D | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| CS134M + D | 8.44E-08 | 1.25E-07 | 8.16E-08 | 0. | 6.59E-08 | 1.09E-08 | 1.58E-07 |
| CS134 | 2.34E-04 | 3.84E-04 | 8.10E-05 | 0. | 1.19E-04 | 4.27E-05 | 2.07E-06 |
| CS135 | 8.30E-05 | 5.78E-05 | 5.93E-06 | 0. | 2.04E-05 | 6.81E-06 | 4.33E-07 |
| CS136 | 2.35E-05 | 6.46E-05 | 4.18E-05 | 0. | 3.44E-05 | 5.13E-06 | 2.27E-06 |
| CS137 + D | 3.27E-04 | 3.13E-04 | 4.62E-05 | 0. | 1.02E-04 | 3.67E-05 | 1.96E-06 |
| CS138 | 2.28E-07 | 3.17E-07 | 2.01E-07 | 0. | 2.23E-07 | 2.40E-08 | 1.46E-07 |
| CS139 + D | 1.45E-07 | 1.61E-07 | 7.74E-08 | 0. | 1.21E-07 | 1.22E-08 | 1.45E-11 |
| BA139 | 4.14E-07 | 2.21E-10 | 1.20E-08 | 0. | 1.93E-10 | 1.30E-10 | 2.39E-05 |
| BA140 + D | 8.31E-05 | 7.28E-08 | 4.85E-06 | 0. | 2.37E-08 | 4.34E-08 | 4.21E-05 |
| BA141 + D | 2.00E-07 | 1.12E-10 | 6.51E-09 | 0. | 9.69E-11 | 6.58E-10 | 1.14E-07 |
| BA142 + D | 8.74E-08 | 6.29E-11 | 4.88E-09 | 0. | 5.09E-11 | 3.70E-11 | 1.14E-09 |
| LA140 | 1.01E-08 | 3.53E-09 | 1.19E-09 | 0. | 0. | 0. | 9.84E-05 |
| LA141 | 1.35E-09 | 3.17E-10 | 6.88E-11 | 0. | 0. | 0. | 7.05E-05 |
| LA142 | 5.24E-10 | 1.67E-10 | 5.23E-11 | 0. | 0. | 0. | 3.31E-05 |
| CE141 | 3.97E-08 | 1.98E-08 | 2.94E-09 | 0. | 8.68E-09 | 0. | 2.47E-05 |
| CE143 + D | 6.99E-09 | 3.79E-06 | 5.49E-10 | 0. | 1.59E-09 | 0. | 5.55E-05 |
| CE144 + D | 2.08E-06 | 6.52E-07 | 1.11E-07 | 0. | 3.61E-07 | 0. | 1.70E-04 |
| PR143 | 3.93E-08 | 1.18E-08 | 1.95E-09 | 0. | 6.39E-09 | 0. | 4.24E-05 |
| PR144 | 1.29E-10 | 3.99E-11 | 6.49E-12 | 0. | 2.11E-11 | 0. | 8.59E-08 |
| ND147 + D | 2.79E-08 | 2.26E-08 | 1.75E-09 | 0. | 1.24E-08 | 0. | 3.58E-05 |
| PM147 | 3.18E-07 | 2.27E-08 | 1.22E-08 | 0. | 4.01E-08 | 0. | 9.19E-06 |
| PM148M + D | 1.03E-07 | 2.05E-08 | 2.05E-08 | 0. | 3.04E-08 | 0. | 5.78E-05 |
| PM148 | 3.02E-08 | 3.63E-09 | 2.35E-09 | 0. | 6.17E-09 | 0. | 9.70E-05 |
| PM149 | 6.49E-09 | 6.90E-10 | 3.74E-10 | 0. | 1.22E-09 | 0. | 4.71E-05 |
| PM151 | 2.92E-09 | 3.55E-10 | 2.31E-10 | 0. | 6.02E-10 | 0. | 4.03E-05 |
| SM151 | 2.56E-07 | 3.81E-08 | 1.20E-08 | 0. | 3.94E-08 | 0. | 5.53E-06 |
| SM153 | 3.65E-09 | 2.27E-09 | 2.19E-10 | 0. | 6.91E-10 | 0. | 3.02E-05 |
| EU152 | 6.15E-07 | 1.12E-07 | 1.33E-07 | 0. | 4.73E-07 | 0. | 1.84E-05 |
| EU154 | 2.30E-06 | 2.07E-07 | 1.89E-07 | 0. | 9.09E-07 | 0. | 4.81E-05 |
| EU155 | 4.82E-07 | 3.47E-08 | 2.72E-08 | 0. | 1.30E-07 | 0. | 8.69E-05 |
| EU156 | 5.62E-08 | 3.01E-08 | 6.23E-09 | 0. | 1.94E-08 | 0. | 6.83E-05 |
| TB160 | 1.66E-07 | 0. | 2.06E-08 | 0. | 4.94E-08 | 0. | 3.68E-05 |
| HO166M | 1.08E-06 | 2.26E-07 | 1.91E-07 | 0. | 3.22E-07 | 0. | 0. |
| W181 | 4.23E-06 | 1.04E-08 | 1.43E-09 | 0. | 0. | 0. | 3.79E-07 |
| W185 | 1.73E-06 | 4.32E-07 | 6.05E-08 | 0. | 0. | 0. | 1.61E-05 |
| W187 | 4.29E-07 | 2.54E-07 | 1.14E-07 | 0. | 0. | 0. | 3.57E-05 |

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| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LI |
|-----------|----------|----------|------------|---------|----------|------|----------|
| PB210 + D | 4.75E-02 | 1.22E-02 | 2.09E-03 | 0. | 3.67E-02 | 0. | 5.57E-05 |
| BI210 + D | 1.97E-06 | 1.02E-05 | 1.69E-07 | 0. | 1.15E-04 | 0. | 5.17E-05 |
| PO210 | 1.52E-03 | 2.43E-03 | 3.67E-04 | 0. | 7.56E-03 | 0. | 6.55E-05 |
| RN222 + D | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| RA223 + D | 2.12E-02 | 2.45E-05 | 4.24E-03 | 0. | 6.50E-04 | 0. | 3.38E-04 |
| RA224 + D | 6.89E-03 | 1.25E-05 | 1.38E-03 | 0. | 3.31E-04 | 0. | 3.78E-04 |
| RA225 + D | 2.80E-02 | 2.50E-05 | 5.59E-03 | 0. | 6.62E-04 | 0. | 3.21E-04 |
| RA226 + D | 5.75E-01 | 1.84E-05 | 4.72E-01 | 0. | 4.88E-04 | 0. | 3.41E-04 |
| RA228 + D | 3.85E-01 | 9.99E-06 | 4.32E-01 | 0. | 2.65E-04 | 0. | 5.81E-05 |
| AC225 | 1.88E-05 | 1.94E-05 | 1.26E-06 | 0. | 2.07E-06 | 0. | 4.31E-04 |
| AC227 + D | 4.12E-03 | 6.63E-04 | 2.55E-04 | 0. | 1.46E-04 | 0. | 8.43E-05 |
| TH227 + D | 5.85E-05 | 7.96E-07 | 1.69E-06 | 0. | 4.22E-06 | 0. | 5.63E-04 |
| TH228 + D | 2.07E-03 | 2.65E-05 | 7.00E-05 | 0. | 1.38E-04 | 0. | 5.79E-04 |
| TH229 | 1.38E-02 | 1.81E-04 | 6.80E-04 | 0. | 8.84E-04 | 0. | 5.27E-04 |
| TH230 | 3.55E-03 | 1.78E-04 | 9.91E-05 | 0. | 8.67E-04 | 0. | 6.19E-05 |
| TH232 + D | 3.96E-03 | 1.52E-04 | 3.01E-04 | 0. | 7.41E-04 | 0. | 5.27E-05 |
| TH234 | 3.42E-07 | 1.51E-08 | 9.88E-09 | 0. | 8.01E-08 | 0. | 1.18E-04 |
| PA231 + D | 7.07E-03 | 2.34E-04 | 2.81E-04 | 0. | 1.28E-03 | 0. | 7.37E-05 |
| PA233 | 1.81E-08 | 2.82E-09 | 3.16E-09 | 0. | 1.04E-08 | 0. | 1.44E-05 |
| U232 + D | 1.76E-02 | 0. | 1.26E-03 | 0. | 1.34E-03 | 0. | 6.98E-05 |
| U233 + D | 3.72E-03 | 0. | 2.25E-04 | 0. | 6.10E-04 | 0. | 6.45E-05 |
| U234 | 3.57E-03 | 0. | 2.21E-04 | 0. | 5.98E-04 | 0. | 6.32E-05 |
| U235 + D | 3.42E-03 | 0. | 2.07E-04 | 0. | 5.61E-04 | 0. | 8.03E-05 |
| U236 | 3.42E-03 | 0. | 2.12E-04 | 0. | 5.73E-04 | 0. | 5.92E-05 |
| U237 | 2.36E-07 | 0. | 6.27E-08 | 0. | 6.81E-07 | 0. | 2.08E-05 |
| U238 + D | 3.27E-03 | 0. | 1.94E-04 | 0. | 5.24E-04 | 0. | 5.66E-05 |
| NP237 + D | 2.36E-03 | 1.81E-04 | 9.79E-05 | 0. | 6.05E-04 | 0. | 8.16E-05 |
| NP238 | 5.83E-08 | 1.18E-09 | 9.08E-10 | 0. | 3.76E-09 | 0. | 4.04E-05 |
| NP239 | 5.25E-09 | 3.77E-10 | 2.65E-10 | 0. | 1.09E-09 | 0. | 2.79E-05 |
| PU238 | 1.25E-03 | 1.56E-04 | 3.16E-05 | 0. | 1.15E-04 | 0. | 7.50E-05 |
| PU239 | 1.36E-03 | 1.65E-04 | 3.31E-05 | 0. | 1.22E-04 | 0. | 6.85E-05 |
| PU240 | 1.36E-03 | 1.65E-04 | 3.31E-05 | 0. | 1.22E-04 | 0. | 6.98E-05 |
| PU241 + D | 4.00E-05 | 1.72E-06 | 8.04E-07 | 0. | 2.96E-06 | 0. | 1.44E-06 |
| PU242 | 1.26E-03 | 1.59E-04 | 3.19E-05 | 0. | 1.17E-04 | 0. | 6.71E-05 |
| PU244 | 1.47E-03 | 1.82E-04 | 3.65E-05 | 0. | 1.35E-04 | 0. | 1.00E-04 |
| AM241 | 1.43E-03 | 6.40E-04 | 1.02E-04 | 0. | 6.23E-04 | 0. | 7.64E-05 |
| AM242M | 1.47E-03 | 6.25E-04 | 1.04E-04 | 0. | 6.30E-04 | 0. | 9.61E-05 |
| AM243 | 1.41E-03 | 6.14E-04 | 9.83E-05 | 0. | 6.06E-04 | 0. | 8.95E-05 |
| CM242 | 8.80E-05 | 6.73E-05 | 5.84E-06 | 0. | 1.87E-05 | 0. | 8.16E-05 |
| CM243 | 1.33E-03 | 6.03E-04 | 8.24E-05 | 0. | 3.08E-04 | 0. | 8.03E-05 |
| CM244 | 1.11E-03 | 5.36E-04 | 6.93E-05 | 0. | 2.54E-04 | 0. | 7.77E-05 |
| CM245 | 1.76E-03 | 6.64E-04 | 1.05E-04 | 0. | 4.11E-04 | 0. | 7.24E-05 |
| CM246 | 1.74E-03 | 6.64E-04 | 1.05E-04 | 0. | 4.10E-04 | 0. | 7.11E-05 |
| CM247 + D | 1.70E-03 | 6.53E-04 | 1.03E-04 | 0. | 4.04E-04 | 0. | 9.35E-05 |
| CM248 | 1.41E-02 | 5.38E-03 | 8.52E-04 | 0. | 3.33E-03 | 0. | 1.51E-03 |
| CF252 | 1.07E-03 | 0. | 2.54E-05 | 0. | 0. | 0. | 2.96E-04 |

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| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
|-----------|----------|----------|------------|----------|----------|----------|-----------|
| H3 | 0. | 1.06E-07 | 1.06E-07 | 1.06E-07 | 1.06E-07 | 1.06E-07 | 1.06E-07 |
| BE10 | 4.48E-06 | 6.94E-07 | 1.13E-07 | 0. | 5.30E-07 | 0. | 2.84E-05 |
| C14 | 4.06E-06 | 8.12E-07 | 8.12E-07 | 8.12E-07 | 8.12E-07 | 8.12E-07 | 8.12E-07 |
| N13 | 1.15E-08 | 1.15E-08 | 1.15E-08 | 1.15E-08 | 1.15E-08 | 1.15E-08 | 1.15E-08 |
| F18 | 8.64E-07 | 0. | 9.47E-08 | 0. | 0. | 0. | 7.78E-08 |
| NA22 | 2.34E-05 | 2.34E-05 | 2.34E-05 | 2.34E-05 | 2.34E-05 | 2.34E-05 | 2.34E-05 |
| NA24 | 2.30E-06 | 2.30E-06 | 2.30E-06 | 2.30E-06 | 2.30E-06 | 2.30E-06 | 2.30E-06 |
| P32 | 2.76E-04 | 1.71E-05 | 1.07E-05 | 0. | 0. | 0. | 2.32E-05 |
| AR39 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| AR41 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| CA41 | 1.97E-04 | 0. | 2.13E-05 | 0. | 0. | 0. | 1.95E-07 |
| SC46 | 7.24E-09 | 1.41E-08 | 4.18E-09 | 0. | 1.35E-08 | 0. | 4.80E-05 |
| CR51 | 0. | 0. | 3.60E-09 | 2.00E-09 | 7.89E-10 | 5.14E-09 | 6.05E-07 |
| MN54 | 0. | 5.90E-06 | 1.17E-06 | 0. | 1.76E-06 | 0. | 1.21E-05 |
| MN56 | 0. | 1.58E-07 | 2.81E-08 | 0. | 2.00E-07 | 0. | 1.04E-05 |
| FE55 | 3.78E-06 | 2.68E-06 | 6.25E-07 | 0. | 0. | 1.70E-06 | 1.16E-06 |
| FE59 | 5.87E-06 | 1.37E-05 | 5.29E-06 | 0. | 0. | 4.32E-06 | 3.24E-05 |
| CO57 | 0. | 2.38E-07 | 3.99E-07 | 0. | 0. | 0. | 4.44E-06 |
| CO58 | 0. | 9.72E-07 | 2.24E-06 | 0. | 0. | 0. | 1.34E-05 |
| CO60 | 0. | 2.81E-06 | 6.33E-06 | 0. | 0. | 0. | 3.66E-05 |
| NI59 | 1.32E-05 | 4.66E-06 | 2.24E-06 | 0. | 0. | 0. | 7.31E-07 |
| NI63 | 1.77E-04 | 1.25E-05 | 6.00E-06 | 0. | 0. | 0. | 1.99E-06 |
| NI65 | 7.49E-07 | 9.57E-08 | 4.36E-08 | 0. | 0. | 0. | 5.193E-06 |
| CU64 | 0. | 1.15E-07 | 5.41E-08 | 0. | 2.91E-07 | 0. | 8.92E-06 |
| ZN65 | 5.76E-06 | 2.00E-05 | 9.33E-06 | 0. | 1.28E-05 | 0. | 8.47E-06 |
| ZN69M + D | 2.40E-07 | 5.66E-07 | 5.19E-08 | 0. | 3.44E-07 | 0. | 3.11E-05 |
| ZN69 | 1.47E-08 | 2.80E-08 | 1.96E-09 | 0. | 1.83E-08 | 0. | 5.16E-08 |
| SE79 | 0. | 3.73E-06 | 6.27E-07 | 0. | 6.50E-06 | 0. | 5.70E-07 |
| BR82 | 0. | 0. | 3.04E-06 | 0. | 0. | 0. | 0. |
| BR83 + D | 0. | 0. | 5.74E-08 | 0. | 0. | 0. | 0. |
| BR84 | 0. | 0. | 7.22E-08 | 0. | 0. | 0. | 0. |
| BR85 | 0. | 0. | 3.05E-09 | 0. | 0. | 0. | 0. |
| KR83M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR85M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR85 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR87 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR88 + D | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR89 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| RB86 | 0. | 2.98E-05 | 1.40E-05 | 0. | 0. | 0. | 4.41E-06 |
| RB87 | 0. | 1.75E-05 | 6.11E-06 | 0. | 0. | 0. | 6.11E-07 |
| RB88 | 0. | 8.52E-08 | 4.54E-08 | 0. | 0. | 0. | 7.30E-15 |
| RB89 + D | 0. | 5.50E-08 | 3.89E-08 | 0. | 0. | 0. | 8.43E-17 |
| SR89 + D | 4.40E-04 | 0. | 1.26E-05 | 0. | 0. | 0. | 5.24E-05 |
| SR90 + D | 8.30E-03 | 0. | 2.05E-03 | 0. | 0. | 0. | 2.33E-04 |
| SR91 + D | 8.07E-06 | 0. | 3.21E-07 | 0. | 0. | 0. | 3.66E-05 |
| SR92 + D | 3.05E-06 | 0. | 1.30E-07 | 0. | 0. | 0. | 7.77E-05 |

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| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
|----------|----------|----------|------------|----------|----------|----------|----------|
| Y90 | 1.37E-08 | 0. | 3.69E-10 | 0. | 0. | 0. | 1.13E-04 |
| Y91M+D | 1.29E-10 | 0. | 4.93E-12 | 0. | 0. | 0. | 6.09E-09 |
| Y91 | 2.01E-07 | 0. | 5.39E-09 | 0. | 0. | 0. | 8.24E-05 |
| Y92 | 1.21E-09 | 0. | 3.50E-11 | 0. | 0. | 0. | 3.32E-05 |
| Y93 | 3.83E-09 | 0. | 1.05E-10 | 0. | 0. | 0. | 1.17E-04 |
| ZR93 +D | 5.53E-08 | 2.73E-08 | 1.49E-08 | 0. | 9.65E-08 | 0. | 2.58E-05 |
| ZR95 +D | 4.12E-08 | 1.30E-08 | 8.94E-09 | 0. | 1.91E-08 | 0. | 3.00E-05 |
| ZR97 +D | 2.37E-09 | 4.69E-10 | 2.16E-10 | 0. | 7.11E-10 | 0. | 1.27E-04 |
| NB93M | 3.44E-08 | 1.13E-08 | 2.83E-09 | 0. | 1.32E-08 | 0. | 4.07E-06 |
| NB95 | 8.22E-09 | 4.56E-09 | 2.51E-09 | 0. | 4.42E-09 | 0. | 1.95E-05 |
| NB97 | 7.37E-11 | 1.83E-11 | 6.68E-12 | 0. | 2.14E-11 | 0. | 4.37E-07 |
| MO93 | 0. | 1.06E-05 | 2.90E-07 | 0. | 3.04E-06 | 0. | 1.29E-06 |
| MO99 +D | 0. | 6.03E-06 | 1.15E-06 | 0. | 1.38E-05 | 0. | 1.08E-05 |
| TC99M | 3.32E-10 | 9.26E-10 | 1.20E-08 | 0. | 1.38E-08 | 5.14E-10 | 6.08E-07 |
| TC99 | 1.79E-07 | 2.63E-07 | 7.17E-08 | 0. | 3.34E-06 | 2.72E-08 | 6.44E-06 |
| TC101 | 3.60E-10 | 5.12E-10 | 5.03E-09 | 0. | 9.26E-09 | 3.12E-10 | 8.75E-17 |
| RU103+D | 2.55E-07 | 0. | 1.09E-07 | 0. | 8.99E-07 | 0. | 2.13E-05 |
| RU105+D | 2.18E-08 | 0. | 8.46E-09 | 0. | 2.75E-07 | 0. | 1.76E-05 |
| RU106+D | 3.92E-06 | 0. | 4.94E-07 | 0. | 7.56E-06 | 0. | 1.88E-04 |
| RH105 | 1.73E-07 | 1.25E-07 | 8.20E-08 | 0. | 5.31E-07 | 0. | 1.59E-05 |
| PD107 | 0. | 2.08E-07 | 1.34E-08 | 0. | 1.88E-06 | 0. | 9.66E-07 |
| PD109 | 0. | 2.51E-07 | 5.70E-08 | 0. | 1.45E-06 | 0. | 2.53E-05 |
| AG110M+D | 2.05E-07 | 1.94E-07 | 1.18E-07 | 0. | 3.70E-07 | 0. | 5.45E-05 |
| AG111 | 8.29E-08 | 3.44E-08 | 1.73E-08 | 0. | 1.12E-07 | 0. | 4.80E-05 |
| CD113M | 0. | 4.51E-06 | 1.45E-07 | 0. | 4.99E-06 | 0. | 2.71E-05 |
| CD115M | 0. | 2.60E-06 | 8.39E-08 | 0. | 2.08E-06 | 0. | 8.23E-05 |
| SN123 | 4.44E-05 | 7.29E-07 | 1.08E-06 | 5.84E-07 | 0. | 0. | 6.71E-05 |
| SN125 +D | 1.19E-05 | 2.37E-07 | 5.37E-07 | 1.86E-07 | 0. | 0. | 1.12E-04 |
| SN126 +D | 1.16E-04 | 2.16E-06 | 3.30E-06 | 5.69E-07 | 0. | 0. | 2.58E-05 |
| SB124 | 3.87E-06 | 7.13E-08 | 1.51E-06 | 8.78E-07 | 0. | 3.38E-06 | 7.80E-05 |
| SB125 +D | 2.48E-06 | 2.71E-08 | 5.80E-07 | 2.37E-09 | 0. | 2.18E-06 | 1.93E-05 |
| SB126 | 1.59E-06 | 3.25E-08 | 5.71E-07 | 8.99E-09 | 0. | 1.14E-06 | 9.41E-05 |
| SB127 | 3.63E-07 | 7.76E-09 | 1.37E-07 | 4.08E-09 | 0. | 2.47E-07 | 6.16E-05 |
| TE125M | 3.83E-06 | 1.38E-06 | 5.12E-07 | 1.07E-06 | 0. | 0. | 1.13E-05 |
| TE127M+D | 9.67E-06 | 3.43E-06 | 1.15E-06 | 2.30E-06 | 3.92E-05 | 0. | 2.41E-05 |
| TE127 | 1.58E-07 | 5.60E-08 | 3.40E-08 | 1.09E-07 | 6.40E-07 | 0. | 1.22E-05 |
| TE129M+D | 1.63E-05 | 6.05E-06 | 2.58E-06 | 5.26E-06 | 6.82E-05 | 0. | 6.12E-05 |
| TE129 | 4.48E-08 | 1.67E-08 | 1.09E-08 | 3.20E-08 | 1.88E-07 | 0. | 2.45E-07 |
| TE131M+D | 2.44E-06 | 1.17E-06 | 9.76E-07 | 1.76E-06 | 1.22E-05 | 0. | 9.39E-05 |
| TE131 +D | 2.79E-08 | 1.15E-08 | 8.72E-09 | 2.15E-08 | 1.22E-07 | 0. | 2.29E-09 |
| TE132 +D | 3.49E-06 | 2.21E-06 | 2.08E-06 | 2.33E-06 | 2.12E-05 | 0. | 7.00E-05 |
| TE133M+D | 6.44E-08 | 3.66E-08 | 3.56E-08 | 5.11E-08 | 3.62E-07 | 0. | 1.48E-07 |
| TE134 +D | 4.47E-08 | 2.87E-08 | 3.00E-08 | 3.67E-08 | 2.74E-07 | 0. | 1.66E-09 |
| I129 | 4.66E-06 | 3.92E-06 | 6.54E-06 | 4.77E-03 | 7.01E-06 | 0. | 4.57E-07 |
| I130 | 1.03E-06 | 2.98E-06 | 1.19E-06 | 2.43E-04 | 4.59E-06 | 0. | 2.29E-06 |
| I131 +D | 5.85E-06 | 8.19E-06 | 4.40E-06 | 2.39E-03 | 1.41E-05 | 0. | 1.62E-06 |

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| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
|----------|----------|----------|------------|----------|----------|----------|----------|
| I132 | 2.79E-07 | 7.30E-07 | 2.62E-07 | 2.46E-05 | 1.15E-06 | 0. | 3.18E-07 |
| I133+D | 2.01E-06 | 3.41E-06 | 1.04E-06 | 4.76E-04 | 5.98E-06 | 0. | 2.58E-06 |
| I134 | 1.46E-07 | 3.87E-07 | 1.39E-07 | 6.45E-06 | 6.10E-07 | 0. | 5.10E-09 |
| I135+D | 6.10E-07 | 1.57E-06 | 5.82E-07 | 1.01E-04 | 2.48E-06 | 0. | 1.74E-06 |
| XE131M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE133M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE133 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE135M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE135 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE137 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE138+D | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| CS134M+D | 2.94E-08 | 6.09E-08 | 3.13E-08 | 0. | 3.39E-08 | 5.95E-09 | 4.05E-08 |
| CS134 | 8.37E-05 | 1.97E-04 | 9.14E-05 | 0. | 6.26E-05 | 2.39E-05 | 2.45E-06 |
| CS135 | 2.78E-05 | 2.55E-05 | 5.96E-06 | 0. | 9.73E-06 | 3.52E-06 | 4.46E-07 |
| CS136 | 8.59E-06 | 3.38E-05 | 2.27E-05 | 0. | 1.84E-05 | 2.90E-06 | 2.72E-06 |
| CS137+D | 1.12E-04 | 1.49E-04 | 5.19E-05 | 0. | 5.07E-05 | 1.97E-05 | 2.12E-06 |
| CS138 | 7.76E-08 | 1.49E-07 | 7.45E-08 | 0. | 1.10E-07 | 1.28E-08 | 6.76E-11 |
| CS139+D | 4.87E-08 | 7.17E-08 | 2.63E-08 | 0. | 5.79E-08 | 6.34E-09 | 3.33E-23 |
| BA139 | 1.39E-07 | 9.78E-11 | 4.05E-09 | 0. | 9.22E-11 | 6.74E-11 | 1.24E-06 |
| BA140+D | 2.84E-05 | 3.48E-08 | 1.83E-06 | 0. | 1.18E-08 | 2.34E-08 | 4.38E-05 |
| BA141+D | 6.71E-08 | 5.01E-11 | 2.24E-09 | 0. | 4.65E-11 | 3.43E-11 | 1.43E-13 |
| BA142+D | 2.99E-08 | 2.99E-11 | 1.84E-09 | 0. | 2.53E-11 | 1.99E-11 | 9.18E-20 |
| LA140 | 3.48E-09 | 1.71E-09 | 4.55E-10 | 0. | 0. | 0. | 9.82E-05 |
| LA141 | 4.55E-10 | 1.40E-10 | 2.31E-11 | 0. | 0. | 0. | 2.48E-05 |
| LA142 | 1.79E-10 | 7.95E-11 | 1.98E-11 | 0. | 0. | 0. | 2.42E-06 |
| CE141 | 1.33E-08 | 8.88E-09 | 1.02E-09 | 0. | 4.18E-09 | 0. | 2.54E-05 |
| CE143+D | 2.35E-09 | 1.71E-06 | 1.91E-10 | 0. | 7.67E-10 | 0. | 5.14E-05 |
| CE144+D | 6.96E-07 | 2.88E-07 | 3.74E-08 | 0. | 1.72E-07 | 0. | 1.75E-04 |
| PR143 | 1.31E-08 | 5.23E-09 | 6.52E-10 | 0. | 3.04E-09 | 0. | 4.31E-05 |
| PR144 | 4.30E-11 | 1.76E-11 | 2.18E-12 | 0. | 1.01E-11 | 0. | 4.74E-14 |
| ND147+D | 9.38E-09 | 1.02E-08 | 6.11E-10 | 0. | 5.99E-09 | 0. | 3.68E-05 |
| PM147 | 1.05E-07 | 9.96E-09 | 4.06E-09 | 0. | 1.90E-08 | 0. | 9.47E-06 |
| PM148M+D | 4.14E-08 | 1.05E-08 | 8.21E-09 | 0. | 1.59E-08 | 0. | 6.61E-05 |
| PM148 | 1.02E-08 | 1.66E-09 | 8.36E-10 | 0. | 3.00E-09 | 0. | 9.90E-05 |
| PM149 | 2.17E-09 | 3.05E-10 | 1.25E-10 | 0. | 5.81E-10 | 0. | 4.49E-05 |
| PM151 | 9.87E-10 | 1.63E-10 | 8.25E-11 | 0. | 2.93E-10 | 0. | 3.66E-05 |
| SM151 | 8.73E-08 | 1.68E-08 | 3.94E-09 | 0. | 1.84E-08 | 0. | 5.70E-06 |
| SM153 | 1.22E-09 | 1.01E-09 | 7.43E-11 | 0. | 3.30E-10 | 0. | 2.85E-05 |
| EU152 | 2.45E-07 | 5.90E-08 | 5.20E-08 | 0. | 2.74E-07 | 0. | 2.17E-05 |
| EU154 | 7.91E-07 | 1.02E-07 | 7.19E-08 | 0. | 4.56E-07 | 0. | 5.39E-05 |
| EU155 | 1.74E-07 | 1.68E-08 | 1.04E-08 | 0. | 6.57E-08 | 0. | 9.63E-05 |
| EU156 | 1.92E-08 | 1.44E-08 | 2.35E-09 | 0. | 9.69E-09 | 0. | 7.36E-05 |
| TB160 | 6.47E-08 | 0. | 8.07E-09 | 0. | 2.56E-08 | 0. | 4.19E-05 |
| HO166M | 3.57E-07 | 1.10E-07 | 7.96E-08 | 0. | 1.61E-07 | 0. | 0. |
| W181 | 1.42E-08 | 4.58E-09 | 4.79E-10 | 0. | 0. | 0. | 3.90E-07 |
| W185 | 5.79E-07 | 1.91E-07 | 2.02E-08 | 0. | 0. | 0. | 1.65E-05 |
| W187 | 1.46E-07 | 1.19E-07 | 4.17E-08 | 0. | 0. | 0. | 3.22E-05 |

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| TEEN INGESTION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INGESTED IN FIRST YR) | | | | | | | |
|--|----------|----------|------------|---------|----------|------|----------|
| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
| PB210 + D | 1.81E-02 | 5.44E-03 | 7.01E-04 | 0. | 1.72E-02 | 0. | 5.74E-05 |
| BI210 + D | 6.59E-07 | 4.51E-06 | 5.66E-08 | 0. | 5.48E-05 | 0. | 5.15E-05 |
| PO210 | 6.09E-04 | 1.07E-03 | 1.23E-04 | 0. | 3.60E-03 | 0. | 6.75E-05 |
| RN222 + D | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| RA223 + D | 7.11E-03 | 1.08E-05 | 1.42E-03 | 0. | 3.10E-04 | 0. | 3.43E-04 |
| RA224 + D | 2.31E-03 | 5.52E-06 | 4.61E-04 | 0. | 1.58E-04 | 0. | 3.71E-04 |
| RA225 + D | 9.37E-03 | 1.10E-05 | 1.87E-03 | 0. | 3.15E-04 | 0. | 3.27E-04 |
| RA226 + D | 3.22E-01 | 8.13E-06 | 2.39E-01 | 0. | 2.32E-04 | 0. | 3.51E-04 |
| RA228 + D | 1.37E-01 | 4.41E-06 | 1.51E-01 | 0. | 1.26E-04 | 0. | 5.98E-05 |
| AC225 | 6.29E-06 | 8.59E-06 | 4.22E-07 | 0. | 9.85E-07 | 0. | 4.36E-04 |
| AC227 + D | 2.05E-03 | 3.03E-04 | 1.22E-04 | 0. | 8.81E-05 | 0. | 8.68E-05 |
| TH227 + D | 1.96E-05 | 3.52E-07 | 5.65E-07 | 0. | 2.01E-06 | 0. | 5.75E-04 |
| TH228 + D | 6.80E-04 | 1.14E-05 | 2.30E-05 | 0. | 6.41E-05 | 0. | 5.97E-04 |
| TH229 | 8.39E-03 | 1.26E-04 | 4.11E-04 | 0. | 6.10E-04 | 0. | 5.43E-04 |
| TH230 | 2.16E-03 | 1.23E-04 | 6.00E-05 | 0. | 5.99E-04 | 0. | 6.38E-05 |
| TH232 + D | 2.42E-03 | 1.05E-04 | 1.63E-04 | 0. | 5.11E-04 | 0. | 5.43E-05 |
| TH234 | 1.14E-07 | 6.68E-09 | 3.31E-09 | 0. | 3.81E-08 | 0. | 1.21E-04 |
| PA231 + D | 4.31E-03 | 1.62E-04 | 1.68E-04 | 0. | 9.10E-04 | 0. | 7.60E-05 |
| PA233 | 7.33E-09 | 1.41E-09 | 1.26E-09 | 0. | 5.32E-09 | 0. | 1.61E-05 |
| U232 + D | 5.89E-03 | 0. | 4.21E-04 | 0. | 6.38E-04 | 0. | 7.19E-05 |
| U233 + D | 1.24E-03 | 0. | 7.54E-05 | 0. | 2.90E-04 | 0. | 6.65E-05 |
| U234 | 1.19E-03 | 0. | 7.39E-05 | 0. | 2.85E-04 | 0. | 6.51E-05 |
| U235 + D | 1.14E-03 | 0. | 6.94E-05 | 0. | 2.67E-04 | 0. | 8.28E-05 |
| U236 | 1.14E-03 | 0. | 7.09E-05 | 0. | 2.73E-04 | 0. | 6.11E-05 |
| U237 | 7.89E-08 | 0. | 2.10E-08 | 0. | 3.24E-07 | 0. | 2.09E-05 |
| U238 + D | 1.09E-03 | 0. | 6.49E-05 | 0. | 2.50E-04 | 0. | 5.83E-05 |
| NP237 + D | 1.44E-03 | 1.25E-04 | 5.85E-05 | 0. | 4.33E-04 | 0. | 8.41E-05 |
| NP238 | 1.95E-08 | 5.22E-10 | 3.04E-10 | 0. | 1.79E-09 | 0. | 3.83E-05 |
| NP239 | 1.76E-09 | 1.66E-10 | 9.22E-11 | 0. | 5.21E-10 | 0. | 2.67E-05 |
| PU238 | 7.21E-04 | 1.02E-04 | 1.82E-05 | 0. | 7.80E-05 | 0. | 7.73E-05 |
| PU239 | 8.27E-04 | 1.12E-04 | 2.01E-05 | 0. | 8.57E-05 | 0. | 7.06E-05 |
| PU240 | 8.26E-04 | 1.12E-04 | 2.01E-05 | 0. | 8.56E-05 | 0. | 7.19E-05 |
| PU241 + D | 1.84E-05 | 9.42E-07 | 3.69E-07 | 0. | 1.71E-06 | 0. | 1.48E-06 |
| PU242 | 7.66E-04 | 1.08E-04 | 1.94E-05 | 0. | 8.25E-05 | 0. | 6.92E-05 |
| PU244 | 8.95E-04 | 1.23E-04 | 2.22E-05 | 0. | 9.45E-05 | 0. | 1.03E-04 |
| AM241 | 8.62E-04 | 3.29E-04 | 5.75E-05 | 0. | 4.31E-04 | 0. | 7.87E-05 |
| AM242M | 8.70E-04 | 3.19E-04 | 5.80E-05 | 0. | 4.30E-04 | 0. | 9.90E-05 |
| AM243 | 8.60E-04 | 3.17E-04 | 5.62E-05 | 0. | 4.22E-04 | 0. | 9.23E-05 |
| CM242 | 2.94E-05 | 2.97E-05 | 1.95E-06 | 0. | 8.89E-06 | 0. | 8.40E-05 |
| CM243 | 6.91E-04 | 2.86E-04 | 4.09E-05 | 0. | 1.91E-04 | 0. | 8.28E-05 |
| CM244 | 5.32E-04 | 2.49E-04 | 3.19E-05 | 0. | 1.49E-04 | 0. | 8.00E-05 |
| CM245 | 1.07E-03 | 3.33E-04 | 6.10E-05 | 0. | 2.85E-04 | 0. | 7.46E-05 |
| CM246 | 1.06E-03 | 3.32E-04 | 6.09E-05 | 0. | 2.84E-04 | 0. | 7.33E-05 |
| CM247 + D | 1.03E-03 | 3.27E-04 | 6.00E-05 | 0. | 2.80E-04 | 0. | 9.63E-05 |
| CM248 | 8.60E-03 | 2.69E-03 | 4.95E-04 | 0. | 2.31E-03 | 0. | 1.55E-03 |
| CR252 | 3.51E-04 | 0. | 8.37E-06 | 0. | 0. | 0. | 3.05E-04 |

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| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
|-----------|----------|----------|------------|----------|----------|----------|----------|
| H3 | 0. | 1.05E-07 | 1.05E-07 | 1.05E-07 | 1.05E-07 | 1.05E-07 | 1.05E-07 |
| BE10 | 3.18E-06 | 4.91E-07 | 7.94E-08 | 0. | 3.71E-07 | 0. | 2.68E-05 |
| C14 | 2.84E-06 | 5.68E-07 | 5.68E-07 | 5.68E-07 | 5.68E-07 | 5.68E-07 | 5.68E-07 |
| N13 | 8.36E-09 | 8.36E-09 | 8.36E-09 | 8.36E-09 | 8.36E-09 | 8.36E-09 | 8.36E-09 |
| F18 | 6.24E-07 | 0. | 6.92E-08 | 0. | 0. | 0. | 1.85E-08 |
| NA22 | 1.74E-05 | 1.74E-05 | 1.74E-05 | 1.74E-05 | 1.74E-05 | 1.74E-05 | 1.74E-05 |
| NA24 | 1.70E-06 | 1.70E-06 | 1.70E-06 | 1.70E-06 | 1.70E-06 | 1.70E-06 | 1.70E-06 |
| P32 | 1.93E-04 | 1.20E-05 | 7.46E-06 | 0. | 0. | 0. | 2.17E-05 |
| AR39 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| AR41 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| CA41 | 1.83E-05 | 0. | 2.00E-05 | 0. | 0. | 0. | 1.84E-07 |
| SC46 | 5.51E-09 | 1.07E-08 | 3.11E-09 | 0. | 9.99E-09 | 0. | 5.21E-05 |
| CR51 | 0. | 0. | 2.66E-09 | 1.59E-09 | 5.86E-10 | 3.53E-09 | 6.69E-07 |
| MN54 | 0. | 4.57E-06 | 8.72E-07 | 0. | 1.36E-06 | 0. | 1.40E-05 |
| MN56 | 0. | 1.15E-07 | 2.04E-08 | 0. | 1.46E-07 | 0. | 3.67E-06 |
| FE55 | 2.75E-06 | 1.90E-06 | 4.43E-07 | 0. | 0. | 1.06E-06 | 1.09E-06 |
| FE59 | 4.34E-06 | 1.02E-05 | 3.91E-06 | 0. | 0. | 2.85E-06 | 3.40E-05 |
| CO57 | 0. | 1.75E-07 | 2.91E-07 | 0. | 0. | 0. | 4.44E-06 |
| CO58 | 0. | 7.45E-07 | 1.67E-06 | 0. | 0. | 0. | 1.51E-05 |
| CO60 | 0. | 2.14E-06 | 4.72E-06 | 0. | 0. | 0. | 4.02E-05 |
| NI59 | 9.76E-06 | 3.35E-06 | 1.63E-06 | 0. | 0. | 0. | 6.90E-07 |
| NI63 | 1.30E-04 | 9.01E-06 | 4.36E-06 | 0. | 0. | 0. | 1.88E-06 |
| NI65 | 5.28E-07 | 6.86E-08 | 3.13E-08 | 0. | 0. | 0. | 1.74E-06 |
| CU64 | 0. | 8.33E-08 | 3.91E-08 | 0. | 2.10E-07 | 0. | 7.10E-06 |
| ZN65 | 4.84E-06 | 1.54E-05 | 6.96E-06 | 0. | 1.03E-05 | 0. | 9.70E-06 |
| ZN69M + D | 1.70E-07 | 4.08E-07 | 3.73E-08 | 0. | 2.47E-07 | 0. | 2.49E-05 |
| ZN69 | 1.03E-08 | 1.97E-08 | 1.37E-09 | 0. | 1.28E-08 | 0. | 2.96E-09 |
| SE79 | 0. | 2.63E-06 | 4.39E-07 | 0. | 4.55E-06 | 0. | 5.38E-07 |
| BR82 | 0. | 0. | 2.26E-06 | 0. | 0. | 0. | 2.59E-06 |
| BR83 + D | 0. | 0. | 4.02E-08 | 0. | 0. | 0. | 5.79E-08 |
| BR84 | 0. | 0. | 5.21E-08 | 0. | 0. | 0. | 4.09E-13 |
| BR85 | 0. | 0. | 2.14E-09 | 0. | 0. | 0. | 0. |
| KR83M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR85M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR85 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR87 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR88 + D | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| KR89 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| RB86 | 0. | 2.11E-05 | 9.83E-06 | 0. | 0. | 0. | 4.16E-06 |
| RB87 | 0. | 1.23E-05 | 4.28E-06 | 0. | 0. | 0. | 5.76E-07 |
| RB88 | 0. | 6.05E-08 | 3.21E-08 | 0. | 0. | 0. | 8.36E-19 |
| RB89 + D | 0. | 4.01E-08 | 2.82E-08 | 0. | 0. | 0. | 2.33E-21 |
| SR89 + D | 3.08E-04 | 0. | 8.84E-06 | 0. | 0. | 0. | 4.94E-05 |
| SR90 + D | 7.58E-03 | 0. | 1.86E-03 | 0. | 0. | 0. | 2.19E-04 |
| SR91 + D | 5.67E-06 | 0. | 2.29E-07 | 0. | 0. | 0. | 2.70E-05 |
| SR92 + D | 2.15E-06 | 0. | 9.30E-08 | 0. | 0. | 0. | 4.26E-05 |

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| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
|------------|----------|----------|------------|----------|----------|----------|----------|
| Y90 | 9.62E-09 | 0. | 2.58E-10 | 0. | 0. | 0. | 1.02E-04 |
| Y91M+D | 9.09E-11 | 0. | 3.52E-12 | 0. | 0. | 0. | 2.67E-10 |
| Y91 | 1.41E-07 | 0. | 3.77E-09 | 0. | 0. | 0. | 7.76E-05 |
| Y92 | 8.45E-10 | 0. | 2.47E-11 | 0. | 0. | 0. | 1.48E-05 |
| Y93 | 2.68E-09 | 0. | 7.40E-11 | 0. | 0. | 0. | 8.50E-05 |
| ZR93 + D | 4.18E-08 | 2.34E-09 | 1.09E-09 | 0. | 8.87E-09 | 0. | 2.43E-06 |
| ZR95 + D | 3.04E-08 | 9.75E-09 | 6.60E-09 | 0. | 1.53E-08 | 0. | 3.09E-05 |
| ZR97 + D | 1.68E-09 | 3.39E-10 | 1.55E-10 | 0. | 5.12E-10 | 0. | 1.05E-04 |
| NB93M | 2.55E-08 | 8.32E-09 | 2.05E-09 | 0. | 9.57E-09 | 0. | 3.84E-06 |
| NB95 | 6.22E-09 | 3.46E-09 | 1.86E-09 | 0. | 3.42E-09 | 0. | 2.10E-05 |
| NB97 | 5.22E-11 | 1.32E-11 | 4.82E-12 | 0. | 1.54E-11 | 0. | 4.87E-08 |
| MO93 | 0. | 7.51E-06 | 2.03E-07 | 0. | 2.13E-06 | 0. | 1.22E-06 |
| MO99 + D | 0. | 4.31E-06 | 8.20E-07 | 0. | 9.76E-06 | 0. | 9.99E-06 |
| TC99M | 2.47E-10 | 6.98E-10 | 8.89E-09 | 0. | 1.06E-08 | 3.42E-10 | 4.13E-07 |
| TC99 | 1.25E-07 | 1.86E-07 | 5.02E-08 | 0. | 2.34E-06 | 1.58E-08 | 6.08E-06 |
| TC101 | 2.54E-10 | 3.66E-10 | 3.59E-09 | 0. | 6.59E-09 | 1.87E-10 | 1.10E-21 |
| RU103 + D | 1.85E-07 | 0. | 7.97E-08 | 0. | 7.06E-07 | 0. | 2.16E-05 |
| RU105 + D | 1.54E-08 | 0. | 6.08E-09 | 0. | 1.99E-07 | 0. | 9.42E-06 |
| RU106 + D | 2.75E-06 | 0. | 3.48E-07 | 0. | 5.31E-06 | 0. | 1.78E-04 |
| RH105 | 1.21E-07 | 8.85E-08 | 5.83E-08 | 0. | 3.76E-07 | 0. | 1.41E-05 |
| PD107 | 0. | 1.47E-07 | 9.40E-09 | 0. | 1.32E-06 | 0. | 9.11E-07 |
| PD109 | 0. | 1.77E-07 | 3.99E-08 | 0. | 1.01E-06 | 0. | 1.96E-05 |
| AG110M + D | 1.60E-07 | 1.48E-07 | 8.79E-08 | 0. | 2.91E-07 | 0. | 6.04E-05 |
| AG111 | 5.81E-08 | 2.43E-08 | 1.21E-08 | 0. | 7.84E-08 | 0. | 4.46E-05 |
| CD113M | 0. | 3.18E-06 | 1.02E-07 | 0. | 3.50E-06 | 0. | 2.56E-05 |
| CD115M | 0. | 1.84E-06 | 5.87E-08 | 0. | 1.46E-06 | 0. | 7.74E-05 |
| SN123 | 3.11E-05 | 5.15E-07 | 7.59E-07 | 4.38E-07 | 0. | 0. | 6.33E-05 |
| SN125 + D | 8.33E-06 | 1.68E-07 | 3.78E-07 | 1.39E-07 | 0. | 0. | 1.04E-04 |
| SN126 + D | 8.45E-05 | 1.67E-06 | 2.40E-06 | 4.92E-07 | 0. | 0. | 2.43E-05 |
| SB124 | 2.80E-06 | 5.29E-08 | 1.11E-06 | 6.79E-09 | 0. | 2.18E-06 | 7.95E-05 |
| SB125 + D | 1.79E-06 | 2.00E-08 | 4.26E-07 | 1.82E-09 | 0. | 1.38E-06 | 1.97E-05 |
| SB126 | 1.15E-06 | 2.34E-08 | 4.15E-07 | 7.04E-09 | 0. | 7.05E-07 | 9.40E-05 |
| SB127 | 2.58E-07 | 5.65E-09 | 9.90E-08 | 3.10E-09 | 0. | 1.53E-07 | 5.90E-05 |
| TE125M | 2.68E-06 | 9.71E-07 | 3.59E-07 | 8.06E-07 | 1.09E-05 | 0. | 1.07E-05 |
| TE125M + D | 6.77E-06 | 2.42E-06 | 8.25E-07 | 1.73E-06 | 2.75E-05 | 0. | 2.27E-05 |
| TE127 | 1.10E-07 | 3.95E-08 | 2.38E-08 | 8.15E-08 | 4.48E-07 | 0. | 8.68E-06 |
| TE129M + D | 1.15E-05 | 4.29E-06 | 1.82E-06 | 3.95E-06 | 4.80E-05 | 0. | 5.79E-05 |
| TE129 | 3.14E-08 | 1.18E-08 | 7.65E-09 | 2.41E-08 | 1.32E-07 | 0. | 2.37E-08 |
| TE131M + D | 1.73E-06 | 8.46E-07 | 7.05E-07 | 1.34E-06 | 8.57E-06 | 0. | 8.40E-05 |
| TE131 + D | 1.97E-08 | 8.23E-09 | 6.22E-09 | 1.62E-08 | 8.63E-08 | 0. | 2.79E-09 |
| TE132 + D | 2.52E-06 | 1.63E-06 | 1.53E-06 | 1.80E-06 | 1.57E-05 | 0. | 7.71E-05 |
| TE133M + D | 4.62E-08 | 2.70E-08 | 2.60E-08 | 3.91E-08 | 2.67E-07 | 0. | 6.64E-08 |
| TE134 + D | 3.24E-08 | 2.12E-08 | 1.30E-08 | 2.83E-08 | 2.05E-07 | 0. | 3.59E-11 |
| I129 | 3.27E-06 | 2.81E-06 | 9.21E-06 | 7.23E-03 | 6.04E-06 | 0. | 4.44E-07 |
| I130 | 7.56E-07 | 2.23E-06 | 8.80E-07 | 1.89E-04 | 3.48E-06 | 0. | 1.92E-06 |
| I131 + D | 4.16E-06 | 5.95E-06 | 3.41E-06 | 1.95E-03 | 1.02E-05 | 0. | 1.57E-06 |

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ADULT INGESTION DOSE COMMITMENT FACTORS (MREM/50Y PER PCI INGESTED IN FIRST YR)

| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
|------------|----------|----------|------------|----------|----------|----------|----------|
| I132 | 2.03E-07 | 5.43E-07 | 1.90E-07 | 1.90E-05 | 8.65E-07 | 0. | 1.02E-07 |
| I133 + D | 1.42E-06 | 2.47E-06 | 7.53E-07 | 3.63E-04 | 4.31E-06 | 0. | 2.22E-06 |
| I134 | 1.06E-07 | 2.88E-07 | 1.03E-07 | 4.99E-06 | 4.58E-07 | 0. | 2.51E-10 |
| I135 + D | 4.43E-07 | 1.16E-06 | 4.28E-07 | 7.65E-05 | 1.86E-06 | 0. | 1.31E-06 |
| XE131M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE133M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE133 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE135M | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE135 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE137 | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| XE138 + D | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| CS134M + D | 2.13E-08 | 4.48E-08 | 2.29E-08 | 0. | 2.43E-08 | 3.83E-09 | 1.58E-08 |
| CS134 | 6.22E-05 | 1.48E-04 | 1.21E-04 | 0. | 4.79E-05 | 1.59E-05 | 2.59E-06 |
| CS135 | 1.95E-05 | 1.80E-05 | 7.99E-06 | 0. | 6.81E-06 | 2.04E-06 | 4.21E-07 |
| CS136 | 6.51E-06 | 2.57E-05 | 1.85E-05 | 0. | 1.43E-05 | 1.96E-06 | 2.92E-06 |
| CS137 + D | 7.97E-05 | 1.09E-04 | 7.14E-05 | 0. | 3.70E-05 | 1.23E-05 | 2.11E-06 |
| CS138 | 6.52E-08 | 1.09E-07 | 5.40E-08 | 0. | 8.01E-08 | 7.91E-09 | 4.65E-13 |
| CS139 + D | 3.41E-08 | 5.08E-08 | 1.85E-08 | 0. | 4.07E-08 | 3.70E-09 | 1.10E-30 |
| BA139 | 9.70E-08 | 6.91E-11 | 2.84E-09 | 0. | 6.46E-11 | 3.92E-11 | 1.72E-07 |
| BA140 + D | 2.03E-05 | 2.55E-08 | 1.33E-06 | 0. | 8.67E-09 | 1.46E-08 | 4.18E-05 |
| BA141 + D | 4.71E-08 | 3.56E-11 | 1.59E-09 | 0. | 3.31E-11 | 2.02E-11 | 2.22E-17 |
| BA142 + D | 2.13E-08 | 2.19E-11 | 1.34E-09 | 0. | 1.85E-11 | 1.24E-11 | 3.00E-26 |
| LA140 | 2.50E-09 | 1.26E-09 | 3.33E-10 | 0. | 0. | 0. | 9.25E-05 |
| LA141 | 3.19E-10 | 9.90E-11 | 1.62E-11 | 0. | 0. | 0. | 1.18E-05 |
| LA142 | 1.28E-10 | 5.82E-11 | 1.45E-11 | 0. | 0. | 0. | 4.25E-07 |
| CE141 | 9.36E-09 | 6.33E-09 | 7.18E-10 | 0. | 2.94E-09 | 0. | 2.42E-05 |
| CE143 + D | 1.65E-09 | 1.22E-06 | 1.35E-10 | 0. | 5.37E-10 | 0. | 4.56E-05 |
| CE144 + D | 4.88E-07 | 2.04E-07 | 2.62E-08 | 0. | 1.21E-07 | 0. | 1.65E-04 |
| PR143 | 9.20E-09 | 3.69E-09 | 4.56E-10 | 0. | 2.13E-09 | 0. | 4.03E-05 |
| PR144 | 3.01E-11 | 1.25E-11 | 1.53E-12 | 0. | 7.05E-12 | 0. | 4.33E-18 |
| ND147 + D | 6.29E-09 | 7.27E-09 | 4.35E-10 | 0. | 4.25E-09 | 0. | 3.49E-05 |
| PM147 | 7.54E-08 | 7.09E-09 | 2.87E-09 | 0. | 1.34E-08 | 0. | 8.93E-06 |
| PM148M + D | 3.07E-08 | 7.95E-09 | 6.08E-09 | 0. | 1.20E-08 | 0. | 6.74E-05 |
| PM148 | 7.17E-09 | 1.19E-09 | 5.99E-10 | 0. | 2.25E-09 | 0. | 9.35E-05 |
| PM149 | 1.52E-09 | 2.15E-10 | 8.78E-11 | 0. | 4.06E-10 | 0. | 4.03E-05 |
| PM151 | 6.97E-10 | 1.17E-10 | 5.91E-11 | 0. | 2.09E-10 | 0. | 3.22E-05 |
| SM151 | 6.90E-08 | 1.19E-08 | 2.85E-09 | 0. | 1.33E-08 | 0. | 5.25E-06 |
| SM153 | 8.57E-10 | 7.15E-10 | 5.22E-11 | 0. | 2.31E-10 | 0. | 2.55E-05 |
| EU152 | 1.95E-07 | 4.44E-08 | 3.90E-08 | 0. | 2.75E-07 | 0. | 2.56E-05 |
| EU154 | 6.15E-07 | 7.56E-08 | 5.38E-08 | 0. | 3.62E-07 | 0. | 5.48E-05 |
| EU155 | 8.60E-08 | 1.22E-08 | 7.87E-09 | 0. | 5.63E-08 | 0. | 9.60E-06 |
| EU156 | 1.37E-08 | 1.06E-08 | 1.71E-09 | 0. | 7.08E-09 | 0. | 7.26E-05 |
| TB160 | 4.70E-08 | 0. | 5.86E-09 | 0. | 1.94E-08 | 0. | 4.33E-05 |
| HO166M | 2.70E-07 | 8.43E-08 | 6.40E-08 | 0. | 1.26E-07 | 0. | 0. |
| W181 | 9.91E-09 | 3.23E-09 | 3.46E-10 | 0. | 0. | 0. | 3.68E-07 |
| W185 | 4.05E-07 | 1.35E-07 | 1.42E-08 | 0. | 0. | 0. | 1.56E-05 |
| W187 | 1.03E-07 | 8.61E-08 | 3.01E-08 | 0. | 0. | 0. | 2.82E-05 |

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| ISOTOPE | BONE | LIVER | TOTAL BODY | THYROID | KIDNEY | LUNG | GI-LLI |
|----------|----------|----------|------------|---------|----------|------|----------|
| PB210 +D | 1.53E-02 | 4.37E-03 | 5.44E-04 | 0. | 1.23E-02 | 0. | 5.42E-05 |
| BI210 +D | 4.61E-07 | 3.18E-06 | 3.96E-08 | 0. | 3.83E-05 | 0. | 4.75E-05 |
| PO210 | 3.56E-04 | 7.56E-04 | 8.59E-05 | 0. | 2.52E-03 | 0. | 6.36E-05 |
| RN222 +D | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| RA223 +D | 4.97E-03 | 7.65E-06 | 9.94E-04 | 0. | 2.17E-04 | 0. | 3.21E-04 |
| RA224 +D | 1.61E-03 | 3.90E-06 | 3.23E-04 | 0. | 1.10E-04 | 0. | 3.40E-04 |
| RA225 +D | 6.56E-03 | 7.78E-06 | 1.31E-03 | 0. | 2.21E-04 | 0. | 3.06E-04 |
| RA226 +D | 3.02E-01 | 5.74E-06 | 2.20E-01 | 0. | 1.63E-04 | 0. | 3.32E-04 |
| RA228 +D | 1.12E-01 | 3.12E-06 | 1.21E-01 | 0. | 8.83E-05 | 0. | 5.64E-05 |
| AC225 | 4.40E-06 | 6.06E-06 | 2.96E-07 | 0. | 6.90E-07 | 0. | 4.07E-04 |
| AC227 +D | 1.87E-03 | 2.48E-04 | 1.11E-04 | 0. | 8.00E-05 | 0. | 8.19E-05 |
| TH227 +D | 1.37E-05 | 2.48E-07 | 3.95E-07 | 0. | 1.41E-06 | 0. | 5.40E-04 |
| TH228 +D | 4.96E-04 | 8.40E-06 | 1.68E-05 | 0. | 4.67E-05 | 0. | 5.63E-04 |
| TH229 | 7.98E-03 | 1.19E-04 | 3.91E-04 | 0. | 5.75E-04 | 0. | 5.12E-04 |
| TH230 | 2.06E-03 | 1.17E-04 | 5.70E-05 | 0. | 5.65E-04 | 0. | 6.02E-05 |
| TH232 +D | 2.30E-03 | 1.00E-04 | 1.50E-04 | 0. | 4.82E-04 | 0. | 5.12E-05 |
| TH234 | 8.01E-08 | 4.71E-09 | 2.31E-09 | 0. | 2.67E-08 | 0. | 1.13E-04 |
| PA231 +D | 4.10E-03 | 1.54E-04 | 1.59E-04 | 0. | 8.64E-04 | 0. | 7.17E-05 |
| PA233 | 5.26E-09 | 1.06E-09 | 9.12E-10 | 0. | 3.99E-09 | 0. | 1.64E-05 |
| U232 +D | 4.13E-03 | 0. | 2.95E-04 | 0. | 4.47E-04 | 0. | 6.78E-05 |
| U233 +D | 8.71E-04 | 0. | 5.28E-05 | 0. | 2.03E-04 | 0. | 6.27E-05 |
| U234 | 8.36E-04 | 0. | 5.17E-05 | 0. | 1.99E-04 | 0. | 6.14E-05 |
| U235 +D | 8.01E-04 | 0. | 4.86E-05 | 0. | 1.87E-04 | 0. | 7.81E-05 |
| U236 | 8.01E-04 | 0. | 4.96E-05 | 0. | 1.91E-04 | 0. | 5.76E-05 |
| U237 | 5.52E-8 | 0. | 1.47E-08 | 0. | 2.27E-07 | 0. | 1.94E-05 |
| U238 +D | 7.67E-04 | 0. | 4.54E-05 | 0. | 1.75E-04 | 0. | 5.50E-05 |
| NP237 +D | 1.37E-03 | 1.19E-04 | 5.54E-05 | 0. | 4.12E-04 | 0. | 7.94E-05 |
| NP238 | 1.37E-08 | 3.69E-10 | 2.13E-10 | 0. | 1.25E-09 | 0. | 3.43E-05 |
| NP239 | 1.19E-09 | 1.17E-10 | 6.45E-11 | 0. | 3.65E-10 | 0. | 2.40E-05 |
| PU238 | 6.80E-04 | 9.58E-05 | 1.71E-05 | 0. | 7.32E-05 | 0. | 7.30E-05 |
| PU239 | 7.87E-04 | 1.06E-04 | 1.91E-05 | 0. | 8.11E-05 | 0. | 6.66E-05 |
| PU240 | 7.85E-04 | 1.06E-04 | 1.91E-05 | 0. | 8.10E-05 | 0. | 6.78E-05 |
| PU241 +D | 1.65E-05 | 8.44E-07 | 3.32E-07 | 0. | 1.53E-06 | 0. | 1.40E-06 |
| PU242 | 7.29E-04 | 1.02E-04 | 1.84E-05 | 0. | 7.81E-05 | 0. | 6.53E-05 |
| PU244 | 8.52E-04 | 1.17E-04 | 2.11E-05 | 0. | 8.95E-05 | 0. | 9.73E-05 |
| AM241 | 8.19E-04 | 2.88E-04 | 5.41E-05 | 0. | 4.07E-04 | 0. | 7.42E-05 |
| AM242M | 8.24E-04 | 2.78E-04 | 5.43E-05 | 0. | 4.05E-04 | 0. | 9.34E-05 |
| AM243 | 8.18E-04 | 2.78E-04 | 5.30E-05 | 0. | 3.99E-04 | 0. | 8.70E-05 |
| CM242 | 2.06E-05 | 2.10E-05 | 1.37E-06 | 0. | 6.22E-06 | 0. | 7.92E-05 |
| CM243 | 6.39E-04 | 2.41E-04 | 3.75E-05 | 0. | 1.75E-04 | 0. | 7.81E-05 |
| CM244 | 4.83E-04 | 2.07E-04 | 2.87E-05 | 0. | 1.34E-04 | 0. | 7.55E-05 |
| CM245 | 1.02E-03 | 2.87E-04 | 5.76E-05 | 0. | 2.69E-04 | 0. | 7.04E-05 |
| CM246 | 1.01E-03 | 2.87E-04 | 5.75E-05 | 0. | 2.68E-04 | 0. | 6.91E-05 |
| CM247 +D | 9.84E-04 | 2.83E-04 | 5.67E-05 | 0. | 2.64E-04 | 0. | 9.09E-05 |
| CM248 | 8.18E-03 | 2.33E-03 | 4.67E-04 | 0. | 2.18E-03 | 0. | 1.47E-03 |
| CF252 | 2.64E-04 | 0. | 6.29E-06 | 0. | 0. | 0. | 2.88E-04 |

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TABLE 2.2

PALISADES
Liquid Effluent

Design Objective Annual Quantity

| <u>Nuclide</u> | <u>Half-Life</u> | <u>Dose Conversion Factors (mrem/Ci)</u> | <u>Individual/Organ</u> | <u>Design Objective Annual Quantity (Curies)</u> |
|----------------|------------------|--|-------------------------|--|
| H-3 | 12.3 yr | 1.75E-06 | Adult/TB | 1.71E+06 |
| Na-24 | 15 h | 5.44E-03 | Teen/TB | 551.5 |
| Sc-46 | 83.9 d | 2.02E-02 | Teen/TB | 148.5 |
| Cr-51 | 27.8 d | 1.56E-03 | Adult/GI (LLI) | 6,410.0 |
| Mn-54 | 303 d | 3.50E-02 | Teen/TB | 85.7 |
| Fe-55 | 2.6 yr | 4.48E-03 | Child/Bone | 2,232.0 |
| Mn-56 | 2.576 h | 1.86E-03 | Teen/TB | 1,612.0 |
| Co-57 | 270 d | 4.39E-03 | Teen/TB | 683.4 |
| Co-58 | 71.3 d | 1.03E-02 | Teen/TB | 291.3 |
| Fe-59 | 45.6 d | 4.08E-02 | Adult/GI (LLI) | 245.1 |
| Co-60 | 5.26 yr | 4.71E-01 | Teen/TB | 6.37 |
| Cu-64 | 12.8 h | 1.32E-03 | Teen/GI (LLI) | 7,575.0 |
| Ni-65 | 2.56 h | 5.82E-04 | Teen/TB | 5,154.0 |
| Zn-65 | 245 d | 1.83E-01 | Teen/TB | 16.4 |
| Br-84 | 31.8 mo | 2.02E-03 | Teen/TB | 1,485.2 |
| Rb-86 | 1.02 mo | 3.06E-01 | Child/TB | 9.80 |
| Rb-88 | 17.8 mo | 6.92E-04 | Teen/TB | 4,335.3 |
| Sr-89 | 52.7 d | 1.56E-01 | Child/Bone | 64.1 |
| Sr-90 | 27.7 yr | 2.71E-00 | Adult/Bone | 3.69 |
| Sr-91 | 9.67 h | 1.16E-03 | Teen/TB | 2,586.0 |
| Sr-92 | 2.71 h | 1.51E-03 | Teen/TB | 1,986.8 |
| Y-92 | 3.53 h | 2.69E-04 | Teen/TB | 11,150.0 |
| Nb-95 | 35 d | 7.24E+00 | Adult/GI (LLI) | 1.38 |
| Zr-95 | 65.5 d | 6.17E-03 | Teen/TB | 486.2 |
| Nb-97 | 72 mo | 6.95E-04 | Teen/TB | 4,316.6 |
| Zr-97 | 17 h | 9.28E-04 | Teen/TB | 3,232.8 |
| Mo-99 | 66.7 h | 1.11E-03 | Teen/Kidney | 9,009.0 |
| Tc-99m | 6.05 h | 1.42E-04 | Teen/TB | 21,126.8 |
| Ru-103 | 39.5 d | 2.74E-03 | Teen/TB | 1,094.9 |
| Ag-110m | 255 d | 7.75E-02 | Teen/TB | 38.7 |

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TABLE 2.2 (continued)

PALISADES
Liquid Effluent

Design Objective Annual Quantity

| <u>Nuclide</u> | <u>Half-Life</u> | <u>Dose Conversion Factors (mrem/Ci)</u> | <u>Individual/Organ</u> | <u>Design Objective Annual Quantity (Curies)</u> |
|----------------|------------------|--|-------------------------|--|
| Cd-113m | 13.6 yr | 6.02E-02 | Adult/GI (LLI) | 166.1 |
| Sb-124 | 60 d | 1.51E-02 | Teen/TB | 198.7 |
| Sb-125 | 2.7 yr | 5.11E-02 | Teen/TB | 58.7 |
| Te-127 | 9.4 h | 7.38E-03 | Teen/GI (LLI) | 1,355.0 |
| Te-127m | 109 d | 1.39E-01 | Teen/Kidney | 71.9 |
| Te-129m | 34.1 d | 2.66E-01 | Adult/GI (LLI) | 37.6 |
| I-130 | 12.3 h | 1.17E-02 | Child/Thyroid | 854.7 |
| I-131 | 8.05 d | 3.27E-01 | Child/Thyroid | 30.6 |
| Te-131m | 30 h | 2.27E-01 | Adult/GI (LLI) | 44.0 |
| I-132 | 2.26 h | 3.18E-05 | Teen/TB | 94,339.0 |
| Te-132 | 77.7 h | 2.93E-01 | Adult/GI (LLI) | 34.1 |
| I-133 | 20.3 h | 3.94E-02 | Child/Thyroid | 253.8 |
| Cs-134 | 2 yr | 2.86E + 00 | Adult/TB | 1.04 |
| I-134 | 52 mo | 2.43E-03 | Teen/TB | 1,234.0 |
| I-135 | 6.68 h | 1.64E-03 | Child/Thyroid | 6,097.0 |
| Cs-136 | 13.7 d | 4.13E-01 | Adult/TB | 7.26 |
| Cs-137 | 30 yr | 1.71E + 00 | Adult/TB | 1.75 |
| Cs-138 | 32.2 mo | 2.31E-03 | Teen/TB | 1,298.0 |
| Ba-139 | 82.9 mo | 4.66E-05 | Teen/TB | 64,377.0 |
| Ba-140 | 12.8 d | 7.96E-04 | Teen/TB | 3,768.0 |
| La-140 | 40.22 h | 1.85E-02 | Adult/GI (LLI) | 540.5 |
| Ce-141 | 32.5 d | 3.70E-04 | Teen/TB | 8,108.0 |
| Ce-144 | 284 d | 1.56E-03 | Teen/TB | 1,923.0 |
| Eu-152 | 12.7 yr | 3.24E-01 | Teen/TB | 9.25 |
| W-187 | 23.9 h | 1.98E-01 | Adult/GI (LLI) | 50.5 |
| Np-239 | 2.346 d | 2.26E-03 | Adult/GI (LLI) | 4,424.0 |

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III. URANIUM FUEL CYCLE DOSE

A. SPECIFICATION

In accordance with Appendix A, Section III.I.1, if either liquid or gaseous quarterly releases exceed the quantity which would cause offsite doses more than twice the limit of Appendix A, Sections III.C.1, III.D.1, or III.H.1, then the cumulative dose contributions from combined release plus direct radiation sources (from the reactor unit and radwaste storage tanks) shall be calculated. The dose is to be determined for the member of the public protected to be the most highly exposed to these combined sources.

B. ASSUMPTIONS

1. The full time resident determined to be maximally exposed individual (excluding infant) is assumed also to be a fisherman. This individual is assumed to drink water and ingest local fish at the rates specified in Sections II.C.2.1 and II.C.2.2.
2. Amount of shore line fishing (at accessible shoreline adjacent to site security fence) is conservatively assumed as 48 hours per quarter (average of approximately 1/2 hour per day each day of the quarter) for the second and third quarters of the year, 36 hours for the fourth quarter and 16 hours for the first quarter.

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C. DOSE CALCULATION

Maximum doses to the total body and internal organs of an individual shall be determined by use of LADTAP and GASPAR computer codes, and doses to like organs and total body summed. Added to this sum will be a mean dose rate, calculated or measured for the shoreline due to Plant present during the quarter in question, times the assumed fishing time.

$$D_{40} = D_G + D_L + (R_T)(T) \quad (2.15)$$

where:

D_{40} = 40 CFR 190 dose (mrem).

D_G = Limiting dose to an individual from gaseous source term (mrem).

D_L = Limiting dose to an individual from liquid source term (mrem).

R_T = Mean dose rate calculated to be applicable to Lake Michigan shoreline adjacent to Plant site (mrem/hr).

T = Assumed shoreline fishing time for the quarter in question (hours).