

**Wolf Creek Nuclear Operating Corporation  
Procedure, AP 07B-003, Revision 8,  
“Offsite Dose Calculation Manual”**



AP 07B-003

OFFSITE DOSE CALCULATION MANUAL

Responsible Manager

Manager Chemistry

|                                   |             |
|-----------------------------------|-------------|
| Revision Number                   | 8           |
| Use Category                      | Information |
| Administrative Controls Procedure | Yes         |
| Management Oversight Evolution    | No          |
| Program Number                    | 07B         |

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## **1.0 PURPOSE**

- 1.1 This procedure contains the Offsite Dose Calculation Manual (ODCM) and the requirements for revision and submittal to the NRC.
- 1.2 This procedure is written in accordance with and satisfies commitments to Regulatory Guide 1.21 Rev. 1 and Regulatory Guide 1.109 Rev. 1. [3.2.1, 3.2.2] **11/12**

## **2.0 SCOPE**

- 2.1 This procedure partially fulfills the requirements of Technical Specifications: 3.3.6 Containment Purge Isolation Instrumentation; 3.3.7 Control Room Emergency Ventilation System Actuation Instrumentation; 3.3.8 Emergency Exhaust System (EES) Actuation Instrumentation; 5.5.2 Primary Coolant Sources Outside Containment; 5.6.3 Radioactive Effluent Release Report; 5.5.1 Offsite Dose Calculation Manual; and 5.5.4 Radioactive Effluent Controls Program. **11/12**
- 2.2 Requirements for the Radiological Environmental Monitoring Program have been moved to AP 07B-004.

## **3.0 REFERENCES AND COMMITMENTS**

### **3.1 References**

- 3.1.1 WCGS Technical Specifications
- 3.1.2 NUREG 0133, Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants
- 3.1.3 AP 07B-004 OFFSITE DOSE CALCULATION MANUAL (RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM)
- 3.1.4 PIR 98-0112, Revising the ODCM with an OTSC
- 3.1.5 Technical Requirements Manual
- 3.1.6 NEI Letters 06-00288, 06-00331, 06-00332
- 3.1.7 Regulatory Guide 1.21, Revision 2.
- 3.1.8 CR 29301, "Document Estimates for Tritium Release from Auxiliary Boiler"
- 3.1.9 CR 36059, "EPRI and NEI C-14 Training Workshop"
- 3.1.10 CR 28094, "ODCM Does Not Fully Implement Regulatory Guide 1.21"

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3.1.11 CR 48258, "ODCM Terminology: Operable/Functional Usage" **11/12**

3.1.12 PIR 2002-0975, "ODCM Revision Process Inconsistencies" **11/12**

3.1.13 CR 47483, "Ni-63 in Liquid Effluents: OE 34998" **11/12**

### 3.2 Commitments

3.2.1 Regulatory Guide 1.21, Revision 1 "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants" **11/12**

3.2.2 Regulatory Guide 1.109, Revision 1, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFRPart50, Appendix I

## 4.0 DEFINITIONS

4.1 UNRESTRICTED AREA - Shall be any area at or beyond the SITE BOUNDARY access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, or any area within the SITE BOUNDARY used for residential quarters or for industrial, commercial, institutional and/or recreational purposes.

4.2 SOURCE CHECK - Shall be the qualitative assessment of channel response when the channel sensor is exposed to a source of increased radioactivity.

4.3 PROCESS CONTROL PROGRAM(PCP) - Shall contain the current formula, sampling, analyses, tests, and determinations to be made to ensure that the processing and packaging of solid radioactive wastes, based on demonstrated processing of actual or simulated wet solid wastes, will be accomplished in such a way as to assure compliance with 10 CFR Part 20, 10 CFR Part 71, and Federal & State regulations and other requirements governing the disposal for the radioactive waste.

4.4 PURGE/PURGING - The controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration, or other operating condition, in such a manner that replacement air or gas is required to purify the confinement.

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4.5 VENTING - The controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is not provided or required during venting. Vent, used in system names, does not imply a venting process.

4.6 CALENDAR MONTH - The period of time from the beginning of the month to the end of the month.

## 5.0 RESPONSIBILITIES

5.1 The Manager Chemistry is responsible for the ODCM.

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## 6.0 PROCEDURE

### 6.1 Revision Of The ODCM

#### NOTE

**To comply with Technical Specification 5.5.1, revisions to the ODCM are not permitted via APF 15C-004-04, ON THE SPOT CHANGE form (3.1.4).**

- 6.1.1 All revisions to the ODCM are to be submitted through the Manager Chemistry via a document revision request (APF 15C-004-01).
- 6.1.2 The Manager Chemistry shall ensure the Document Revision Request (APF 15C-004-01) package includes the following:
1. Each change shall be identified by markings in the margins of the affected pages, clearly indicating the area of the page that was changed, and shall indicate the date (e.g., month/year) the change was implemented. Pursuant to TS 5.5.1, revision bars indicating changes prior to the current reporting period may be removed. 11/12
  2. Sufficient information to support the change together with the appropriate analyses or evaluations justifying the change(s) and
  3. A determination that the change will maintain the level of Radioactive Effluent Control required by Wolf Creek Technical Specification 5.5.4.g (gaseous effluent), 10CFR 20.1302 (liquid effluent), 40 CFR Part 190, 10 CFR 50.36A, and Appendix I to 10 CFR Part 50 and not adversely impact the accuracy or reliability of effluent dose or setpoint calculations.
- 6.1.3 The ODCM revision shall become effective after review and acceptance by the PSRC and the approval of the Plant Manager.

### 6.2 ODCM Submittal To NRC

- 6.2.1 Changes to the ODCM shall be submitted to the Commission in the form of a complete, legible copy of the entire ODCM as a part of or concurrent with the Annual Radioactive Effluent Release Report for the period of the report in which any change to the ODCM was made.

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**7.0    RECORDS**

7.1    The following is a lifetime QA Record:

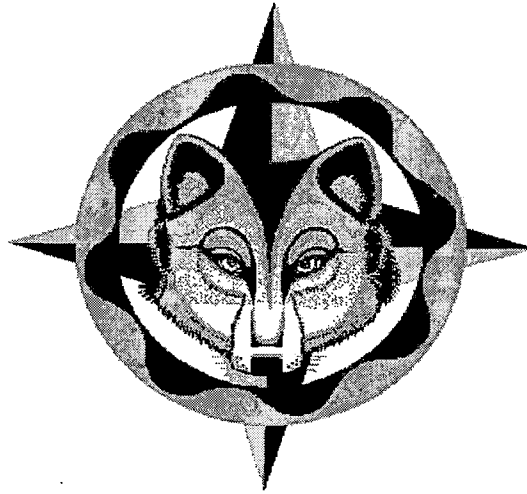
7.1.1    AP 07B-003, OFFSITE DOSE CALCULATION MANUAL

**8.0    FORMS**

8.1    None

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## Wolf Creek Generating Station



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**1.0 Introduction**

The Offsite Dose Calculation Manual describes the Radioactive Effluent Controls Program. The implementation of this program ensures compliance with the requirements of 10 CFR 50.36, 10 CFR 20.106, 10 CFR 20.1302, 10 CFR 50 Appendix I and 40 CFR 190.

On January 1, 1994, 10CFR20.20.1001-20.2402 was implemented. Wolf Creek maintains the existing level of gaseous effluent control established from specifications in the first implementation of 10 CFR 20.106, now contained in Wolf Creek Technical Specification 5.5.4.g. Compliance with Technical Specification 5.5.4.g has been determined by the NRC to be ALARA.

On December 18, 1999 Wolf Creek implemented 10 CFR 20.1302 limits for radioactive liquid effluents. The concentration of radioactive material released in liquid effluents to unrestricted area conforms to 10 times the concentration values in Appendix B, Table 2, Column 2, to 10 CFR 20.1001-20.2402.

The ODCM describes the methodology and parameters used in the calculation of offsite doses due to radioactive liquid and gaseous effluents. The ODCM contents for calculation of dose are based on "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants (NUREG-0133)," and Regulatory Guide 1.109, Revision 1.

Dose calculations are performed for the limiting age group i.e., Adult age group for the liquid pathway, and the Child age group for gaseous effluent organ doses.

The ODCM provides the limitations on the FUNCTIONALITY of radioactive liquid and gaseous monitoring instrumentation including surveillance tests and setpoint determination. Each Surveillance Requirement shall be performed within the specified surveillance interval with a maximum allowable extension not to exceed 25% of the specified interval.

**11/12**

The ODCM provides descriptions of the information that should be included in the Annual Radioactive Effluent Release Reports.

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**2.0 Liquid Effluents**

**2.1 Concentration - Compliance With 10 CFR 20**

The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS shall be limited to 10 times the limit specified in 10 CFR Part 20, Appendix B, Table 2, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to  $2 \times 10^{-4}$  microCurie/mL total activity. (USAR Chapter 11)

**2.1.1 Remedial Action**

With the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS exceeding the above limits, immediately restore the concentration to within the above limits.

**2.1.2 Surveillance Requirements**

To show compliance with this requirement, concentrations of actual liquid effluents will be determined by performing Isotopic Analyses. Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program of Table 2-1.

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**TABLE 2-1**  
RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

| LIQUID RELEASE TYPE                    | SAMPLE FREQUENCY | PRINCIPAL GAMMA EMITTERS       | I-131                      | DISSOLVED/ ENTRAINED GASES (GAMMA) | GROSS ALPHA AND H-3                                  | Sr-89, Sr-90               | Fe-55, Ni-63<br>11/12      |
|----------------------------------------|------------------|--------------------------------|----------------------------|------------------------------------|------------------------------------------------------|----------------------------|----------------------------|
| 1. Batch Tanks (2)                     |                  |                                |                            |                                    |                                                      |                            | Q Composite (4)            |
| a. THB07A&B<br>LLD (1)                 | P                | P (3)<br>5E-7                  | P<br>1E-6                  | M<br>1E-5                          | M<br>Composite (4)<br>1E-7 for Alpha<br>1E-5 for H-3 | Q<br>Composite (4)<br>5E-8 | 1E-6                       |
| b. THF04A&B<br>LLD (1)                 | P                | P (3)<br>5E-7                  | P<br>1E-6                  | M<br>1E-5                          | M<br>Composite (4)<br>1E-7 for Alpha<br>1E-5 for H-3 | Q<br>Composite (4)<br>5E-8 | Q<br>Composite (4)<br>1E-6 |
| 2. Continuous Releases (5)             |                  |                                |                            |                                    |                                                      |                            |                            |
| a. Steam Generator Blowdown<br>LLD (1) | Daily (6)        | W (3)<br>Composite (4)<br>5E-7 | W<br>Composite (4)<br>1E-6 | M<br>1E-5                          | M<br>Composite (4)<br>1E-7 for Alpha<br>1E-5 for H-3 | Q<br>Composite (4)<br>5E-8 | Q<br>Composite (4)<br>1E-6 |
| b. Turbine Building Sump<br>LLD (1)    | Daily (6)        | W (3)<br>Composite (4)<br>5E-7 | W<br>Composite (4)<br>1E-6 | M<br>1E-5                          | M<br>Composite (4)<br>1E-7 for Alpha<br>1E-5 for H-3 | Q<br>Composite (4)<br>5E-8 | Q<br>Composite (4)<br>1E-6 |
| c. Waste Water Treatment<br>LLD (1)    | Daily (6)        | W (3)<br>Composite (4)<br>5E-7 | W<br>Composite (4)<br>1E-6 | M<br>1E-5                          | M<br>Composite (4)<br>1E-7 for Alpha<br>1E-5 for H-3 | Q<br>Composite (4)<br>5E-8 | Q<br>Composite (4)<br>1E-6 |
| d. Lime Sludge Pond<br>LLD (1)         | Daily (6)        | W (3)<br>Composite (4)<br>5E-7 | W<br>Composite (4)<br>1E-6 | M<br>1E-5                          | M<br>Composite (4)<br>1E-7 for Alpha<br>1E-5 for H-3 | Q<br>Composite (4)<br>5E-8 | Q<br>Composite (4)<br>1E-6 |

LLD = ( $\mu$ Ci/mL)

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**TABLE 2-1 (Continued)**

TABLE NOTATIONS

- (1) The LLD is defined, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66 s_b}{E \times V \times 2.22 \times 10^6 \times Y \times \text{Decay}}$$

Where: LLD = the "a priori" lower limit of detection (microCuries per unit mass or volume),

$s_b$  = the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, (counts per minute),  $s_b = \sqrt{B}/LT$

Where: B = background sum (counts)

LT = live time (minutes),

E = the counting efficiency (counts per disintegration),

V = the sample size (units of mass or volume),

$2.22 \times 10^6$  = the number of disintegrations per minute per microCurie,

Y = the fractional radiochemical yield, when applicable,

Decay = decay factor(s), There are three decay factors that may be appropriate for use depending on the nature of the sample and the half life of the nuclide. Any combination of the three may be used. The factors are as follows:

- A) This decay factor corrects for decay from the time of sampling to the start of the analysis.

$e^{-\lambda \Delta t_s}$ , where:

$\Delta t_s$  = decay time = acquisition start time - sample time

$\lambda$  =  $\ln 2$ /half-life

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**TABLE 2-1 (Continued)**  
TABLE NOTATIONS

- B) This decay factor corrects for decay during the analysis.

$$\frac{1 - e^{-\lambda RT}}{\lambda \times RT}$$

$$\lambda = \ln 2 / \text{half-life}$$

RT = real time of counting

- C) This decay factor corrects for decay during sampling.

$$\frac{1 - e^{-\lambda \Delta t_d}}{\lambda \Delta t_d}$$

$$\lambda = \ln 2 / \text{half-life}$$

$\Delta t_d$  = deposition time = (sample time - deposition start time), or *for effluents only* (sample time - midpoint of sample period)

**NOTE**

**All times used in decay calculations should be in the same units.**

Typical values of E, V, Y,  $t_s$ ,  $t_d$  should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

For very low background counting, the LLD can optionally be calculated as follows:

$$LLD = \frac{2.71 + 4.66 s_b}{E \times V \times 2.22 \times 10^6 \times Y \times \text{Decay}}$$

- (2) A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed by a method described in plant procedures to assure representative sampling.

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**TABLE 2-1 (Continued)**

TABLE NOTATIONS

- (3) The principal gamma emitters for which the LLD specification applies include the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the annual Radioactive Effluent Release Report in the format outlined in Regulatory Guide 1.21, Appendix B, Revision 1, June 1974.
- (4) A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen that is representative of the liquids released. Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite samples to be representative of the effluent release.
- (5) A continuous release is the discharge of liquid wastes of a nondiscrete volume, e.g., from a volume of a system that has an input flow during the continuous release.
- (6) Samples shall be taken at the initiation of effluent flow and at least once per 24 hours thereafter while the release is occurring. To be representative of the liquid effluent, the sample volume shall be proportioned to the effluent stream discharge volume. The ratio of sample volume to effluent discharge volume shall be maintained constant for all samples taken for the composite sample.

FREQUENCY NOTATION

| <u>NOTATION</u> | <u>FREQUENCY</u>                 |
|-----------------|----------------------------------|
| S               | At least once per 12 hours.      |
| D               | At least once per 24 hours.      |
| W               | At least once per 7 days         |
| M               | At least once per 31 days.       |
| Q               | At least once per 92 days.       |
| SA              | At least once per 184 days.      |
| R               | At least once per 18 months.     |
| S/U             | Prior to each reactor startup.   |
| N.A.            | Not applicable.                  |
| P               | Completed prior to each release. |

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**2.2 Dose - Compliance With 10 CFR 50 Appendix I**

The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each unit, to UNRESTRICTED AREAS shall be limited:

- a. During any calendar quarter to less than or equal to 1.5 mrem to the whole body and to less than or equal to 5 mrem to any organ, and
- b. During any calendar year to less than or equal to 3 mrem to the whole body and to less than or equal to 10 mrem to any organ.

**2.2.1 Remedial Action**

With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits. This Special Report shall also include the results of radiological analyses of the drinking water source, and the radiological impact on finished drinking water supplies with regard to the requirements of 40 CFR Part 141, Clean Drinking Water Act. This requirement of (1.) and (2.) are applicable only if drinking water supply is taken from the receiving body within 3 miles of the plant discharge.

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### 2.2.2 Surveillance Requirements

Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined using the following methodology at least once per 31 days.

$$D_{\tau} = \sum_i \left( A_{i\tau} \sum_{\lambda=1}^m \Delta t_{\lambda} C_{i\lambda} F_{\lambda} \right)$$

Where:  $D_{\tau}$  = the cumulative dose commitment to the total body or any organ,  $\tau$ , from the liquid effluent for the total

$$\text{time period } \sum_{\lambda=1}^m \Delta t_{\lambda}, \text{ in mrem}$$

$\Delta t_{\lambda}$  = the length of the  $\lambda$ th time period over which  $C_{i\lambda}$  and  $F_{\lambda}$  are averaged for all liquid releases, in hours.

$C_{i\lambda}$  = the average concentration of radionuclide, 'i', in undiluted liquid effluent flow during time period  $\Delta t_{\lambda}$ , in  $\mu\text{Ci/mL}$ .

$F_{\lambda}$  = the near field average dilution factor for  $C_{i\lambda}$  during any liquid effluent release where:

$$F_{\lambda} = \frac{f}{(f+F)K}$$

Where:  $f$  = Liquid Radioactive Waste Flow (Waste Water Flow)

$F$  = Liquid Dilution Flow, the average dilution flow during release.

$K$  = Applicable factor; the site dependent value for the mixing effect of the discharge structure. This value is conservatively assumed to be 1 (one) for this section.

$A_{i\tau}$  = The site related ingestion dose commitment factor to the total body or any organ, ' $\tau$ ', for each identified principal gamma and beta emitter, mrem/hr per  $\mu\text{Ci/mL}$ . See Tables A.4-1 through A.4-4.

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The limiting age group for liquid dose calculations is the Adult age group.

$$A_{it} = 1.14E5 (U_w / D_w + U_f \times BF_i) DF_i$$

Where:  $D_w$  = Dilution factor from the near field area to the potable water intake for water consumption, for Wolf Creek Generating Station this factor is 1 (one).

$BF_i$  = Bioaccumulation factor for radionuclide 'i', in fish, pCi/Kg per pCi/l, from Table A.1-1 from Regulatory Guide 1.109 (Rev. 1).

$DF_i$  = Adult dose Conversion factor for radionuclide, 'i', in mrem/pCi, from Table A.3-1, from Regulatory Guide 1.109 (Rev. 1).

$U_w$  = Adult water consumption, (730 l/yr. from Reg. Guide 1.109)

$U_f$  = Adult fish consumption, (21 kg/yr. from Reg. Guide 1.109)

$$1.14E5 = \text{Units conversion factor} = \frac{10^6 \text{ pCi}/\mu\text{Ci} \times 10^3 \text{ ml/L}}{8760 \text{ hr/yr}}$$

The dose calculations are based on the actual isotopic analysis of the radioactive liquid effluents, the radioactive liquid effluent flow, and the dilution flow.

The above dose calculations utilize NUREG-0133 equations and Regulatory Guide 1.109 tables. For the effluent pathways in use at Wolf Creek, NUREG-0133 and Regulatory Guide 1.109 are equivalent calculations when the 'nuclide transit time to point of exposure', used in Regulatory Guide 1.109, is set to zero. NUREG-0133 calculations are developed and used here for calculation simplification in the event manual calculations are needed. Software currently in use utilizes the equivalent Regulatory Guide 1.109 equations to provide greater software versatility. Equations have been proven equivalent algebraically and numerically.

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### 2.3 Projected Dose

The Liquid Radwaste Treatment System shall be FUNCTIONAL and appropriate portions of the system shall be used to reduce releases of radioactivity when the projected doses due to liquid effluent, from each unit, to UNRESTRICTED AREAS would exceed 0.06 mrem to the whole body or 0.2 mrem to any organ in a 31 day period. 11/12

#### 2.3.1 Remedial Action

With radioactive liquid waste being discharged without treatment and in excess of the above limits and any portion of the Liquid Radwaste Treatment System not in operation, prepare and submit to the Commission within 30 days, a Special Report that includes the following information:

- a. Explanation of why liquid radwaste was being discharged without treatment, identification of any nonfunctional equipment or subsystems, and the reason for the nonfunctionality, 11/12
- b. Action(s) taken to restore the nonfunctional equipment to FUNCTIONAL status, and 11/12
- c. Summary description of action(s) taken to prevent a recurrence.

#### 2.3.2 Surveillance Requirements

2.3.2.1 Doses due to liquid releases from each unit to UNRESTRICTED AREAS shall be projected at least once per 31 days in accordance with the following methodology when Liquid Radwaste Treatment Systems are not being fully utilized.

$$D_{31} = \left[ \frac{A}{T} \right] \times 31$$

Where,

$D_{31}$  = Projected 31 day dose

A = Cumulative dose for previous three calendar months

T = Number of days that the cumulative dose occurred in A above

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- 2.3.2.2** The installed Liquid Radwaste Treatment System shall be considered FUNCTIONAL by meeting the requirements of Sections 2.1 and 2.2. **11/12**

**2.4 Instrumentation**

The radioactive liquid effluent monitoring instrumentation channels shown in Table 2-2 shall be FUNCTIONAL with their Alarm/Trip Setpoints set to ensure that the limits of Section 2.1 are not exceeded. The Alarm/Trip Setpoints of these channels shall be determined and adjusted in accordance with the methodology and parameters described in Section 2.4.4. **11/12**

**2.4.1 Remedial Action**

- 2.4.1.1** With a radioactive liquid effluent monitoring instrumentation channel Alarm/Trip Setpoint less conservative than required by the above, immediately suspend the release of radioactive liquid effluents monitored by the affected channel, or declare the channel nonfunctional. **11/12**

- 2.4.1.2** With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels FUNCTIONAL, take the ACTION shown in Table 2-2. Restore the nonfunctional instrumentation to FUNCTIONAL status within the time specified in the ACTION, or explain in the next annual Radioactive Effluent Release Report, why this nonfunctionality was not corrected within the time specified. **11/12**

**2.4.2 Surveillance Requirements**

Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated FUNCTIONAL by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL OPERATIONAL TEST at the frequencies shown in Table 2-3. **11/12**

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**TABLE 2-2**  
RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

| <u>INSTRUMENT</u>                                                              | <u>MINIMUM<br/>CHANNELS<br/>FUNCTIONAL</u> | <u>ACTION</u><br><b>11/12</b> |
|--------------------------------------------------------------------------------|--------------------------------------------|-------------------------------|
| 1. Radioactivity Monitors Providing Alarm and Automatic Termination of Release |                                            |                               |
| a. Liquid Radwaste Discharge Monitor (HB-RE-18)                                | 1                                          | 31                            |
| b. Steam Generator Blowdown Discharge Monitor (BM-RE-52)                       | 1                                          | 32                            |
| c. Turbine Building Drain Monitor (LE-RE-59)                                   | 1                                          | 32                            |
| d. Secondary Liquid Waste System Monitor (HF-RE-45)                            | 1                                          | 31                            |
| e. Wastewater Treatment System Influent Monitor (HF-RE-95)                     | 1                                          | 32                            |
| 2. Flow Rate Measurement Devices                                               |                                            |                               |
| a. Liquid Radwaste Discharge Line                                              |                                            |                               |
| 1) Waste Monitor Tank A Discharge Line                                         | 1                                          | 33                            |
| 2) Waste Monitor Tank B Discharge Line                                         | 1                                          | 33                            |
| b. Steam Generator Blowdown Discharge Line                                     | 1                                          | 33                            |
| c. Secondary Liquid Waste System Discharge Line                                |                                            |                               |
| 1) Secondary Liquid Waste Monitor Tank A Discharge Line                        | 1                                          | 33                            |
| 2) Secondary Liquid Waste Monitor Tank B Discharge Line                        | 1                                          | 33                            |

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**TABLE 2-2 (Continued)**  
ACTION STATEMENTS

Action 31 - With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue for up to 14 days provided that prior to initiating a release: **11/12**

- a. At least two independent samples are analyzed in accordance with Section 2.1.2, and
- b. At least two technically qualified members of the facility staff independently verify the release rate calculations and discharge line valving.

Otherwise, suspend release of radioactive effluents via this pathway.

Action 32 - With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue for up to 30 days provided grab samples are analyzed for principle gamma emitters and I-131 at a lower limit of detection as specified in Table 2-1. **11/12**

- a. At least once per 12 hours when the specific activity of the secondary coolant is greater than 0.01 microCurie/gram DOSE EQUIVALENT I-131, or
- b. At least once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 microCurie/gram DOSE EQUIVALENT I-131.

Action 33 - With the number of channels FUNCTIONAL less than required by the Minimum Channels FUNCTIONAL requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours during actual releases. Pump performance curves generated in place may be used to estimate flow. **11/12**

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**TABLE 2-3**  
RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION  
SURVEILLANCE REQUIREMENTS

| <u>INSTRUMENT</u>                                                              | <u>CHANNEL<br/>CHECK</u> | <u>SOURCE<br/>CHECK</u> | <u>CHANNEL<br/>CALIBRATION</u> | <u>CHANNEL<br/>OPERATIONAL<br/>TEST</u> |
|--------------------------------------------------------------------------------|--------------------------|-------------------------|--------------------------------|-----------------------------------------|
| 1. Radioactivity Monitors providing alarm and automatic termination of release |                          |                         |                                |                                         |
| a. Liquid Radwaste Discharge Monitor (HB-RE-18)                                | D                        | P                       | R(2)                           | Q(1)                                    |
| b. Steam Generator Blowdown Discharge Monitor (BM-RE-52)                       | D                        | M                       | R(2)                           | Q(1)                                    |
| c. Turbine Building Drain Monitor (LE-RE-59)                                   | D                        | M                       | R(2)                           | Q(1)                                    |
| d. Secondary Liquid Waste System Monitor (HF-RE-45)                            | D                        | P                       | R(2)                           | Q(1)                                    |
| e. Wastewater Treatment System Influent Monitor (HF-RE-95)                     | D                        | M                       | R(2)                           | Q(1)                                    |
| 2. Flow Rate Measurement Devices                                               |                          |                         |                                |                                         |
| a. Liquid Radwaste Discharge Line                                              | D(3)                     | N.A.                    | R                              | N.A.                                    |
| b. Steam Generator Blowdown Discharge Line                                     | D(3)                     | N.A.                    | R                              | N.A.                                    |
| c. Secondary Liquid Waste System Discharge Line                                | D(3)                     | N.A.                    | R                              | N.A.                                    |

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**TABLE 2-3 (Continued)**  
TABLE NOTATIONS

- (1) The CHANNEL OPERATIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation occur as appropriate if any of the following conditions exists:
  - a. Instrument indicates measured levels above the Alarm/Trip Setpoint (isolation and alarm), or
  - b. Circuit failure (alarm only), or
  - c. Instrument indicates a downscale failure (alarm only), or
  - d. Instrument controls not set in operate mode (alarm only).
- (2) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference (gas or liquid and solid) standards certified by the National Institute of Standards and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range or energy, measurement range, and establish monitor response to a solid calibration source. For subsequent CHANNEL CALIBRATION, NIST traceable standard (gas, liquid, or solid) may be used; or a gas, liquid, or solid source that has been calibrated by relating it to equipment that was previously (within 30 days) calibrated by the same geometry and type of source standard traceable to NIST.
- (3) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous, periodic, or batch releases are made.

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### 2.4.3 Liquid Monitor Calibration Methodology

The five monitors associated with liquid releases are listed below:

| <u>Monitor ID</u> | <u>Description</u>                           |
|-------------------|----------------------------------------------|
| 0-BM-RE-52        | Steam Generator Blowdown Discharge Monitor   |
| 0-LE-RE-59        | Turbine Building Drain Monitor               |
| 0-HF-RE-45        | Secondary Liquid Waste System Monitor        |
| 0-HB-RE-18        | Liquid Radwaste Discharge Monitor            |
| 0-HF-RE-95        | Wastewater Treatment System Influent Monitor |

Liquid effluent streams are monitored by an NaI(Tl) Detector. The detector operates in a gross counting mode and is gamma sensitive.

Calibration of the liquid monitors shall be performed using three standard solutions of Cs-137. The solutions shall cover the appropriate range of the detector and have concentrations of approximately  $5 \times 10^{-7}$   $\mu\text{Ci/cc}$ ,  $1 \times 10^{-5}$   $\mu\text{Ci/cc}$ , and  $1 \times 10^{-3}$   $\mu\text{Ci/cc}$ . The solutions shall be presented to the detector and the meter reading in counts per minute shall be recorded. A determination of linearity shall be produced using the counts per minute vs. concentration data.

### 2.4.4 Liquid Effluent Monitor Setpoints

The High Alarm/Trip Setpoints for the Liquid Effluent Radiation Monitors are based on 10 times the instantaneous concentration limits of 10 CFR 20, Appendix B, Table 2, Column 2 applied at the boundary of the restricted area. Specifically, the High Alarm Setpoint will correspond to 10 times the 10 CFR Part 20 limits at the Boundary of the restricted area. Since the high alarm/trip initiates isolation of the particular system and termination of the release, this setpoint represents assurance that 10 times the instantaneous liquid release limit of 10 CFR Part 20 is not exceeded. Auditable records shall be maintained indicating the actual setpoints used at all times.

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The following discussion explains the setpoint methodology, which is applied in greater detail in subsequent sections. The calculated Alarm and Trip Action Setpoints for the Liquid Effluent Line Monitors must satisfy the following equation:

$$c\left(\frac{f}{F+f}\right) \leq \text{ECL}$$

Where: ECL = Ten times the liquid Effluent Concentration Limit (ECL) of 10 CFR 20, which implements Section 2.1 in  $\mu\text{Ci/mL}$ .

$c$  = The Setpoint, in  $\mu\text{Ci/mL}$ , of the Radioactivity Monitor measuring the radioactivity concentration in the effluent line (waste water line) prior to dilution and subsequent release. The Setpoint is inversely proportional to the Volumetric Flow of the effluent line and directly proportional to the Volumetric Flow of the dilution stream plus the effluent stream. The Setpoint represents a Value, which if exceeded would result in concentrations exceeding 10 times the limits of 10 CFR 20 in the restricted area.

$f$  = The Effluent Pump Flow Rate (waste water flow rate) as measured at the Radiation Monitor Location, in Volume per Unit Time, but in the same units as  $F$ , below.

$F$  = The Dilution Water Flow Rate as measured prior to the release point, in Volume per Unit Time.

Rearranged, the expression for determining the setpoint on the Liquid Radwaste Effluent Line Monitor becomes:

$$c \leq \text{ECL} \left( \frac{F+f}{f} \right) (\mu\text{Ci/ml})$$

If no gamma activity is detected, calculate the monitor setpoint by assigning the available ECL fraction to 10 times the 10 CFR 20 ECL for I-131.

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**2.4.4.1**

**Continuous Liquid Effluent Monitors**

The three monitors associated with continuous liquid releases are listed below:

| <u>Monitor ID</u> | <u>Description</u>                            |
|-------------------|-----------------------------------------------|
| 0-BM-RE-52        | Stm Generator Blowdown Discharge Monitor      |
| 0-LE-RE-59        | Turbine Building Drain Monitor                |
| 0-HF-RE-95        | Waste Water Treatment System Influent Monitor |

The Steam Generator Blowdown Discharge Effluent Monitor continuously monitors the Blowdown Discharge Pump Outlet to detect excess radioactivity due to System Demineralizer breakthrough or abnormal Primary to Secondary leakage. The Blowdown Discharge Monitor's High Alarm Setpoint initiates CLOSURE of the Blowdown Isolation Valves and the Blowdown Discharge Valve. Similarly, the High Radiation Alarm on the Turbine Building Drain Monitor and Waste Water Treatment Monitor initiates CLOSURE of the Drain Line Isolation Valves to prevent the release of radioactive effluents.

Monitor setpoints will be conservatively based on I-131, the most restrictive isotope expected to be present. This is particularly appropriate for the Turbine Building Drain Line Monitor since the most probable source is the Secondary Steam System which is expected to have negligible activity unless there is a significant Primary to Secondary leak. Due to changing activities, it will not be possible to select a radionuclide distribution on which to base the monitor setpoint. Additionally, maximum effluent flows and minimum dilution flows will normally be assumed.

The High Alarm/Trip Setpoint will be set to correspond to 10 times the I-131 ECL limit at the boundary of the restricted area from 10 CFR Part 20, Appendix B, Table 2, Column 2. The alert alarm is set one order of magnitude below the High Alarm/Trip Setpoint for release points that have dilution and to the High Alarm value for those without dilution. This High Alarm/Trip Setpoint assures the limits of Section 2.1 are not exceeded at the boundary of the restricted area.

In the event that an alarm is TRIPPED, an evaluation of the system will be made by taking an actual isotopic and flow analysis of the discharge.

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The above continuous liquid effluents are not radioactive effluents until activity has been detected by the Liquid Effluent Monitor, a Tritium analysis of the Secondary system, or a gross Beta analysis of the Secondary system. At that time an analysis of the effluent will be made to verify activity in the system effluent. During periods of time when the above liquid effluents are not radioactive the High Alarm/Trip Setpoint may be set to 1.5 times the background count rate.

The high alarm/trip setpoints for continuous releases are calculated using the following methodology:

$$\text{SETPOINT } (\mu\text{Ci/ml}) = \text{ECL}_{\text{I-131}} \times \frac{F+f}{f} \times \text{AF} \times \text{SF}$$

Where:  $\text{ECL}_{\text{I-131}}$  = Effluent Concentration Limit of I-131, 1E-5  $\mu\text{Ci/mL}$  (10 times the Effluent Concentration Limit of I-131)

$F$  = Dilution flow rate.

$f$  = Effluent (waste water) flow rate through any of the three previously named monitors.

$\text{AF}$  = The allocation fraction; a conservative factor used to allocate portions of a shared dilution stream to separate concurrent releases to ensure the concentration limits of section 2.1 are not exceeded. The sum of allocation fractions for concurrent releases with a shared discharge point shall not exceed 1.0 and may be altered based on plant need. For cases where the ECL fraction exceeds 1.0, dilution is required to ensure compliance with section 2.1, and the allocation fraction must be applied to ensure this compliance is met.

$\text{SF}$  = The safety factor; a conservative factor used to compensate for statistical fluctuations and errors of measurement. Default value is 1.0; however, this value may be set, administratively, to values less than 1.0

The setpoint calculation is based on the minimum dilution flow rate, the maximum possible effluent flow rate, and, due to changing conditions, I-131 which is the most restrictive isotope expected to be present.

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In the event that an alarm is reached, the release will be evaluated to see if the limit of Section 2.1 was exceeded by using the actual Dilution Flow Rate, the actual Effluent Flow Rate, and the actual isotopic analysis as outlined in Section 2.4.4.2. The setpoint will still be based on the 10 times the 10 CFR 20 ECL of I-131 due to the changing conditions of activity and I-131 being the most restrictive isotope.

**2.4.4.2      Batch Radioactive Liquid Effluent Monitor**

The two monitors associated with liquid batch releases are listed below:

| <u>Monitor ID</u> | <u>Description</u>                    |
|-------------------|---------------------------------------|
| 0-HF-RE-45        | Secondary Liquid Waste System Monitor |
| 0-HB-RE-18        | Liquid Radwaste Discharge Monitor     |

The High Alarm/Trip setpoint is a function of dilution flow rate, tank flow rate, and isotopic composition. A laboratory isotopic analysis is made of each batch prior to discharge. Based on the isotopic analysis and existing flow condition, the setpoint will be calculated and set on the appropriate monitor to ensure the 10 times the Effluent Concentration Limits of 10 CFR 20, Appendix B, Table 2, Column 2 (WCNOC ODCM Attachment A, Section 2.1) are not exceeded. The Alert/Alarm Setpoint is set to 80% of the High Alarm/Trip setpoint.

The High Alarm/Trip setpoints are determined using the following methodology:

- 1) Determine concentrations of radioactivity of the batch being considered for release.

The isotopic concentration of the batch is the sum of the concentrations for the isotopes present as determined from the analysis required in Table 2-1.

$$\sum_i C_i = \sum_g C_g + C_a + C_s + C_t + C_f$$

Where:  $C_i$  = The concentration of nuclide i as determined by the analysis of the waste sample.

$C_g$  = The sum of the concentrations  $C_g$  of each measured gamma emitting nuclide observed by gamma-ray spectroscopy of the waste sample.

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\*C<sub>a</sub> = The measured concentration C<sub>a</sub> of alpha emitting nuclides observed by gross alpha analysis of the monthly composite sample.

\*C<sub>s</sub> = The measured concentrations of Sr-89 and Sr-90 in liquid waste as determined by analysis of the quarterly composite sample.

\*C<sub>t</sub> = The measured concentration of H-3 in liquid waste.

\*C<sub>f</sub> = The measured concentration of Fe-55 and Ni-63 in liquid waste as determined by analysis of the quarterly composite. **11/12**

\*Values for these concentrations will be based on previous composite sample analysis as required by Table 2-1.

- 2) The measured radionuclide concentrations are used to calculate the required dilution factor, RDF, which is the ratio of total dilution flow rate to tank flow rate required to assure that the limiting concentrations of Section 2.1 are met at the point of discharge. This is referred to as the required dilution factor and is determined according to:

$$RDF = \frac{\left( \sum_i \frac{C_i}{ECL_i} \right) F}{AF \times SF} = \frac{F}{f}$$

Where: RDF = Required dilution factor to meet 10 times 10 CFR 20 ECLs at point of discharge.

C<sub>i</sub> = Measured concentrations of C<sub>g</sub>, C<sub>a</sub>, C<sub>s</sub>, C<sub>t</sub> and C<sub>f</sub>, as defined in Step 1. Terms C<sub>a</sub>, C<sub>s</sub>, C<sub>t</sub> and C<sub>f</sub>, will be included in the calculation as appropriate.

ECL<sub>i</sub> = ECL<sub>g</sub>, ECL<sub>a</sub>, ECL<sub>s</sub>, ECL<sub>t</sub> and ECL<sub>f</sub>, are 10 times the limiting concentrations of the appropriate radionuclide from 10 CFR 20, Appendix B, Table 2, Column 2. For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-04, µCi/mL total activity.

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AF = The allocation fraction; a conservative factor used to allocate portions of a shared dilution stream to separate concurrent releases to ensure the concentration limits of section 2.1 are not exceeded. The sum of allocation fractions for concurrent releases with a shared discharge point shall not exceed 1.0 and may be altered based on plant need. For cases where the ECL fraction exceeds 1.0, dilution is required to ensure compliance with section 2.1, and the allocation fraction must be applied to ensure this compliance is met.

SF = The safety factor; a conservative factor used to compensate for statistical fluctuations and errors of measurement. Default value is 1.0.

F = Dilution Flow Rate

f = Effluent Flow Rate (Waste Water Flow Rate)

- 3) The calculated maximum permissible waste tank effluent flow rate,  $f_{\max}$ , is based on the required dilution factor, RDF, and the effective dilution flow rate,  $F_{\text{eff}}$ .

$$f_{\max} \leq \frac{F_{\text{eff}} + f}{\text{RDF}} \approx \frac{F_{\text{eff}}}{\text{RDF}} \text{ for } f \ll F_{\text{eff}}$$

Where:  $f_{\max}$  = The calculated maximum permissible waste tank effluent flow rate.

f = The expected effluent (waste stream) flow rate; normally the rated capacity of the effluent pump.

RDF = The required dilution factor; as defined previously.

$$F_{\text{eff}} = F_m \left[ 1 - \sum_i \frac{\text{LC}_i}{\text{ECL}_i} \right]$$

Where:  $F_{\text{eff}}$  = Effective dilution flow rate. This is applied since the cooling lake into which the effluent is discharged is also the dilution stream. This accounts for the recirculation of previously emitted radionuclides should they be detected by sample analysis of the cooling lake water.

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$F_m$  = The expected minimum dilution water flow rate. For the purpose of setpoint calculations the expected minimum dilution flow rate is assigned a value based upon the type and number of pumps RUNNING into the circulating water piping.

$LC_i$  = The measured concentration of nuclide,  $i$ , in the cooling lake water sample.

$ECL_i$  = The effluent concentration limit; set to 10 times the Effluent Concentration Limit of nuclide's from 10 CFR 20, Appendix B, Table 2, Column 2 in accordance with ODCM Attachment A, Section 2.1.

Thus the pump flow rate,  $f$  in the above equation, is set at or below  $f_{max}$ . Even though the value of  $f_{max}$  may be larger than the actual effluent pump capacity it does represent the upper limit to the effluent flow rate, whereby the requirement of 10 CFR 20 may still be met. If  $RDF \leq 1$ , the effluent pump flow rate may be assigned any value since the waste tank effluent concentration meets the limits of 10 CFR 20 without dilution and the release may be made without regard to the setpoints for other release pathways. For those discharge pathways selected to be secured during the release under consideration, the pump flow rate should be set at as low a value as practicable to detect any inadvertent release. A setpoint for the dilution stream flow rate is not applicable since the minimum flow rate is administratively set.

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- 4) The liquid radiation monitor setpoint may now be determined based on the values of  $\Sigma_i$ ,  $C_i$ ,  $f$ , and  $f_{\max}$  as previously defined. The monitor response is primarily due to gamma radiation, therefore, the actual setpoint is based on  $\Sigma_g$  and  $C_g$ . The calculated monitor setpoint concentration is determined as follows:

$$c = A \sum_g C_g (\mu\text{Ci/ml})$$

Where: A = Adjustment factor which will allow the setpoint to be established in a practical manner for convenience and to prevent spurious alarms.

$$A = \frac{f_{\max}}{f}$$

If  $A > 1$ , calculate  $c$  to determine the maximum value for the actual monitor setpoint ( $\mu\text{Ci/mL}$ ).

If  $A < 1$ , no release may be made. Calculations must be repeated to reduce monitor setpoint by applying a combination of higher dilution flow, lower tank/system release rate, or increased allocation fraction (AF).

If  $\text{RDF} < 1$ , no further dilution is required and the release may be made without regard to available dilution or to other releases made simultaneously. However, it is necessary to establish a monitor setpoint which will provide alarm should the release concentration inadvertently exceed 10 CFR 20 limits. This can be accomplished by establishing the adjustment factor as follows:

$$A = \frac{1}{\text{RDF}}$$

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### 3.0 Gaseous Effluents

Gaseous effluent releases from the Unit Vent and Radwaste Building Vent are monitored continuously. The Unit Vent is the release point for the Fuel/Auxiliary Building, access control area, containment purge, and condenser air discharge. The Radwaste Building Vent is the release point for Waste Gas Decay Tanks and the Radwaste Building Ventilation System.

Waste Gas Decay Tank releases and Containment Building releases are treated as batch releases. Waste Gas Decay Tank releases are monitored by the Radwaste Building Exhaust Monitor. Containment Building releases (purges) are monitored by the Containment Purge System monitors and the Plant Unit Vent Monitor.

Monitor identifications are as follows:

| <u>Monitor ID</u>  | <u>Release Point Description</u>                                                                                           |
|--------------------|----------------------------------------------------------------------------------------------------------------------------|
| O-GT-RE-21 A and B | Unit Vent (Fuel/Auxiliary Building, access control area, containment purge, condenser air discharge)                       |
| O-GH-RE-10 A and B | Radwaste Building vent (Radwaste Building, waste gas decay tank discharge. Acts to isolate Waste Gas Decay Tank discharge) |
| O-GT-RE-22 & 33    | Containment Purge System Monitor (acts to isolate the purge; is not an effluent monitor)                                   |
| O-GT-RE-31 & 32    | Containment Atmosphere Monitor (acts to isolate purge; not an effluent monitor)                                            |

The setpoint for monitors may be determined either based on total body dose or skin dose rate. The dose rate limits are for dose rates at the unrestricted area boundary. The monitor setpoint is the lesser of the total body dose rate or skin dose rate.

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**3.1 Dose Rate - Compliance With Technical Specification 5.5.4.g**

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:

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

**3.1.1 Remedial Action**

With the dose rate(s) exceeding the above limits, immediately restore the release to within the above limit(s).

**3.1.2 Surveillance Requirements**

The dose rate to radionuclides in gaseous effluents shall be determined to be within the above limits in accordance with the methodology described below by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 3-1.

Based on the methodology of NUREG-0133;

- a. Release rate limit for noble gases:

$$(\overline{X/Q}) \sum_i K_i Q_i < 500 \text{ mrem/yr for the total body,}$$

and

$$(\overline{X/Q}) \sum_i (L_i + 1.1 M_i) Q_i < 3000 \text{ mrem/yr for the skin}$$

Where:  $K_i$  = Total body dose factor due to gamma emissions for each identified noble gas radionuclide, in mrem/yr per  $\mu\text{Ci}/\text{m}^3$ , from Table A.1-2.

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$(\overline{X/Q}) = 2.2\text{E-}06 \text{ sec/m}^3$ , the highest calculated annual average relative concentration at the restricted area boundary in the north sector.

$Q_i$  = Release rate of radionuclide  $i$  from vent, in  $\mu\text{Ci/sec}$ .

$L_i$  = Skin dose factor due to beta emissions for each identified noble gas radionuclide, in  $\text{mrem/yr per } \mu\text{Ci/m}^3$ , from Table A.1-2.

$M_i$  = Air dose factor due to gamma emissions for each identified noble gas radionuclide, in  $\text{mrad/yr per } \mu\text{Ci/m}^3$  from Table A.1-2.

1.1 = Conversion constant of air dose to skin dose.

- b. Release rate limit for all radionuclides and radioactive materials in particulate form and radionuclides other than noble gases:

$$(\overline{X/Q}) \sum_i R_{aij}^I Q_i < 1500 \text{ mrem/yr to any organ (j)}.$$

Where:  $(\overline{X/Q}) = 2.2\text{E-}06 \text{ sec/m}^3$  (the highest annual average).  
The highest calculated annual average relative concentration for estimating the dose to any individual at the unrestricted area boundary in the North sector.

$R_{aij}^I$  = The dose parameter for radionuclides other than noble gases for the inhalation pathway (I) summed separately over the radionuclides ( $i$ ) for each organ ( $j$ ) and age group ( $a$ ), in  $\text{mrem/yr per } \mu\text{Ci/m}^3$ . See Table A.5-4. See step 3.2.2.2,  $R_{aij}^I$  for Inhalation Pathway Factor, for the calculation of  $R_{aij}^I$  for the child age group.

$Q_i$  = The release rate of radionuclides,  $i$ , in gaseous effluent from all vent releases, in  $\mu\text{Ci/sec}$ .

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All radionuclides are assumed to be released in elemental form. The limit is applicable to the location (unrestricted area boundary or beyond), characterized by the value of  $X/Q$  which results in the maximum total body or skin dose commitment. The factors  $K_i$ ,  $L_i$ , and  $M_i$  relate the radionuclide airborne concentrations to various dose rates assuming a semi-infinite cloud. These factors are taken from Table B-1 of the Regulatory Guide 1.109 and multiplied by  $10^6$  to convert  $\text{pCi}^{-1}$  to  $\mu\text{Ci}^{-1}$  and listed in Table A.1-2.

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**TABLE 3-1**  
RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

| Gaseous Release Type                                         | Sample Frequency | Principal Gamma Emitters | H-3 (Oxide)  | I-131/<br>I-133         | Gross Alpha | Sr-89,<br>Sr-90           |
|--------------------------------------------------------------|------------------|--------------------------|--------------|-------------------------|-------------|---------------------------|
| 1. Unit Vent<br>Gas<br>LLD(1)<br>Particulate                 | M                | M(3) (2)<br>1E-4         | M(4)<br>1E-6 |                         |             |                           |
| LLD(1)<br>Charcoal<br>LLD(1)                                 | Continuous (6)   | W(7)<br>1E-11 (2)        |              |                         | M<br>1E-11  | Q<br>Composite<br>1E-11   |
|                                                              | Continuous (6)   |                          |              | W(7)<br>1E-12/<br>1E-10 |             |                           |
| 2. Radwaste<br>Building Vent<br>Gas<br>LLD(1)<br>Particulate | M                | M(2)<br>1E-4             | M<br>1E-6    |                         |             |                           |
| LLD(1)<br>Charcoal<br>LLD(1)                                 | Continuous (6)   | W(7) (2)<br>1E-11        |              |                         | M<br>1E-11  | Q<br>(Composite)<br>1E-11 |
|                                                              | Continuous (6)   |                          |              | W(7)<br>1E-12/<br>1E-10 |             |                           |
| 3. Containment<br>Purge or Vent<br>Gas<br>LLD(1)             | P (3)            | P (3) (2)<br>1E-4        | M<br>1E-6    |                         |             |                           |
| 4. Waste Gas<br>Decay Tanks<br>Gas<br>LLD(1)                 | P                | P (2)<br>1E-4            |              |                         |             |                           |

LLD = (μCi/ml)

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**TABLE 3-1 (Continued)**

TABLE NOTATIONS

- (1) The LLD is defined, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66 s_b}{E \times V \times (2.22E+6) \times Y \times \text{Decay}}$$

Where: LLD = the "a priori" lower limit of detection (microCuries per unit mass or volume),

$s_b$  = the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, (counts per minute),  $s_b = \sqrt{B / LT}$

Where: B = background sum (counts)

LT = live time (minutes),

E = the counting efficiency (counts per disintegration),

V = the sample size (units of mass or volume),

2.22E+6 = the number of disintegrations per minute per microCurie,

Y = the fractional radiochemical yield, when applicable,

Decay = decay factor(s), There are three decay factors that may be appropriate for use depending on the nature of the sample and the half life of the nuclide. Any combination of the three may be used. The factors are as follows:

- A) This decay factor corrects for decay from the time of sampling to the start of the analysis.

$$e^{-\lambda \Delta t_s}, \text{ where:}$$

$\Delta t_s$  = decay time = acquisition start time - sample time

$\lambda$  =  $\ln 2$ /half-life

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**TABLE 3-1 (Continued)**  
TABLE NOTATIONS

- B) This decay factor corrects for decay during the analysis.

$$\frac{1 - e^{-\lambda RT}}{\lambda \times RT}$$

$$\lambda = \ln 2 / \text{half-life}$$

RT = real time of counting

- C) This decay factor corrects for decay during sampling.

$$\frac{1 - e^{-\lambda \Delta t_d}}{\lambda \Delta t_d}$$

$$\lambda = \ln 2 / \text{half-life}$$

$\Delta t_d$  = deposition time = (sample time - deposition start time), or *for effluents only* (sample time - midpoint of sample period)

**NOTE**

**All times used in decay calculations should be in the same units.**

Typical values of E, V, Y,  $t_s$ ,  $t_d$  should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

For very low background counting, the LLD can be optionally calculated as follows:

$$LLD = \frac{2.71 + 4.66 s_b}{E \times V \times 2.22 \times 10^6 \times Y \times \text{Decay}}$$

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**TABLE 3-1 (Continued)**

TABLE NOTATIONS

- (2) The principal gamma emitters for which the LLD specification applies include the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 in noble gas releases and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, I-131, Cs-134, Cs-137, Ce-141 and Ce-144 in iodine and particulate releases. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the annual Radioactive Effluent Release Report in the format outlined in Regulatory Guide 1.21, Appendix B, Revision 1, June 1974.
- (3) Sampling and analysis shall also be performed following shutdown, startup, or a THERMAL POWER change greater than or equal to 15% of RATED THERMAL POWER within 1 hour period.
- (4) Tritium grab samples shall be taken and analyzed at least once per 24 hours when the refueling canal is flooded.
- (6) The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Sections 3.1, 3.2 and 3.3.
- (7) Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing, or after removal from sampler. For unit vent, sampling shall also be performed at least once per 24 hours for at least 7 days following each shutdown, startup or THERMAL POWER change exceeding 15% of RATED THERMAL POWER within a 1-hour period, and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement to sample once per 24 hours does not apply if analysis shows that both the DOSE EQUIVALENT I-131 concentration in the reactor coolant and the unit vent noble gas monitor activity have not increased more than a factor of 3.

FREQUENCY NOTATION

| <u>NOTATION</u> | <u>FREQUENCY</u>                 |
|-----------------|----------------------------------|
| S               | At least once per 12 hours.      |
| D               | At least once per 24 hours.      |
| W               | At least once per 7 days         |
| M               | At least once per 31 days.       |
| Q               | At least once per 92 days.       |
| SA              | At least once per 184 days.      |
| R               | At least once per 18 months.     |
| S/U             | Prior to each reactor startup.   |
| N.A.            | Not applicable.                  |
| P               | Completed prior to each release. |

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**3.2 Dose - Compliance With 10 CFR 50 Appendix I**

**3.2.1 Noble Gases**

The air dose due to noble gases released in gaseous effluents, from each unit, to areas at and beyond the SITE BOUNDARY shall be limited to the following:

- a. During any calendar quarter: Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation, and
- b. During any calendar year: Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

**3.2.1.1 Remedial Action**

With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, a special report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

**3.2.1.2 Surveillance Requirements**

Cumulative dose contributions for the current calendar quarter and calendar year for noble gases shall be determined in accordance with the following methodology at least once per 31 days. The dose calculations for the actual releases of radioactive noble gases in gaseous effluent will be consistent with the methodology provided in Reg. Guide 1.109, Rev. 1. The following dose calculations will be performed:

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a. During any calendar quarter;

For gamma radiation;

$$D = 3.17E-8 \sum_{i=1} M_i \left[ \left( \overline{X/Q} \right) \times Q_i \right] \leq 5 \text{ mrad.}$$

For beta radiation:

$$D = 3.17E-8 \sum_{i=1} N_i \left[ \left( \overline{X/Q} \right) \times Q_i \right] \leq 10 \text{ mrad.}$$

b. During any calendar year:

For gamma radiation;

$$D = 3.17E-8 \sum_{i=1} M_i \left[ \left( \overline{X/Q} \right) \times Q_i \right] \leq 10 \text{ mrad.}$$

For beta radiation:

$$D = 3.17E-8 \sum_{i=1} N_i \left[ \left( \overline{X/Q} \right) \times Q_i \right] \leq 20 \text{ mrad.}$$

Where: 3.17 E-8 = The inverse of the number of seconds in a year.

$M_i$  = The air dose factor due to gamma emissions for each identified noble gas radionuclide, in mrad/yr per  $\mu\text{Ci}/\text{m}^3$  from Table A.1-2 (Reg. Guide 1.109, Table B-1, Col. 4).

$N_i$  = The air dose factor due to beta emissions for each identified noble gas radionuclide, in mrad/year per  $\mu\text{Ci}/\text{m}^3$  from Table A.1-2 (Reg. Guide 1.109, Table B-1, Column 2).

$\left( \overline{X/Q} \right)$  =  $2.2E-06 \text{ sec}/\text{m}^3$ , the highest calculated annual average relative concentration at the restricted area boundary in the north sector.

$Q_i$  = The release of noble gas radionuclides, 'i', in gaseous effluents, in  $\mu\text{Ci}$ . Releases shall be cumulative over the calendar quarter or year as appropriate.

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**3.2.2 Radioiodines, Particulates and Other Radionuclides**

The dose to a MEMBER OF THE PUBLIC from Iodine-131 and 133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released, from each unit, to areas at and beyond the SITE BOUNDARY shall be limited to the following:

- a. During any calendar quarter: Less than or equal to 7.5 mrems to any organ; and
- b. During any calendar year: Less than or equal to 15 mrems to any organ.

**3.2.2.1 Remedial Action**

With the calculated dose from the release of Iodine-131 and 133, tritium, and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, a special report that identifies the cause(s) for exceeding the limits and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

**3.2.2.2 Surveillance Requirements**

Cumulative dose contributions for the current calendar quarter and current calendar year for Iodine-131 and 133, tritium, and radionuclides in particulate form with half-lives greater than 8 days shall be determined in accordance with the following methodology at least once per 31 days. To show compliance, the dose calculations for the actual releases of the subject materials are consistent with the methodology provided in Regulation Guide 1.109, Revision 1. The following dose calculations will be performed:

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$$a. D(\text{mrem}) = 3.17\text{E}-8 \sum_i R_{aij} [(WQ_i)] \leq 7.5 \text{ mrem (for the calendar quarter)}$$

$$b. D(\text{mrem}) = 3.17\text{E}-8 \sum_i R_{aij} [(WQ_i)] \leq 15 \text{ mrem (for the calendar year)}$$

Where: 3.17 E-8 = The inverse of the number of seconds in a year.

$Q_i$  = The release of radioiodines, radioactive materials in particulate form and radionuclides other than noble gases in gaseous effluents, 'i', in  $\mu\text{Ci}$ . Releases shall be cumulative over the calendar quarter or year as appropriate. The  $Q_i$  value shall be determined as the product of the flow rate through the release point and grab samples of the effluent analyzed in accordance with Table 3-1.

$W$  = The annual average dispersion parameter for estimating the dose to an individual at the controlling location.

$W = (X/Q)$ ,  $2.2 \text{ E}-6 \text{ sec/m}^3$  for the inhalation pathway.

$W = (D/Q)$ ,  $1.8 \text{ E}-8 \text{ m}^{-2}$ , for the food and ground plane pathways.

$R_{aij}$  = The dose factor for each identified radionuclide, 'i', in  $\text{mrem/yr per } \mu\text{Ci/m}^3$  for each age group, 'a', and target (organ), 'j'. See Table A.5-2 through Table A.5-20.

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Where:

Inhalation Pathway Factor,  $R_{aij}^I [X/Q]$

$$R_{aij}^I [X/Q] = K' (BR)_a (DFA_i)_{aj} (\text{mrem/yr per } \mu\text{Ci/m}^3)$$

Where:  $K'$  = a constant of unit conversion,  $10^6 \text{ pCi}/\mu\text{Ci}$ .

$(BR)_a$  = The breathing rate of the receptor of age group (a), in  $\text{m}^3/\text{yr}$ .

The breathing rates  $(BR)_a$  for the various age groups are tabulated below, as given in Regulatory Guide 1.109, Table E-5.

| <u>AGE GROUP (a)</u> | <u>BREATHING RATE (<math>\text{m}^3/\text{yr}</math>)</u> |
|----------------------|-----------------------------------------------------------|
| Infant               | 1400                                                      |
| Child                | 3700                                                      |
| Teen                 | 8000                                                      |
| Adult                | 8000                                                      |

$(DFA_i)_{aj}$  = The maximum organ inhalation dose factor for the receptor of age group (a), organ (j), for the  $i^{\text{th}}$  radionuclide, in  $\text{mrem/pCi}$ . The body is considered as an organ in the selection of  $(DFA_i)_a$ . See Tables A.2-1, A.2-2, A.2-3, & A.2-4. From Regulatory Guide 1.109, Tables E-7, E-8, E-9 and E-10.

Ground Plane Pathway Factor,  $R_i^G [D/Q]$

$$R_i^G [D/Q] = K' K'' (SF) DFG_i \left[ (1 - e^{-\lambda_i t}) / \lambda_i \right] (\text{m}^2 \times \text{mrem/yr per } \mu\text{Ci/sec})$$

Where:  $K'$  = A constant of unit conversion,  $10^6 \text{ pCi}/\mu\text{Ci}$ .

$K''$  = A constant of unit conversion, 8760 hr/year.

$\lambda_i$  = The decay constant for the  $i^{\text{th}}$  radionuclide,  $\text{sec}^{-1}$ .

$t$  = The exposure time,  $9.47\text{E}8 \text{ sec}$  (30 years).

$DFG_i$  = The ground plane dose conversion factor for the  $i^{\text{th}}$  radionuclide ( $\text{mrem/hr per pCi/m}^2$ ). Note that all age groups and organs are assumed to receive the same dose for the total body. See Table A.2-5. (Regulatory Guide 1.109, Table E-6).

$SF$  = The shielding factor (dimensionless), 0.7 (Reg. Guide 1.109)

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Grass-Cow-Milk Pathway Factor,  $R_{aij}^C [D/Q]$

$$R_{aij}^C [D/Q] = K' \left( \frac{Q_F (U_{ap})}{\lambda_i + \lambda_w} \right) F_m(r) (DFL_i)_{aj} (f_p / Y_p) (e^{-\lambda_i t_r}) (m^2 \text{mrem/yr per } \mu\text{Ci/sec})$$

Where:  $K'$  = A constant of unit conversion,  $10^6$  pCi/ $\mu$ Ci.

$Q_F$  = The cow's consumption rate, in Kg/day (wet weight), 50 kg/day. (Reg. Guide 1.109, Table E-3).

$U_{ap}$  = The receptor's milk consumption rate for age (a), in liters/yr. (Reg. Guide 1.109, Table E-5).

|        |   |          |
|--------|---|----------|
| Infant | = | 330 l/yr |
| Child  | = | 330 l/yr |
| Teen   | = | 400 l/yr |
| Adult  | = | 310 l/yr |

$Y_p$  = The agricultural productivity by unit area of pasture feed grass, in kg/m<sup>2</sup>, 0.7 kg/m<sup>2</sup>. (Reg. Guide 1.109, Table E-15)

$F_m$  = The stable element transfer coefficients, in days/liter, see Table A.3-5. (Reg. Guide 1.109, Table E-1)

$r$  = Fraction of deposited activity retained on cow's feed grass,  $r=1$  for radioiodine and  $r=0.2$  for particulates. (Reg. Guide 1.109, Table E-15)

$(DFL_i)_{aj}$  = The ingestion dose factor for the  $i^{\text{th}}$  radionuclide for the receptor for organ (j) in age group (a), in mrem/pCi. See Tables A.3-1, A.3-2, A.3-3, and A.3-4. (Reg. Guide 1.109, Table E-11, E-12, E-13, and E-14)

$\lambda_i$  = The decay constant for the  $i^{\text{th}}$  radionuclide, in sec<sup>-1</sup>.

$\lambda_w$  = The decay constant for removal of activity on leaf and plant surfaces by weathering,  $5.73 \text{ E-}7 \text{ sec}^{-1}$  (corresponding to a 14 day half-life).

$f_p$  = The product of the fraction of the year that the cow is on pasture and the fraction of cow feed that is pasture grass. The value is assumed to be 1.0, which is the most restrictive case.

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$t_f$  = The transport time from pasture to cow, to milk, to receptor, in sec,  $1.73 \text{ E}5 \text{ sec}$  (2 days). (Reg. Guide 1.109, Table E-15).

Grass-Goat-Milk Pathway Factor,  $R_{aij}^C [D/Q]$

$$R_{aij}^C [D/Q] = K' \left( \frac{Q_F (U_{ap})}{\lambda_i + \lambda_w} \right) F_m(r) (DFL_i)_{aj} (f_p / Y_p) (e^{-\lambda_i t_f}) (m^2 \text{ mrem/yr per } \mu\text{Ci/sec})$$

Where:  $Q_F$  = The goat's consumption rate, in Kg/day (wet weight), 6 Kg/day. (Reg. Guide 1.109, Table E-3).

$t_f$  = The transport time from pasture to goat, to milk, to receptor, in sec,  $1.73 \text{ E}5 \text{ sec}$  (2 days). (Reg. Guide 1.109, Table E-15).

$f_p$  = The product of the fraction of the year that the goat is on pasture and the fraction of goat feed that is pasture grass. The value is assumed to be 1.0, which is the most restrictive case.

all other terms are defined under the Grass-Cow-Milk-Pathway Factor.

The concentration of tritium in cow or goat milk is based on the airborne concentration rather than the deposition. Therefore, the  $R_{aij}^C$  is based on  $(X/Q)$ ,

$$R_{aij}^C [X/Q] = K' K''' F_m Q_F U_{ap} (DFL_i)_{aj} [0.75 (0.5/H)] (mrem/yr per \mu\text{Ci/m}^3)$$

Where:  $K'''$  = a constant of unit conversion,  $10^3 \text{ gm/Kg}$ .

$H$  = Absolute humidity of the atmosphere,  $8 \text{ gm/m}^3$  (Reg. Guide 1.109).

0.75 = The fraction of total feed that is water. (NUREG 0133)

0.5 = The ratio of the specific activity of the feed grass water to the atmospheric water. (NUREG 0133)

all other terms are previously defined.

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Grass-Cow-Meat Pathway Factor,  $R_{aij}^M [D/Q]$

$$R_{aij}^M [D/Q] = K' \left( \frac{Q_F (U_{ap})}{\lambda_i + \lambda_w} \right) F_m(r) (DFL_i)_{aj} (f_p/Y_p) (e^{-\lambda_i t_f}) (m^2 \text{ mrem/yr per mCi/sec})$$

Where:  $F_m$  = The stable element transfer coefficients, in days/kg, Table A.3-5. (Reg. Guide 1.109, Table E-1).

$U_{ap}$  = The receptor's meat consumption rate for age (a), in kg/yr. (Reg. Guide 1.109, Table E-5).

|        |   |     |
|--------|---|-----|
| Infant | = | 0   |
| Child  | = | 41  |
| Teen   | = | 65  |
| Adult  | = | 110 |

$t_f$  = The transport time from pasture to receptor, in sec.,  $1.73 \text{ E}6$  (20 days) (Reg. Guide 1,109, Table E-15).

All other terms are previously defined.

The concentration of tritium in meat is based on its airborne concentration rather than the deposition. Therefore, the  $R_{aij}^M$  is based on (X/Q): (All terms defined above.)

$$R_{aij}^M [X/Q] = K' K'' F_m Q_F U_{ap} (DFL_i)_{aj} [0.75 (0.5/H)] (mrem/yr per \mu\text{Ci/m}^3)$$

Vegetation Pathway Factor,  $R_{aij}^V [D/Q]$

Man is considered to consume two types of vegetation (fresh and stored) that differs only in the time period between harvest and consumption, therefore:

$$R_{aij}^V [D/Q] = K' \left[ \frac{r}{Y_v (\lambda_i + \lambda_w)} \right] (DFL_i)_{aj} [(U_a^L)(f_L)(e^{-\lambda_i t_L}) + (U_a^S)(f_S)(e^{-\lambda_i t_S})] (m^2 \times mrem/yr per \mu\text{Ci/sec})$$

Where:  $K'$  = A constant of unit conversion,  $10^6 \text{ pCi}/\mu\text{Ci}$ .

$U_a^L$  = The consumption rate of fresh leafy vegetation by the receptor in age group (a), in kg/yr. (Reg. Guide 1.109, Table E-5).

|        |   |    |       |
|--------|---|----|-------|
| Infant | = | 0  | kg/yr |
| Child  | = | 26 | kg/yr |
| Teen   | = | 42 | kg/yr |
| Adult  | = | 64 | kg/yr |

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$U_a^s$  = The consumption rate of stored vegetation by the receptor in age group (a), Kg/yr. (Reg. Guide 1.109, Table E-5).

Infant = 0 kg/yr  
Child = 520 kg/yr  
Teen = 630 kg/yr  
Adult = 520 kg/yr

$f_L$  = The fraction of the annual intake of fresh leafy vegetation grown locally. (default = 1.0) (Reg. Guide 1.109).

$f_g$  = The fraction of the annual intake of stored vegetation grown locally (default = 0.76) (Reg. Guide 1.109).

$t_L$  = The average time between harvest of leafy vegetation and its consumption, in seconds,  $8.6 \text{ E4 sec}$  (1 day). (Reg. Guide 1.109).

$t_h$  = The average time between harvest of stored vegetation and its consumption, in seconds,  $5.18 \text{ E6 sec}$  (60 days) (Reg. Guide 1.109, Table E-15).

$Y_v$  = The vegetation area density,  $2.0 \text{ kg/m}^2$ . (Reg. Guide 1.109, Table E-15).

All other factors previously defined.

The concentration of tritium in vegetation is based on the airborne concentration rather than the deposition. Therefore, the  $R_{aij}^v$  is based on (X/Q):

$$R_{aij}^v [X/Q] = K' K'' [U_a^L f_L + U_a^S f_g] (DFL_i)_{aj} [0.75 (0.5/H)] (\text{mrem/yr per } \mu\text{Ci/m}^3)$$

Where: All terms defined previously. All values indicated are default values from Reg. Guide 1.109, Rev. 1.

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**3.3 Projected Dose**

The VENTILATION EXHAUST TREATMENT SYSTEM and the WASTE GAS HOLDUP SYSTEM shall be FUNCTIONAL and appropriate portions of these systems shall be used to reduce releases of radioactivity when the projected doses in 31 days due to gaseous effluent releases, from each unit, to areas at and beyond the SITE BOUNDARY would exceed: 11/12

- a. 0.2 mrad to air from gamma radiation, or
- b. 0.4 mrad to air from beta radiation, or
- c. 0.3 mrem to any organ of a MEMBER OF THE PUBLIC.

**3.3.1 Remedial Action**

With radioactive gaseous waste being discharged without treatment and in excess of the above limits, prepare and submit to the Commission within 30 days, a special report that includes the following information:

- a. Identification of any nonfunctional equipment or subsystems, and the reason for the nonfunctionality, 11/12
- b. Action(s) taken to restore the nonfunctional equipment to FUNCTIONAL status, and 11/12
- c. Summary description of action(s) taken to prevent a recurrence.

**3.3.2 Surveillance Requirements**

**3.3.2.1** Doses due to gaseous releases from each unit to areas at and beyond the SITE BOUNDARY shall be projected at least once per 31 days in accordance with the following methodology when Gaseous Radwaste Treatment Systems are not being fully utilized.

$$D_{31} = \left[ \frac{A}{T} \right] \times 31$$

Where:  $D_{31}$  = Projected 31 day dose

A = Cumulative dose for previous three calendar months

T = Number of days that the cumulative dose occurred in A above

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- 3.3.2.2** The installed VENTILATION EXHAUST TREATMENT SYSTEM and WASTE GAS HOLDUP SYSTEM shall be considered FUNCTIONAL by meeting Section 3.1 and 3.2 limits. **11/12**

**3.4** **Instrumentation**

The radioactive gaseous effluent monitoring instrumentation channels shown in Table 3-2 shall be FUNCTIONAL with their Alarm/Trip Setpoints set to ensure that the limits of Section 3.1 are not exceeded. The Alarm/Trip Setpoints of these channels meeting Section 3.1 shall be determined and adjusted in accordance with the methodology and parameters of Section 3.4.4 below. **11/12**

**3.4.1** **Remedial Action**

- a. With a radioactive gaseous effluent monitoring instrumentation channel Alarm/Trip Setpoint less conservative than required by the above specification, immediately suspend the release of radioactive gaseous effluents monitored by the affected channel, or declare the channel nonfunctional. **11/12**
- b. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels FUNCTIONAL take the ACTION shown in Table 3-2. Restore the nonfunctional instrumentation to FUNCTIONAL status within the time specified in the ACTION, or explain in the next annual Radioactive Effluent Release Report, why this nonfunctionality was not corrected within the time specified. **11/12**

**3.4.2** **Surveillance Requirements**

Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated FUNCTIONAL by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL OPERATIONAL TEST at the frequencies shown in Table 3-3. **11/12**

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| TABLE 3-2<br>RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION                                      |                                            |                      |                                   |
|-----------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------|-----------------------------------|
| <u>INSTRUMENT</u>                                                                                         | <u>MINIMUM<br/>CHANNELS<br/>FUNCTIONAL</u> | <u>APPLICABILITY</u> | <u>ACTION</u><br><br><u>11/12</u> |
| 1. Unit Vent System                                                                                       |                                            |                      |                                   |
| a. Noble Gas Activity Monitor - Providing Alarm (GT-RE-21B)                                               | 1                                          | *                    | 40                                |
| b. Iodine Sampler (GT-RE-21A, GT-RE-21B)                                                                  | 1                                          | *                    | 43                                |
| c. Particulate Sampler (GT-RE-21A, GT-RE-21B)                                                             | 1                                          | *                    | 43                                |
| d. Flow Rate                                                                                              | N.A.                                       | *                    | 45                                |
| e. Sampler Flow Rate Monitor                                                                              | 1                                          | *                    | 39                                |
| 2. Containment Purge System                                                                               |                                            |                      |                                   |
| a. Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release (GT-RE-22, GT-RE-33) | 1                                          | *                    | 41                                |
| b. Flow Rate                                                                                              | N.A.                                       | *                    | 45                                |
| 3. Radwaste Building Vent System                                                                          |                                            |                      |                                   |
| a. Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release (GH-RE-10B)          | 1                                          | *                    | 38, 40                            |
| b. Iodine Sampler (GH-RE-10A, GH-RE-10B)                                                                  | 1                                          | *                    | 43                                |
| c. Particulate Sampler (GH-RE-10A, GH-RE-10B)                                                             | 1                                          | *                    | 43                                |
| d. Flow Rate                                                                                              | N.A.                                       | *                    | 45                                |
| e. Sampler Flow Rate Monitor                                                                              | 1                                          | *                    | 39                                |

\*At all times.

|                 |                                 |                |
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**TABLE 3-2 (Continued)**  
TABLE NOTATIONS  
ACTION STATEMENTS

ACTION 38 - With the number of channels FUNCTIONAL less than required by the minimum channels FUNCTIONAL requirement, the contents of the tank(s) may be released to the environment for up to 14 days provided that prior to initiating the release: **11/12**

- a. At least two independent samples of the tank's contents are analyzed, and
- b. At least two technically qualified members of the facility staff independently verify the release rate calculations and discharge valve lineup.

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 39 - With the number of channels FUNCTIONAL less than required by the minimum channels FUNCTIONAL requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours. **11/12**

ACTION 40 - With the number of channels FUNCTIONAL less than required by the minimum channels FUNCTIONAL requirement, effluent releases via this pathway may continue for up to 30 days provided grab samples are taken at least once per 12 hours and these samples are analyzed for radioactivity within 24 hours. **11/12**

ACTION 41 - With the number of channels FUNCTIONAL less than required by the minimum channels FUNCTIONAL requirement, immediately suspend PURGING of radioactive effluents via this pathway. **11/12**

ACTION 43 - With the number of channels FUNCTIONAL less than required by the minimum channels FUNCTIONAL requirement, effluent releases via the affected pathway may continue for up to 30 days provided samples are continuously collected with auxiliary sample equipment as required in Table 3-1. Revised 08/11 to include either 'A' or 'B' pathways as options for fulfilling this requirement, as both fulfill the requirement of being samplers by plant design. **11/12**

ACTION 45 - Flow rate for this system shall be based on fan status and operating curves or actual measurements.

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| <p style="text-align: center;"><u>TABLE 3-3</u><br/>RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE<br/>REQUIREMENTS</p> |                          |                         |                                |                                         |                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------|--------------------------------|-----------------------------------------|-------------------------------------------------------------|
| <u>INSTRUMENT</u>                                                                                                                             | <u>CHANNEL<br/>CHECK</u> | <u>SOURCE<br/>CHECK</u> | <u>CHANNEL<br/>CALIBRATION</u> | <u>CHANNEL<br/>OPERATIONAL<br/>TEST</u> | <u>MODES FOR<br/>WHICH<br/>SURVEILLANCE<br/>IS REQUIRED</u> |
| 1. Unit Vent System                                                                                                                           |                          |                         |                                |                                         |                                                             |
| a. Noble Gas Activity Monitor-<br>Providing Alarm (GT-RE-21)                                                                                  | D                        | M                       | R(3)                           | Q(2)                                    | *                                                           |
| b. Iodine Sampler                                                                                                                             | W                        | N.A.                    | N.A.                           | N.A.                                    | *                                                           |
| c. Particulate Sampler                                                                                                                        | W                        | N.A.                    | N.A.                           | N.A.                                    | *                                                           |
| d. Flow Rate                                                                                                                                  | N.A.                     | N.A.                    | R(4)                           | N.A.                                    | *                                                           |
| e. Sampler Flow Rate Monitor                                                                                                                  | D                        | N.A.                    | R                              | Q                                       | *                                                           |
| 2. Containment Purge System                                                                                                                   |                          |                         |                                |                                         |                                                             |
| a. Noble Gas Activity Monitor-<br>Providing Alarm and Auto-<br>matic Termination of Re-<br>lease (GT-RE-22, GT-RE-33)                         | D                        | P                       | R(3)                           | Q(1)                                    | *                                                           |
| b. Iodine Sampler                                                                                                                             | W                        | N.A.                    | N.A.                           | N.A.                                    | *                                                           |
| c. Particulate Sampler                                                                                                                        | W                        | N.A.                    | N.A.                           | N.A.                                    | *                                                           |
| d. Flow Rate                                                                                                                                  | N.A.                     | N.A.                    | R(4)                           | N.A.                                    | *                                                           |
| e. Sampler Flow Rate Monitor                                                                                                                  | D                        | N.A.                    | R                              | N.A.                                    | *                                                           |
| 3. Radwaste Building Vent System                                                                                                              |                          |                         |                                |                                         |                                                             |
| a. Noble Gas Activity Monitor-<br>Providing Alarm and Auto-<br>matic Termination of<br>Release (GH-RE-10)                                     | D,P                      | M,P                     | R(3)                           | Q(1)                                    | *                                                           |
| b. Iodine Sampler                                                                                                                             | W                        | N.A.                    | N.A.                           | N.A.                                    | *                                                           |
| c. Particulate Sampler                                                                                                                        | W                        | N.A.                    | N.A.                           | N.A.                                    | *                                                           |
| d. Flow Rate                                                                                                                                  | N.A.                     | N.A.                    | R(4)                           | N.A.                                    | *                                                           |
| e. Sampler Flow Rate Monitor                                                                                                                  | D                        | N.A.                    | R                              | N.A.                                    | *                                                           |

\*At all times.

|                 |                                 |                |
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**TABLE 3-3 (Continued)**  
TABLE NOTATIONS

- (1) The CHANNEL OPERATIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation as appropriate occur if any of the following conditions exists:
  - a. Instrument indicates measured levels above the Alarm/Trip Setpoint (isolation and alarm), or
  - b. Circuit failure (alarm only), or
  - c. Instrument indicates a downscale failure (alarm only) or
  - d. Instrument controls not set in operate mode (alarm only).
- (2) The CHANNEL OPERATIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any one or combination of the following conditions exists:
  - a. Instrument indicates measured levels above the alarm setpoint
  - b. Circuit failure
  - c. Instrument indicates a downscale failure
  - d. Instrument controls not set in operate mode.
- (3) The initial CHANNEL CALIBRATION shall be performed using one or more of the reference (gas or liquid and solid) standards certified by the National Institute of Standards and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy, measurement range, and establish monitor response to a solid calibration source. For subsequent CHANNEL CALIBRATION, NIST traceable standard (gas, liquid or solid) may be used; or a gas, liquid, or solid source that has been calibrated by relating it to equipment that was previously (within 30 days) calibrated by the same geometry and type of source traceable to NIST.
- (4) If flow rate is determined by exhaust fan status and fan performance curves, the following surveillance operations shall be performed at least once per 18 months:
  - a. The specific vent flows by direct measurement, or
  - b. The differential pressure across the exhaust fan and vent flow established by the fan's "flow- P" curve, or
  - c. The fan motor horsepower measured and vent flow established by the fan's "flow-horsepower" curve.

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### 3.4.3 Airborne Radiation Monitor Calibration Methodology

The following monitors are associated with gaseous releases

| <u>Monitor ID</u> | <u>Monitor Description</u> | <u>Monitor Type</u>      |
|-------------------|----------------------------|--------------------------|
| O-GT-RE-21A       | Plant Unit Vent            | Particulate, Iodine      |
| O-GH-RE-10A       | Radwaste Building Effluent | Particulate, Iodine      |
| O-GT-RE-21B       | Plant Unit Vent            | Wide Range Gas           |
| O-GH-RE-10B       | Radwaste Building Effluent | Wide Range Gas           |
| O-GT-RE-22 & 33   | Containment Purge Exhaust  | Particulate, Iodine, Gas |
| O-GT-RE-31 & 32   | Containment Atmosphere     | Particulate, Iodine, Gas |

#### 3.4.3.1 Particulate Detector

Beta particulate is monitored by a 50 mm diameter by 0.25 mm thick plastic scintillator optically coupled to a 50 mm diameter photomultiplier tube. This detector shall be calibrated over its range of energy and rate capabilities.

For energy range calibration four sources shall be used. Each source consists of a filter paper impregnated with a beta emitting radionuclide. The radionuclides used should be Tc-99, Cs-137, Cl-36, and Rh-106. Each source shall be positioned in the filter paper retaining ring and counted separately. The count rates for each radionuclide source shall be recorded and the data plotted on a graph of cpm/ $\mu$ Ci versus average beta energy. This curve represents the detectors response characteristics over the range of beta energies observed. The efficiency for setpoint calculations shall be based on the efficiency of the detector for Cs-137.

The detector shall be calibrated for its rate capabilities using a filter paper impregnated with standard activities of Cs-137. Increasing amounts of a standard Cs-137 solution shall be impregnated on a filter paper. The counts per minute for each Cs-137 standard shall be recorded. A determination of linearity shall be produced using the counts per minute vs. concentration data. At least three sources covering approximately  $\frac{1}{4}$ ,  $\frac{1}{2}$ , and  $\frac{3}{4}$  of full scale shall be checked.

#### 3.4.3.2 Iodine Detector

Iodine gas is monitored by absorbing the gas on a charcoal filter element. The charcoal filter is viewed by an NaI(Tl) integral line gamma scintillator assembly.

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Because of its short half-life and the difficulty in handling gaseous iodine, barium sources shall be used for calibration. The photo peaks of interest are as follows:

- a. Ba-133: 356 KeV gamma is 0.69 efficient/disintegration
- b. I-131: 364 KeV gamma is 0.82 efficient/disintegration

Therefore, each iodine disintegration will produce  $0.82/0.69 \times$  barium disintegrations. Assuming that the detector efficiency for 356 KeV is the same as for the 364 KeV, the sensitivity for I-131 equals  $1.19 \times$  Ba-133 (counts/min)  $\mu\text{Ci}$ . The standard sources shall be constructed by impregnating a standard Ba-133 solution into the charcoal filter element. The geometry shall simulate the iodine retention on the first surface of the charcoal. Sources shall be prepared to cover approximately  $\frac{1}{4}$ ,  $\frac{1}{2}$  and  $\frac{3}{4}$  of full scale. The barium counts per minute for each standard shall be adjusted to iodine counts per minute as described above. A determination of linearity shall be produced using the corrected counts per minute vs. concentration data.

### 3.4.3.3 Gas Detector

The gas detectors associated with monitors O-GT-RE-22 & 33, O-GT-RE-31 & 32 and the low-range detectors of monitors O-GT-RE-21B and O-GH-RE-10B are a plastic scintillator identical to the particulate detector. The mid-range and high-range detectors of monitors O-GT-RE-21B and O-GH-RE-10B are cadmium telluride, solid state sensors.

Sources for all gas detectors shall be produced by evacuating the sample chamber with a vacuum pump. The sample chamber then shall be backfilled to the desired pressure with a source of standard Xe-133. The source is then counted and the counts per minute recorded. A determination of linearity shall be produced using the counts per minute vs. concentration data. Sources shall be prepared to cover approximately  $\frac{1}{4}$ ,  $\frac{1}{2}$  and  $\frac{3}{4}$  of full scale for the detectors associated with monitors O-GT-RE-22 and 33, O-GT-RE-31 and 32 and the low-range detectors of monitors O-GT-RE-21B and O-GH-RE-10B. Sources shall be prepared for the mid/high range detector to cover two points on the mid-range scale. For ALARA purposes, response for the high-range scale shall be extrapolated using the data from the mid-range calibration.

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**3.4.4 Airborne Monitor Setpoints**

**3.4.4.1 High Alarm Trip Setpoint Calculations**

The alarm trip setpoint is set to the lesser of the Total Body Dose Rate Setpoint or Skin Dose Rate Setpoint calculations, if the calculated setpoint does not exceed default maximum values.

**3.4.4.1.1 Total Body Dose Rate Setpoint Calculations**

The limit of the total body dose rate is 500 mrem/yr at the unrestricted area boundary. The monitor alarm/trip setpoint based on total body dose will be calculated as follows:

$$S_{tb} \leq (SF \times AF) \times D_{tb} \times R_t$$

Where:  $S_{tb}$  = The monitors alarm/trip setpoint based on the total body dose rate. ( $\mu\text{Ci/cc}$ )

$D_{tb}$  = Limit of 500 mrem/yr total body, conservatively interpreted as a continuous release over a one year period.

SF = Normally, the safety factor will be set to 0.85. This number is chosen since the gaseous monitors are set using Xe-133 energy level. Xe-133 comprises 85% of total noble gaseous activity expected. (See USAR Table 11.1-1). If desired, the 0.85 can be further modified to compensate for statistical fluctuations and errors of measurement.

AF = Allocation factor for each release so that simultaneous releases can be made without exceeding the limit. AF may be calculated as follows:

$$AF = \frac{RF}{TF}$$

Where: RF = Release flow rate of the release point under consideration.

TF = Total flow rate of all release points including release under consideration.

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**NOTE**

If the monitor setpoint ( $S_{tb}$ ) units desired are ( $\mu\text{Ci/sec}$ ), then use 'c' in place of 'Q' as shown in the following equation for  $R_t$ .  $R_t$ , however, is no longer representing 'monitor response per mrem/yr'. This results in:

$$R_t = \frac{c}{\left( \overline{X/Q} \sum_i K_i c_i \right)}$$

$R_t$  = monitor response per mrem/yr to the total body, determined according to:

$$R_t = \frac{c}{\left( \overline{X/Q} \sum_i K_i Q_i \right)}$$

Where:  $c$  = The monitor response to the gaseous effluent noble gas ( $\mu\text{Ci/cc}$ ) corresponding to grab sample radionuclide concentrations.

$\left( \overline{X/Q} \right)$  = The highest calculated annual average atmospheric dispersion ( $\text{sec/m}^3$ ) at the restricted area boundary.

$K_i$  = The total body dose factor due to gamma emissions from isotope  $i$  (mrem/yr per  $\mu\text{Ci/m}^3$ ) from Table A.1-2.

$Q_i$  = Rate of release of noble gas radionuclide  $i$  ( $\mu\text{Ci/sec}$ ) (concentration of radionuclide  $i$  x waste stream release flow rate)

#### 3.4.4.1.2 Skin Dose Rate Setpoint Calculations

The limit of the skin dose rate is 3000 mrem/yr at the restricted area boundary. The monitor alarm/trip setpoint is calculated as follows:

$$S_s \leq (SF \times AF) \times D_s \times R_s$$

Where:  $S_s$  = The monitors alarm/trip setpoint based on the skin dose rate. ( $\mu\text{Ci/cc}$ )

$D_s$  = Limit of 3000 mrem/yr to the skin of the body, conservatively interpreted as a continuous release over a one year period.

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NOTE

If the monitor setpoint ( $S_s$ ) units desired are ( $\mu\text{Ci/sec}$ ), then use 'c' in place of 'Q' as shown in the following equation for  $R_t$ .  $R_t$ , however, is no longer representing 'monitor response per mrem/yr'. This results in:

$$R_s = \frac{c}{\left( \overline{(X/Q)} \sum_i (L_i + 1.1M_i) c_i \right)}$$

$R_s$  = Monitor response per mrem/yr to the skin of the body.

$$R_s = \frac{c}{\left( \overline{(X/Q)} \sum_i (L_i + 1.1M_i) Q_i \right)}$$

Where:  $L_i$  = Skin dose factor due to beta emissions from isotope i (mrem/yr per  $\mu\text{Ci/m}^3$ ) from Table A.1-2.

1.1 = Conversion factor to mrem skin dose per mrad air dose.

$M_i$  = Air dose factor due to gamma emissions from isotope i (mrad/yr per  $\mu\text{Ci/m}^3$ ) from Table A.1-2.

The factors SF, AF, c,  $\overline{(X/Q)}$  and  $Q_i$  are as defined in Section 3.4.4.1.1.

The results of equations from Sections 3.4.4.1.1 and 3.4.4.1.2 are compared to determine the smaller setpoint. The actual monitor setpoint is the lower of the two values.

A pre-release isotopic analysis is performed for batch releases from Waste Gas Decay Tanks and Containment Building purges to determine the identity and quantity of the principal radionuclides. The appropriate alarm/trip setpoint(s) are adjusted accordingly to ensure that the limits of 3.1 are not exceeded.

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**3.4.4.2      Alert Alarm Setpoint Calculations**

The Noble Gas Alert Alarm for the Plant Unit Vent (O-GT-RE-21) and Radwaste Building Exhaust Monitor (O-GH-RE-10), is set to alert operators to that average concentration which if maintained for a full year would result in the 10 CFR 50, Appendix I Annual Dose Guidelines being reached. Section 3.2.1 limits the annual dose due to noble gases to  $\leq 10$  mrad for gamma radiation and  $\leq 20$  mrad for beta radiation. Section 3.2.2 limits the annual dose to a MEMBER OF THE PUBLIC from Iodine-131, Iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents to  $\leq 15$  mrem to any organ. These two sections contain the annual dose limits due to gaseous releases found in 10 CFR 50, Appendix I.

**3.4.4.2.1      Noble Gas Alert Alarm Setpoint Calculation**

The alert alarm setpoint is the lesser of

$$S_{\gamma} \leq (SF \times AF) \times D_{\gamma} \times R_{\gamma}$$

$$S_{\beta} \leq (SF \times AF) \times D_{\beta} \times R_{\beta}$$

Where:  $S_{\gamma}$  = Monitor setpoint based on gamma radiation.

$D_{\gamma}$  = Limit of 10 mrad/yr conservatively interpreted as a continuous release over a one year period.

$R_{\gamma}$  = Monitor response per mrad/yr determined according to the following equation. The same note applies as in sections 3.4.4.1.1 and 3.4.4.1.2 for calculation of the setpoint in  $\mu\text{Ci/sec}$ .

$$R_{\gamma} = \frac{c}{\left( \left( \overline{X/Q} \right) \sum_i M_i \times Q_i \right)}$$

Where:  $M_i$  = Gamma air dose factor (mrad/yr per  $\mu\text{Ci/m}^3$ ).  
See Table A.1-2.

$S_{\beta}$  = Monitor setpoint based on beta radiation.

$D_{\beta}$  = Limit of 20 mrad/yr conservatively interpreted as a continuous release over a one year period.

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$R_\beta$  = Monitor response per mrad/yr determined according to the following equation. The same note applies as in sections 3.4.4.1.1 and 3.4.4.1.2 for calculation of the setpoint in  $\mu\text{Ci/sec}$ .

$$R_\beta = \frac{c}{\left( \left( \overline{X/Q} \right) \sum_i N_i \times Q_i \right)}$$

Where:  $N_i$  = Beta air dose factor (mrad/yr per  $\mu\text{Ci/m}^3$ ). See Table A.1-2.

A semi-fixed alert alarm setpoint for the Plant Unit Vent Monitor (O-GT-RE-21) and Radwaste Building Vent Monitor (O-GH-RE-10) is calculated using the following:

$$\text{Setpoint } (\mu\text{Ci/cc}) = \frac{\left( (10 \text{ mrad/yr})(.85)(AF) \right)}{\left( \left( \overline{X/Q} \right) \sum_i P_i \times M_i \times Q \right)}$$

Where:  $P_i$  = Fractional value of isotope expected,  $C_i/C_T$ ,

$C_i$  = Concentration in  $\mu\text{Ci/cc}$  of isotope.

$C_T$  = Total Gaseous Activity from USAR Table 11.1-1

$AF$  = Either unit vent flow or Radwaste Building vent flow divided by the combined flow of the unit vent and Radwaste Building vent.

$Q$  = Vent flow rate in cc/sec.

Isotopes used and  $P_i$  values are as follows:

| ISOTOPE | $P_i$ |
|---------|-------|
| Kr-85M  | .018  |
| Kr-87   | .010  |
| Kr-88   | .033  |
| Xe-133M | .017  |
| Xe-133  | .851  |
| Xe-135  | .051  |

Should this semi-fixed alert alarm cause a continuous alarm condition, then actual setpoints will be calculated.

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### 3.4.4.3

### Particulate And Iodine Alarm Setpoints

Setpoints for the gaseous effluent particulate and iodine channels are set using Cs-137 MPC for particulates and I-131 MPC for iodines. The following is the calculation used:

$$\text{Setpoint } (\mu\text{Ci/cc}) = \frac{(\text{MPC}_i)(\text{AF})(\text{SF})}{(Q)(\overline{X/Q})}$$

Where:

$$\text{MPC}_i = 5 \times 10^{-10} \mu\text{Ci/cc for Cs-137}$$

$$= 1 \times 10^{-10} \mu\text{Ci/cc for I-131}$$

$$\text{AF} = \text{as defined previously}$$

$$\text{SF} = 0.0625 \text{ for I-131 } *$$

$$= 0.9375 \text{ for Cs-137 } *$$

\*derived from ratio of isotope activity (either I-131 or Cs-137) to sum of activity of Cs-137 and I-131 found in USAR Table 11.1-1 for reactor coolant.

$$Q = \text{Vent flow in m}^3/\text{sec}$$

This will provide the hi alarm setpoint. The alert alarm setpoint is 10% of the hi alarm setpoint.

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**4.0 Total Dose**

The annual (Calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mremS to the whole body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mremS.

**4.1 Remedial Action**

With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Section 2.2a, 2.2b, 3.2.1a, 3.2.1b, 3.2.2a and 3.2.2b calculation should be made including direct radiation contributions from the units and from outside storage tanks to determine whether the above limits of Section 4.0 above has been exceeded. If such is the case, prepare and submit to the Commission within 30 days, a special report that defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the above limits. This special report, as defined in 10 CFR 20.405e and 10CFR20.2203, shall include an analysis that estimates the radiation exposure (dose) to a MEMBER OF THE PUBLIC from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s) covered by this report. It shall also describe levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the above limits, and if the release condition resulting in violation of 40 CFR Part 190 has not already been corrected, the special report shall include a request for a variance in accordance with the provisions of 40 CFR Part 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

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**4.2 Surveillance Requirements**

- 4.2.1** Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with the methodology of Sections 2.2 and 3.2 at least once per 31 days when the release of radioactive materials in liquid or gaseous effluents exceed twice the limits of Section 2.2a, 2.2b, 3.2.1a, 3.2.1b, 3.2.2a and 3.2.2b. Otherwise, no further evaluation is required.
- 4.2.2** Cumulative dose contribution from direct radiation from the reactor unit and from Radwaste storage tanks shall be determined utilizing the results of routine plane perimeter surveys, RDD data or a combination of both, when necessary. This requirement is applicable only under conditions set forth in the remedial action above. **11/12**

**5.0 Radiological Environmental Monitoring Program (Contained in AP 07B-004)** **11/12**

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## 6.0 Bases

The bases contained on the succeeding pages summarizes the general requirements of Section 2.0, 3.0, 4.0 and 5.0 of the ODCM.

### Section 2.0 Liquid Effluents

#### Section 2.1 Concentration

This section is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will be less than 10 times the concentration levels specified in 10 CFR Part 20, Appendix B, Table 2, Column 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within: (1) the Section II. A design objective of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC, and (2) the limits of 10 CFR Part 20.1301(e) to the population. The concentration limit for dissolved or entrained noble gases are based upon the assumption that Xe-135 is the controlling radioisotope and its effluent concentration in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2. This specification does not affect the requirement to comply with the annual limitations of 10 CFR 20.1301.

The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

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**Section 2.2 Dose**

This section is provided to implement the requirements of Section II.A, III.A and IV.A of Appendix I, 10 CFR Part 50. The remedial action implements the guides set forth in Section II.A of Appendix I and provides the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." Also, for fresh water sites with drinking water supplies that can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR Part 141. The dose calculation methodology and parameters in the ODCM implement the requirements in Section III.A of Appendix I which specify that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I, Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

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**Section 2.3 Liquid Radwaste Treatment System**

The FUNCTIONALITY of the Liquid Radwaste Treatment Systems ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirement that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable." This section implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and design objective given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the Liquid Radwaste Treatment System were specified as a suitable fraction of the dose design objective set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

11/12

**Section 2.4 Radioactive Liquid Effluent Monitoring Instrumentation**

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The FUNCTIONALITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

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**Section 3.0 Gaseous Effluents**

**Section 3.1 Dose Rate**

This section provides reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC in an UNRESTRICTED AREA either at or beyond the SITE BOUNDARY in excess of the design objectives of Wolf Creek Technical Specification 5.5.4.g. This specification is provided to ensure that gaseous effluents from all units on the site will be appropriately controlled. It provides operational flexibility for the release of gaseous effluents to satisfy Wolf Creek Technical Specification 5.5.4.g. For MEMBERS OF THE PUBLIC who may at times be within the SITE BOUNDARY, the occupancy of that MEMBER OF THE PUBLIC will usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY to less than or equal to 500 mrem/year to the whole body or to less than or equal to 3000 mrem/year to the skin. These release rate limits also restrict, at all times the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrem/year. This specification does not affect the requirement to comply with the annual limitations of 10 CFR 20.1301.

The required detection capabilities for radioactive materials in gaseous waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L.A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem 40, 586-93 (1968), and Hartwell, J.K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

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**Section 3.2.1 Dose - Noble Gases**

This section is provided to implement the requirements of Section II.B, III.A and IV.A of Appendix I, 10 CFR Part 50. The remedial action implements the guides set forth in Section II.B of Appendix I and provides the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The surveillance requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The dose calculation methodology and parameters established in the ODCM for calculating the doses due to the actual release rates of radioactive materials in gaseous effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1, July 1977. The ODCM equations provided for determining the air doses at and beyond the SITE BOUNDARY are based upon the historical average atmospheric conditions.

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**Section 3.2.2 Dose - Iodine-131 and 133, Tritium and Radioactive Material in Particulate Form**

This section is provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR Part 50. The remedial actions are the guides set forth in Section II.C of Appendix I, and provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The ODCM calculational methods specified in the surveillance requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methodology and parameters for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculational of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Revision 1, July 1977. These equations provide for determining the actual doses based upon historical average conditions. The release rate limits for Iodine-131 and 133, tritium, and radionuclides in particulate form with half lives greater than 8 days are dependent upon the existing radionuclide pathways to man, in the areas at and beyond the SITE BOUNDARY. The pathways that were examined in the development of these calculations were: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, (4) deposition on the ground with subsequent exposure of man.

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**Section 3.3 Gaseous Radwaste Treatment System**

The FUNCTIONALITY of the WASTE GAS HOLDUP SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM ensures that the systems will be available for use whenever gaseous effluents require treatment prior to release to the environment. The requirement that the appropriate portions of this system be used when specified provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." This section implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Section II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents. 11/12

**Section 3.4 Radioactive Gaseous Effluent Monitoring Instrumentation**

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The Alarm/Trip Setpoints for these instruments shall be adjusted to values calculated in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of Wolf Creek Technical Specification 5.5.4.g. The FUNCTIONALITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63 and 64 of Appendix A to 10 CFR Part 50. The sensitivity of any noble gas activity monitor used to show compliance with the gaseous effluent release requirements of Section 3.2 shall be such that concentrations as low as  $1 \times 10^{-6}$   $\mu\text{Ci/cc}$  are measurable. 11/12

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**Section 4.0 Total Dose**

This section is provided to meet the dose limitations of 40 CFR Part 190 that have been incorporated into 10 CFR Part 20 by 46 FR 18525. The section requires the preparation and submittal of a special report whenever the calculated doses due to releases of radioactivity and the radiation from uranium fuel cycle sources exceed 25 mremS to the whole body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mremS. For sites containing up to four reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR Part 190 if the individual reactors remain within twice the dose design objectives of Appendix I, and if direct radiation doses from the reactor Units and from outside storage tanks are kept small. The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR Part 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 8 km must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40 CFR 190.11 and 10 CFR 20.2203, is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR Part 190, and does not apply in any way to the other requirements for dose limitation of 10 CFR Part 20. An individual is not considered a MEMBER OF THE PUBLIC during any period in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

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**7.0 Reports**

**7.1 Annual Radiological Environmental Operating Report (contained in AP 07B-004)**

**7.2 Annual Radioactive Effluent Release Report**

The Annual Radioactive Effluent Release Report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the Unit as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light Water-Cooled Nuclear Power Plants," Revision 1, June 1974, with data summarized on a quarterly basis following the format of Appendix B thereof. For solid wastes, the format for Table 3 in Appendix B shall be supplemented with three additional categories: class of solid waste (as defined by 10 CFR Part 61), type of container (e.g., LSA, Type A, Type B, Large Quantity), and SOLIDIFICATION agent or absorbent (e.g., cement, urea formaldehyde). **11/12**

The Annual Radioactive Effluent Release Report to be submitted before May 1 of each year shall also include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing on magnetic tape of wind speed, wind direction, and atmospheric stability, and precipitation (if measured), or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability.\* This same report shall include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the Unit or Station during the previous calendar year. This same report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY during the report period. All assumptions used in making these assessments, i.e., specific activity, exposure time and location, shall be included in these reports. Historical average meteorological conditions or the meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents, as determined by sampling frequency and measurement, shall be used for determining the gaseous pathway doses. The assessment of radiation doses shall be performed in accordance with the methodology and parameters in the ODCM.

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The Annual Radioactive Effluent Release Report to be submitted before May 1 of each year shall also include an assessment of radiation doses to the likely most exposed MEMBER OF THE PUBLIC from reactor releases and other nearby uranium fuel cycle sources, including doses from primary effluent pathways and direct radiation, for the previous calendar year to show conformance with 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operation." Acceptable methods for calculating the dose contribution from liquid and gaseous effluents are given in Regulatory Guide 1.109, Rev. 1, October 1977.

\*In lieu of submission with the Annual Radioactive Effluent Release Report, the licensee has the option of retaining this summary of required meteorological data on site in a file that shall be provided to the NRC upon request.

The Annual Radioactive Effluent Release Report shall include:

- a. A list and description, including total Curies, of unplanned releases from the site to UNRESTRICTED AREAS of radioactive materials in gaseous and liquid effluents made during the reporting period.
- b. Any changes made during the reporting period to the ODCM, pursuant to Technical Specification 5.5.1.
- c. Major changes to the Radwaste Treatment Systems for the period in which the evaluation was reviewed and accepted by the PSRC. The discussion of each change shall contain:
  - 1) A summary of the evaluation that led to the determination that the change could be made in accordance with 10 CFR 50.59;
  - 2) Sufficient detailed information to totally support the reason for the change without benefit of additional and supplemental information;
  - 3) A detailed description of the equipment, components, and processes involved and the interfaces with other plant systems.

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- 4) An evaluation of the change which shows the predicted releases of radioactive materials in liquid and gaseous effluents and/or quantity of solid waste that differ from those previously predicted in the license application and amendments thereto;
  - 5) An evaluation of the change, which shows the expected maximum exposures to a MEMBER OF THE PUBLIC in the UNRESTRICTED AREA and to the general population that differ from those previously estimated in the license application and amendments thereto;
  - 6) A comparison of the predicted releases of radioactive materials, in liquid and gaseous effluents and in solid waste, to the actual releases for the period prior to when the changes are to be made;
  - 7) An estimate of the exposure to plant operating personnel as a result of the change; and
  - 8) Documentation of the fact that the change was reviewed and found acceptable by the PSRC.
- d. A listing of new locations for dose calculations identified by the Land Use Census,
  - e. A description of the events leading to liquid holdup tanks or gas storage tanks exceeding the limits of TR 3.10.1 OR TSR 3.10.3.1.
  - f. An explanation as to why the nonfunctionality of a liquid or gaseous effluent monitoring instrumentation was not corrected within the time specified. **11/12**
  - g. A description of the events leading to a missed sample required by Table 2-1 or 3-1.
  - h. NEI Groundwater Protection Initiative requirements (Ref. 3.1.9)
    1. A report of onsite groundwater sample results.
    2. A description of dose calculations for releases from site.
    3. A summary of onsite spills & leaks that require notification to county, state & NRC.

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**APPENDIX A**  
Dose Conversion Factor Tables

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**TABLE A.1-1\***  
**BIOACCUMULATION FACTORS TO BE USED IN**  
**THE ABSENCE OF SITE-SPECIFIED DATA**  
(pCi/kg per pCi/liter)

| ELEMENT | FRESHWATER FISH |
|---------|-----------------|
| 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         |
| **Ag    | 2.3E 00         |
| **Sb    | 1.0E 00         |

\* Taken from Regulatory Guide 1.109 (Rev.1)

\*\* Taken from Regulatory Guide 1.109 (Rev.0)

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**TABLE A.1-2**

| Radionuclide | DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS*          |                                                      |                                                      |                                                      |
|--------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|
|              | Total Body                                           | Skin Dose Factor                                     | Gamma Air                                            | Beta Air                                             |
|              | Dose Factor                                          |                                                      | Dose Factor                                          | Dose Factor                                          |
|              | $\frac{K_i}{(\text{mrem/yr per } \mu\text{Ci/m}^3)}$ | $\frac{L_i}{(\text{mrem/yr per } \mu\text{Ci/m}^3)}$ | $\frac{M_i}{(\text{mrad/yr per } \mu\text{Ci/m}^3)}$ | $\frac{N_i}{(\text{mrad/yr per } \mu\text{Ci/m}^3)}$ |
| Kr-83M       | 7.56E-02**                                           | ---                                                  | 1.93E+01                                             | 2.88E+02                                             |
| Kr-85M       | 1.17E+03                                             | 1.46E+03                                             | 1.23E+03                                             | 1.97E+03                                             |
| Kr-85        | 1.61E+01                                             | 1.34E+03                                             | 1.72E+01                                             | 1.95E+03                                             |
| Kr-87        | 5.92E+03                                             | 9.73E+03                                             | 6.17E+03                                             | 1.03E+04                                             |
| Kr-88        | 1.47E+04                                             | 2.37E+03                                             | 1.52E+04                                             | 2.93E+03                                             |
| Kr-89        | 1.66E+04                                             | 1.01E+04                                             | 1.73E+04                                             | 1.06E+04                                             |
| Kr-90        | 1.56E+04                                             | 7.29E+03                                             | 1.63E+04                                             | 7.83E+03                                             |
| Xe-131M      | 9.15E+01                                             | 4.76E+02                                             | 1.56E+02                                             | 1.11E+03                                             |
| Xe-133       | 2.94E+02                                             | 3.06E+02                                             | 3.53E+02                                             | 1.05E+03                                             |
| Xe-133M      | 2.51E+02                                             | 9.94E+02                                             | 3.27E+02                                             | 1.48E+03                                             |
| Xe-135M      | 3.12E+03                                             | 7.11E+02                                             | 3.36E+03                                             | 7.39E+02                                             |
| Xe-135       | 1.81E+03                                             | 1.86E+03                                             | 1.92E+03                                             | 2.46E+03                                             |
| Xe-137       | 1.42E+03                                             | 1.22E+04                                             | 1.51E+03                                             | 1.27E+04                                             |
| Xe-138       | 8.83E+03                                             | 4.13E+03                                             | 9.21E+03                                             | 4.75E+03                                             |
| Ar-41        | 8.84E+03                                             | 2.69E+03                                             | 9.30E+03                                             | 3.28E+03                                             |

\*Based on Regulatory Guide 1.109 (Rev.1)

\*\*7.56E-02 =  $7.56 \times 10^{-2}$

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**TABLE A.2-1\***  
INHALATION DOSE FACTORS FOR ADULTS  
(MREM PER PCI INHALED)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | NO DATA  | 1.58E-07 | 1.58E-07 | 1.58E-07 | 1.58E-07 | 1.58E-07 | 1.58E-07 |
| C       | 14  | 2.27E-06 | 4.26E-07 | 4.26E-07 | 4.26E-07 | 4.26E-07 | 4.26E-07 | 4.26E-07 |
| NA      | 24  | 1.28E-06 | 1.28E-06 | 1.28E-06 | 1.28E-06 | 1.28E-06 | 1.28E-06 | 1.28E-06 |
| P       | 32  | 1.65E-04 | 9.64E-06 | 6.26E-06 | NO DATA  | NO DATA  | NO DATA  | 1.08E-05 |
| CR      | 51  | NO DATA  | NO DATA  | 1.25E-08 | 7.44E-09 | 2.85E-09 | 1.80E-06 | 4.15E-07 |
| MN      | 54  | NO DATA  | 4.95E-06 | 7.87E-07 | NO DATA  | 1.23E-06 | 1.75E-04 | 9.67E-06 |
| MN      | 56  | NO DATA  | 1.55E-10 | 2.29E-11 | NO DATA  | 1.63E-10 | 1.18E-06 | 2.53E-06 |
| FE      | 55  | 3.07E-06 | 2.12E-06 | 4.93E-07 | NO DATA  | NO DATA  | 9.01E-06 | 7.54E-07 |
| FE      | 59  | 1.47E-06 | 3.47E-06 | 1.32E-06 | NO DATA  | NO DATA  | 1.27E-04 | 2.35E-05 |
| CO      | 58  | NO DATA  | 1.98E-07 | 2.59E-07 | NO DATA  | NO DATA  | 1.16E-04 | 1.33E-05 |
| CO      | 60  | NO DATA  | 1.44E-06 | 1.85E-06 | NO DATA  | NO DATA  | 7.46E-04 | 3.56E-05 |
| NI      | 63  | 5.40E-05 | 3.93E-06 | 1.81E-06 | NO DATA  | NO DATA  | 2.23E-05 | 1.67E-06 |
| NI      | 65  | 1.92E-10 | 2.62E-11 | 1.14E-11 | NO DATA  | NO DATA  | 7.00E-07 | 1.54E-06 |
| CU      | 64  | NO DATA  | 1.83E-10 | 7.69E-11 | NO DATA  | 5.78E-10 | 8.48E-07 | 6.12E-06 |
| ZN      | 65  | 4.05E-06 | 1.29E-05 | 5.82E-06 | NO DATA  | 8.62E-06 | 1.08E-04 | 6.68E-06 |
| ZN      | 69  | 4.23E-12 | 8.14E-12 | 5.65E-13 | NO DATA  | 5.27E-12 | 1.15E-07 | 2.04E-09 |
| BR      | 83  | NO DATA  | NO DATA  | 3.01E-08 | NO DATA  | NO DATA  | NO DATA  | 2.90E-08 |
| BR      | 84  | NO DATA  | NO DATA  | 3.91E-08 | NO DATA  | NO DATA  | NO DATA  | 2.05E-13 |
| BR      | 85  | NO DATA  | NO DATA  | 1.60E-09 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| RB      | 86  | NO DATA  | 1.69E-05 | 7.37E-06 | NO DATA  | NO DATA  | NO DATA  | 2.08E-06 |
| RB      | 88  | NO DATA  | 4.84E-08 | 2.41E-08 | NO DATA  | NO DATA  | NO DATA  | 4.18E-19 |
| RB      | 89  | NO DATA  | 3.20E-08 | 2.12E-08 | NO DATA  | NO DATA  | NO DATA  | 1.16E-21 |
| SR      | 89  | 3.80E-05 | NO DATA  | 1.09E-06 | NO DATA  | NO DATA  | 1.75E-04 | 4.37E-05 |
| SR      | 90  | 1.24E-02 | NO DATA  | 7.62E-04 | NO DATA  | NO DATA  | 1.20E-03 | 9.02E-05 |
| SR      | 91  | 7.74E-09 | NO DATA  | 3.13E-10 | NO DATA  | NO DATA  | 4.56E-06 | 2.39E-05 |
| SR      | 92  | 8.43E-10 | NO DATA  | 3.64E-11 | NO DATA  | NO DATA  | 2.06E-06 | 5.38E-06 |
| Y       | 90  | 2.61E-07 | NO DATA  | 7.01E-09 | NO DATA  | NO DATA  | 2.12E-05 | 6.32E-05 |
| Y       | 91M | 3.26E-11 | NO DATA  | 1.27E-12 | NO DATA  | NO DATA  | 2.40E-07 | 1.66E-10 |
| Y       | 91  | 5.78E-05 | NO DATA  | 1.55E-06 | NO DATA  | NO DATA  | 2.13E-04 | 4.81E-05 |
| Y       | 92  | 1.29E-09 | NO DATA  | 3.77E-11 | NO DATA  | NO DATA  | 1.96E-06 | 9.19E-06 |
| Y       | 93  | 1.18E-08 | NO DATA  | 3.26E-10 | NO DATA  | NO DATA  | 6.06E-06 | 5.27E-05 |
| ZR      | 95  | 1.34E-05 | 4.30E-06 | 2.91E-06 | NO DATA  | 6.77E-06 | 2.21E-04 | 1.88E-05 |
| ZR      | 97  | 1.21E-08 | 2.45E-09 | 1.13E-09 | NO DATA  | 3.71E-09 | 9.84E-06 | 6.54E-05 |
| NB      | 95  | 1.76E-06 | 9.77E-07 | 5.26E-07 | NO DATA  | 9.67E-07 | 6.31E-05 | 1.30E-05 |
| MO      | 99  | NO DATA  | 1.51E-08 | 2.87E-09 | NO DATA  | 3.64E-08 | 1.14E-05 | 3.10E-05 |
| TC      | 99M | 1.29E-13 | 3.64E-13 | 4.63E-12 | NO DATA  | 5.52E-12 | 9.55E-08 | 5.20E-07 |

\*Taken from Regulatory Guide 1.109 (Rev. 1)

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**TABLE A.2-1\*(cont'd)**  
INHALATION DOSE FACTORS FOR ADULTS  
(MREM PER PCI INHALED)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 5.22E-15 | 7.52E-15 | 7.38E-14 | NO DATA  | 1.35E-13 | 4.99E-08 | 1.36E-21 |
| RU      | 103  | 1.91E-07 | NO DATA  | 8.23E-08 | NO DATA  | 7.29E-07 | 6.31E-05 | 1.38E-05 |
| RU      | 105  | 9.88E-11 | NO DATA  | 3.89E-11 | NO DATA  | 1.27E-10 | 1.37E-06 | 6.02E-06 |
| RU      | 106  | 8.64E-06 | NO DATA  | 1.09E-06 | NO DATA  | 1.67E-05 | 1.17E-03 | 1.14E-04 |
| AG      | 110M | 1.35E-06 | 1.25E-06 | 7.43E-07 | NO DATA  | 2.46E-06 | 5.79E-04 | 3.78E-05 |
| TE      | 125M | 4.27E-07 | 1.98E-07 | 5.84E-08 | 1.31E-07 | 1.55E-06 | 3.92E-05 | 8.83E-06 |
| TE      | 127M | 1.58E-06 | 7.21E-07 | 1.96E-07 | 4.11E-07 | 5.72E-06 | 1.20E-04 | 1.87E-05 |
| TE      | 127  | 1.75E-10 | 8.03E-11 | 3.87E-11 | 1.32E-10 | 6.37E-10 | 8.14E-07 | 7.17E-06 |
| TE      | 129M | 1.22E-06 | 5.84E-07 | 1.98E-07 | 4.30E-07 | 4.57E-06 | 1.45E-04 | 4.79E-05 |
| TE      | 129  | 6.22E-12 | 2.99E-12 | 1.55E-12 | 4.87E-12 | 2.34E-11 | 2.42E-07 | 1.96E-08 |
| TE      | 131M | 8.74E-09 | 5.45E-09 | 3.63E-09 | 6.88E-09 | 3.86E-08 | 1.82E-05 | 6.95E-05 |
| TE      | 131  | 1.39E-12 | 7.44E-13 | 4.49E-13 | 1.17E-12 | 5.46E-12 | 1.74E-07 | 2.30E-09 |
| TE      | 132  | 3.25E-08 | 2.69E-08 | 2.02E-08 | 2.37E-08 | 1.82E-07 | 3.60E-05 | 6.37E-05 |
| I       | 130  | 5.72E-07 | 1.68E-06 | 6.60E-07 | 1.42E-04 | 2.61E-06 | NO DATA  | 9.61E-07 |
| I       | 131  | 3.15E-06 | 4.47E-06 | 2.56E-06 | 1.49E-03 | 7.66E-06 | NO DATA  | 7.85E-07 |
| I       | 132  | 1.45E-07 | 4.07E-07 | 1.45E-07 | 1.43E-05 | 6.48E-07 | NO DATA  | 5.08E-08 |
| I       | 133  | 1.08E-06 | 1.85E-06 | 5.65E-07 | 2.69E-04 | 3.23E-06 | NO DATA  | 1.11E-06 |
| I       | 134  | 8.05E-08 | 2.16E-07 | 7.69E-08 | 3.73E-06 | 3.44E-07 | NO DATA  | 1.26E-10 |
| I       | 135  | 3.35E-07 | 8.73E-07 | 3.21E-07 | 5.60E-05 | 1.39E-06 | NO DATA  | 6.56E-07 |
| CS      | 134  | 4.66E-05 | 1.06E-04 | 9.10E-05 | NO DATA  | 3.59E-05 | 1.22E-05 | 1.30E-06 |
| CS      | 136  | 4.88E-06 | 1.83E-05 | 1.38E-05 | NO DATA  | 1.07E-05 | 1.50E-06 | 1.46E-06 |
| CS      | 137  | 5.98E-05 | 7.76E-05 | 5.35E-05 | NO DATA  | 2.78E-05 | 9.40E-06 | 1.05E-06 |
| CS      | 138  | 4.14E-08 | 7.76E-08 | 4.05E-08 | NO DATA  | 6.00E-08 | 6.07E-09 | 2.33E-13 |
| BA      | 139  | 1.17E-10 | 8.32E-14 | 3.42E-12 | NO DATA  | 7.78E-14 | 4.70E-07 | 1.12E-07 |
| BA      | 140  | 4.88E-06 | 6.13E-09 | 3.21E-07 | NO DATA  | 2.09E-09 | 1.59E-04 | 2.73E-05 |
| BA      | 141  | 1.25E-11 | 9.41E-15 | 4.20E-13 | NO DATA  | 8.75E-15 | 2.42E-07 | 1.45E-17 |
| BA      | 142  | 3.29E-12 | 3.38E-15 | 2.07E-13 | NO DATA  | 2.86E-15 | 1.49E-07 | 1.96E-26 |
| LA      | 140  | 4.30E-08 | 2.17E-08 | 5.73E-09 | NO DATA  | NO DATA  | 1.70E-05 | 5.73E-05 |
| LA      | 142  | 8.54E-11 | 3.88E-11 | 9.65E-12 | NO DATA  | NO DATA  | 7.91E-07 | 2.64E-07 |
| CE      | 141  | 2.49E-06 | 1.69E-06 | 1.91E-07 | NO DATA  | 7.83E-07 | 4.52E-05 | 1.50E-05 |
| CE      | 143  | 2.33E-08 | 1.72E-08 | 1.91E-09 | NO DATA  | 7.60E-09 | 9.97E-06 | 2.83E-05 |
| CE      | 144  | 4.29E-04 | 1.79E-04 | 2.30E-05 | NO DATA  | 1.06E-04 | 9.72E-04 | 1.02E-04 |
| PR      | 143  | 1.17E-06 | 4.69E-07 | 5.80E-08 | NO DATA  | 2.70E-07 | 3.51E-05 | 2.50E-05 |
| PR      | 144  | 3.76E-12 | 1.56E-12 | 1.91E-13 | NO DATA  | 8.81E-13 | 1.27E-07 | 2.69E-18 |
| ND      | 147  | 6.59E-07 | 7.62E-07 | 4.56E-08 | NO DATA  | 4.45E-07 | 2.76E-05 | 2.16E-05 |
| W       | 187  | 1.06E-09 | 8.85E-10 | 3.10E-10 | NO DATA  | NO DATA  | 3.63E-06 | 1.94E-05 |
| NP      | 239  | 2.87E-08 | 2.82E-09 | 1.55E-09 | NO DATA  | 8.75E-09 | 4.70E-06 | 1.49E-05 |

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**TABLE A.2-2\***  
INHALATION DOSE FACTORS FOR TEENAGER  
(MREM PER PCI INHALED)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | NO DATA  | 1.59E-07 | 1.59E-07 | 1.59E-07 | 1.59E-07 | 1.59E-07 | 1.59E-07 |
| C       | 14  | 3.25E-06 | 6.09E-07 | 6.09E-07 | 6.09E-07 | 6.09E-07 | 6.09E-07 | 6.09E-07 |
| NA      | 24  | 1.72E-06 | 1.72E-06 | 1.72E-06 | 1.72E-06 | 1.72E-06 | 1.72E-06 | 1.72E-06 |
| P       | 32  | 2.36E-04 | 1.37E-05 | 8.95E-06 | NO DATA  | NO DATA  | NO DATA  | 1.16E-05 |
| CR      | 51  | NO DATA  | NO DATA  | 1.69E-08 | 9.37E-09 | 3.84E-09 | 2.62E-06 | 3.75E-07 |
| MN      | 54  | NO DATA  | 6.39E-06 | 1.05E-06 | NO DATA  | 1.59E-06 | 2.48E-04 | 8.35E-06 |
| MN      | 56  | NO DATA  | 2.12E-10 | 3.15E-11 | NO DATA  | 2.24E-10 | 1.90E-06 | 7.18E-06 |
| FE      | 55  | 4.18E-06 | 2.98E-06 | 6.93E-07 | NO DATA  | NO DATA  | 1.55E-05 | 7.99E-07 |
| FE      | 59  | 1.99E-06 | 4.62E-06 | 1.79E-06 | NO DATA  | NO DATA  | 1.91E-04 | 2.23E-05 |
| CO      | 58  | NO DATA  | 2.59E-07 | 3.47E-07 | NO DATA  | NO DATA  | 1.68E-04 | 1.19E-05 |
| CO      | 60  | NO DATA  | 1.89E-06 | 2.48E-06 | NO DATA  | NO DATA  | 1.09E-03 | 3.24E-05 |
| NI      | 63  | 7.25E-05 | 5.43E-06 | 2.47E-06 | NO DATA  | NO DATA  | 3.84E-05 | 1.77E-06 |
| NI      | 65  | 2.73E-10 | 3.66E-11 | 1.59E-11 | NO DATA  | NO DATA  | 1.17E-06 | 4.59E-06 |
| CU      | 64  | NO DATA  | 2.54E-10 | 1.06E-10 | NO DATA  | 8.01E-10 | 1.39E-06 | 7.68E-06 |
| ZN      | 65  | 4.82E-06 | 1.67E-05 | 7.80E-06 | NO DATA  | 1.08E-05 | 1.55E-04 | 5.83E-06 |
| ZN      | 69  | 6.04E-12 | 1.15E-11 | 8.07E-13 | NO DATA  | 7.53E-12 | 1.98E-07 | 3.56E-08 |
| BR      | 83  | NO DATA  | NO DATA  | 4.30E-08 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| BR      | 84  | NO DATA  | NO DATA  | 5.41E-08 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| BR      | 85  | NO DATA  | NO DATA  | 2.29E-09 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| RB      | 86  | NO DATA  | 2.38E-05 | 1.05E-05 | NO DATA  | NO DATA  | NO DATA  | 2.21E-06 |
| RB      | 88  | NO DATA  | 6.82E-08 | 3.40E-08 | NO DATA  | NO DATA  | NO DATA  | 3.65E-15 |
| RB      | 89  | NO DATA  | 4.40E-08 | 2.91E-08 | NO DATA  | NO DATA  | NO DATA  | 4.22E-17 |
| SR      | 89  | 5.43E-05 | NO DATA  | 1.56E-06 | NO DATA  | NO DATA  | 3.02E-04 | 4.64E-05 |
| SR      | 90  | 1.35E-02 | NO DATA  | 8.35E-04 | NO DATA  | NO DATA  | 2.06E-03 | 9.56E-05 |
| SR      | 91  | 1.10E-08 | NO DATA  | 4.39E-10 | NO DATA  | NO DATA  | 7.59E-06 | 3.24E-05 |
| SR      | 92  | 1.19E-09 | NO DATA  | 5.08E-11 | NO DATA  | NO DATA  | 3.43E-06 | 1.49E-05 |
| Y       | 90  | 3.73E-07 | NO DATA  | 1.00E-08 | NO DATA  | NO DATA  | 3.66E-05 | 6.99E-05 |
| Y       | 91M | 4.63E-11 | NO DATA  | 1.77E-12 | NO DATA  | NO DATA  | 4.00E-07 | 3.77E-09 |
| Y       | 91  | 8.26E-05 | NO DATA  | 2.21E-06 | NO DATA  | NO DATA  | 3.67E-04 | 5.11E-05 |
| Y       | 92  | 1.84E-09 | NO DATA  | 5.36E-11 | NO DATA  | NO DATA  | 3.35E-06 | 2.06E-05 |
| Y       | 93  | 1.69E-08 | NO DATA  | 4.65E-10 | NO DATA  | NO DATA  | 1.04E-05 | 7.24E-05 |
| ZR      | 95  | 1.82E-05 | 5.73E-06 | 3.94E-06 | NO DATA  | 8.42E-06 | 3.36E-04 | 1.86E-05 |
| ZR      | 97  | 1.72E-08 | 3.40E-09 | 1.57E-09 | NO DATA  | 5.15E-09 | 1.62E-05 | 7.88E-05 |
| NB      | 95  | 2.32E-06 | 1.29E-06 | 7.08E-07 | NO DATA  | 1.25E-06 | 9.39E-05 | 1.21E-05 |
| MO      | 99  | NO DATA  | 2.11E-08 | 4.03E-09 | NO DATA  | 5.14E-08 | 1.92E-05 | 3.36E-05 |
| TC      | 99M | 1.73E-13 | 4.83E-13 | 6.24E-12 | NO DATA  | 7.20E-12 | 1.44E-07 | 7.66E-07 |

\*Taken from Regulatory Guide 1.109 (Rev. 1)

|                 |                                 |                |
|-----------------|---------------------------------|----------------|
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**TABLE A.2-2\* (cont'd)**  
INHALATION DOSE FACTORS FOR TEENAGER  
(MREM PER PCI INHALED)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 7.40E-15 | 1.05E-14 | 1.03E-13 | NO DATA  | 1.90E-13 | 8.34E-08 | 1.09E-16 |
| RU      | 103  | 2.63E-07 | NO DATA  | 1.12E-07 | NO DATA  | 9.29E-07 | 9.79E-05 | 1.36E-05 |
| RU      | 105  | 1.40E-10 | NO DATA  | 5.42E-11 | NO DATA  | 1.76E-10 | 2.27E-06 | 1.13E-05 |
| RU      | 106  | 1.23E-05 | NO DATA  | 1.55E-06 | NO DATA  | 2.38E-05 | 2.01E-03 | 1.20E-04 |
| AG      | 110M | 1.73E-06 | 1.64E-06 | 9.99E-07 | NO DATA  | 3.13E-06 | 8.44E-04 | 3.41E-05 |
| TE      | 125M | 6.10E-07 | 2.80E-07 | 8.34E-08 | 1.75E-07 | NO DATA  | 6.70E-05 | 9.38E-06 |
| TE      | 127M | 2.25E-06 | 1.02E-06 | 2.73E-07 | 5.48E-07 | 8.17E-06 | 2.07E-04 | 1.99E-05 |
| TE      | 127  | 2.51E-10 | 1.14E-10 | 5.52E-11 | 1.77E-10 | 9.10E-10 | 1.40E-06 | 1.01E-05 |
| TE      | 129M | 1.74E-06 | 8.23E-07 | 2.81E-07 | 5.72E-07 | 6.49E-06 | 2.47E-04 | 5.06E-05 |
| TE      | 129  | 8.87E-12 | 4.22E-12 | 2.20E-12 | 6.48E-12 | 3.32E-11 | 4.12E-07 | 2.02E-07 |
| TE      | 131M | 1.23E-08 | 7.51E-09 | 5.03E-09 | 9.06E-09 | 5.49E-08 | 2.97E-05 | 7.76E-05 |
| TE      | 131  | 1.97E-12 | 1.04E-12 | 6.30E-13 | 1.55E-12 | 7.72E-12 | 2.92E-07 | 1.89E-09 |
| TE      | 132  | 4.50E-08 | 3.63E-08 | 2.74E-08 | 3.07E-08 | 2.44E-07 | 5.61E-05 | 5.79E-05 |
| I       | 130  | 7.80E-07 | 2.24E-06 | 8.96E-07 | 1.86E-04 | 3.44E-06 | NO DATA  | 1.14E-06 |
| I       | 131  | 4.43E-06 | 6.14E-06 | 3.30E-06 | 1.83E-03 | 1.05E-05 | NO DATA  | 8.11E-07 |
| I       | 132  | 1.99E-07 | 5.47E-07 | 1.97E-07 | 1.89E-05 | 8.65E-07 | NO DATA  | 1.59E-07 |
| I       | 133  | 1.52E-06 | 2.56E-06 | 7.78E-07 | 3.65E-04 | 4.49E-06 | NO DATA  | 1.29E-06 |
| I       | 134  | 1.11E-07 | 2.90E-07 | 1.05E-07 | 4.94E-06 | 4.58E-07 | NO DATA  | 2.55E-09 |
| I       | 135  | 4.62E-07 | 1.18E-06 | 4.36E-07 | 7.76E-05 | 1.86E-06 | NO DATA  | 8.69E-07 |
| CS      | 134  | 6.28E-05 | 1.41E-04 | 6.86E-05 | NO DATA  | 4.69E-05 | 1.83E-05 | 1.22E-06 |
| CS      | 136  | 6.44E-06 | 2.42E-05 | 1.71E-05 | NO DATA  | 1.38E-05 | 2.22E-06 | 1.36E-06 |
| CS      | 137  | 8.38E-05 | 1.06E-04 | 3.89E-05 | NO DATA  | 3.80E-05 | 1.51E-05 | 1.06E-06 |
| CS      | 138  | 5.82E-08 | 1.07E-07 | 5.58E-08 | NO DATA  | 8.28E-08 | 9.84E-09 | 3.38E-11 |
| BA      | 139  | 1.67E-10 | 1.18E-13 | 4.87E-12 | NO DATA  | 1.11E-13 | 8.08E-07 | 8.06E-07 |
| BA      | 140  | 6.84E-06 | 8.38E-09 | 4.40E-07 | NO DATA  | 2.85E-09 | 2.54E-04 | 2.86E-05 |
| BA      | 141  | 1.78E-11 | 1.32E-14 | 5.93E-13 | NO DATA  | 1.23E-14 | 4.11E-07 | 9.33E-14 |
| BA      | 142  | 4.62E-12 | 4.63E-15 | 2.84E-13 | NO DATA  | 3.92E-15 | 2.39E-07 | 5.99E-20 |
| LA      | 140  | 5.99E-08 | 2.95E-08 | 7.82E-09 | NO DATA  | NO DATA  | 2.68E-05 | 6.09E-05 |
| LA      | 142  | 1.20E-10 | 5.31E-11 | 1.32E-11 | NO DATA  | NO DATA  | 1.27E-06 | 1.50E-06 |
| CE      | 141  | 3.55E-06 | 2.37E-06 | 2.71E-07 | NO DATA  | 1.11E-06 | 7.67E-05 | 1.58E-05 |
| CE      | 143  | 3.32E-08 | 2.42E-08 | 2.70E-09 | NO DATA  | 1.08E-08 | 1.63E-05 | 3.19E-05 |
| CE      | 144  | 6.11E-04 | 2.53E-04 | 3.28E-05 | NO DATA  | 1.51E-04 | 1.67E-03 | 1.08E-04 |
| PR      | 143  | 1.67E-06 | 6.64E-07 | 8.28E-08 | NO DATA  | 3.86E-07 | 6.04E-05 | 2.67E-05 |
| PR      | 144  | 5.37E-12 | 2.20E-12 | 2.72E-13 | NO DATA  | 1.26E-12 | 2.19E-07 | 2.94E-14 |
| ND      | 147  | 9.83E-07 | 1.07E-06 | 6.41E-08 | NO DATA  | 6.28E-07 | 4.65E-05 | 2.28E-05 |
| W       | 187  | 1.50E-09 | 1.22E-09 | 4.29E-10 | NO DATA  | NO DATA  | 5.92E-06 | 2.21E-05 |
| NP      | 239  | 4.23E-08 | 3.99E-09 | 2.21E-09 | NO DATA  | 1.25E-08 | 8.11E-06 | 1.65E-05 |

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**TABLE A.2-3\***  
INHALATION DOSE FACTORS FOR CHILD  
(MREM PER PCI INHALED)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | NO DATA  | 3.04E-07 | 3.04E-07 | 3.04E-07 | 3.04E-07 | 3.04E-07 | 3.04E-07 |
| C       | 14  | 9.70E-06 | 1.82E-06 | 1.82E-06 | 1.82E-06 | 1.82E-06 | 1.82E-06 | 1.82E-06 |
| NA      | 24  | 4.35E-06 | 4.35E-06 | 4.35E-06 | 4.35E-06 | 4.35E-06 | 4.35E-06 | 4.35E-06 |
| P       | 32  | 7.04E-04 | 3.09E-05 | 2.67E-05 | NO DATA  | NO DATA  | NO DATA  | 1.14E-05 |
| CR      | 51  | NO DATA  | NO DATA  | 4.17E-08 | 2.31E-08 | 6.57E-09 | 4.59E-06 | 2.93E-07 |
| MN      | 54  | NO DATA  | 1.16E-05 | 2.57E-06 | NO DATA  | 2.71E-06 | 4.26E-04 | 6.19E-06 |
| MN      | 56  | NO DATA  | 4.48E-10 | 8.43E-11 | NO DATA  | 4.52E-10 | 3.55E-06 | 3.33E-05 |
| FE      | 55  | 1.28E-05 | 6.80E-06 | 2.10E-06 | NO DATA  | NO DATA  | 3.00E-05 | 7.75E-07 |
| FE      | 59  | 5.59E-06 | 9.04E-06 | 4.51E-06 | NO DATA  | NO DATA  | 3.43E-04 | 1.91E-05 |
| CO      | 58  | NO DATA  | 4.79E-07 | 8.55E-07 | NO DATA  | NO DATA  | 2.99E-04 | 9.29E-06 |
| CO      | 60  | NO DATA  | 3.55E-06 | 6.12E-06 | NO DATA  | NO DATA  | 1.91E-03 | 2.60E-05 |
| NI      | 63  | 2.22E-04 | 1.25E-05 | 7.56E-06 | NO DATA  | NO DATA  | 7.43E-05 | 1.71E-06 |
| NI      | 65  | 8.08E-10 | 7.99E-11 | 4.44E-11 | NO DATA  | NO DATA  | 2.21E-06 | 2.27E-05 |
| CU      | 64  | NO DATA  | 5.39E-10 | 2.90E-10 | NO DATA  | 1.63E-09 | 2.59E-06 | 9.92E-06 |
| ZN      | 65  | 1.15E-05 | 3.06E-05 | 1.90E-05 | NO DATA  | 1.93E-05 | 2.69E-04 | 4.41E-06 |
| ZN      | 69  | 1.81E-11 | 2.61E-11 | 2.41E-12 | NO DATA  | 1.58E-11 | 3.84E-07 | 2.75E-06 |
| BR      | 83  | NO DATA  | NO DATA  | 1.28E-07 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| BR      | 84  | NO DATA  | NO DATA  | 1.48E-07 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| BR      | 85  | NO DATA  | NO DATA  | 6.84E-09 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| RB      | 86  | NO DATA  | 5.36E-05 | 3.09E-05 | NO DATA  | NO DATA  | NO DATA  | 2.16E-06 |
| RB      | 88  | NO DATA  | 1.52E-07 | 9.90E-08 | NO DATA  | NO DATA  | NO DATA  | 4.66E-09 |
| RB      | 89  | NO DATA  | 9.33E-08 | 7.83E-08 | NO DATA  | NO DATA  | NO DATA  | 5.11E-10 |
| SR      | 89  | 1.62E-04 | NO DATA  | 4.66E-06 | NO DATA  | NO DATA  | 5.83E-04 | 4.52E-05 |
| SR      | 90  | 2.73E-02 | NO DATA  | 1.74E-03 | NO DATA  | NO DATA  | 3.99E-03 | 9.28E-05 |
| SR      | 91  | 3.28E-08 | NO DATA  | 1.24E-09 | NO DATA  | NO DATA  | 1.44E-05 | 4.70E-05 |
| SR      | 92  | 3.54E-09 | NO DATA  | 1.42E-10 | NO DATA  | NO DATA  | 6.49E-06 | 6.55E-05 |
| Y       | 90  | 1.11E-06 | NO DATA  | 2.99E-08 | NO DATA  | NO DATA  | 7.07E-05 | 7.24E-05 |
| Y       | 91M | 1.37E-10 | NO DATA  | 4.98E-12 | NO DATA  | NO DATA  | 7.60E-07 | 4.64E-07 |
| Y       | 91  | 2.47E-04 | NO DATA  | 6.59E-06 | NO DATA  | NO DATA  | 7.10E-04 | 4.97E-05 |
| Y       | 92  | 5.50E-09 | NO DATA  | 1.57E-10 | NO DATA  | NO DATA  | 6.46E-06 | 6.46E-05 |
| Y       | 93  | 5.04E-08 | NO DATA  | 1.38E-09 | NO DATA  | NO DATA  | 2.01E-05 | 1.05E-04 |
| ZR      | 95  | 5.13E-05 | 1.13E-05 | 1.00E-05 | NO DATA  | 1.61E-05 | 6.03E-04 | 1.65E-05 |
| ZR      | 97  | 5.07E-08 | 7.34E-09 | 4.32E-09 | NO DATA  | 1.05E-08 | 3.06E-05 | 9.49E-05 |
| NB      | 95  | 6.35E-06 | 2.48E-06 | 1.77E-06 | NO DATA  | 2.33E-06 | 1.66E-04 | 1.00E-05 |
| MO      | 99  | NO DATA  | 4.66E-08 | 1.15E-08 | NO DATA  | 1.06E-07 | 3.66E-05 | 3.42E-05 |
| TC      | 99M | 4.81E-13 | 9.41E-13 | 1.56E-11 | NO DATA  | 1.37E-11 | 2.57E-07 | 1.30E-06 |

\*Taken from Regulatory Guide 1.109 (Rev. 1)

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**TABLE A.2-3\* (cont'd)**  
INHALATION DOSE FACTORS FOR CHILD  
(MREM PER PCI INHALED)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 2.19E-14 | 2.30E-14 | 2.91E-13 | NO DATA  | 3.92E-13 | 1.58E-07 | 4.41E-09 |
| RU      | 103  | 7.55E-07 | NO DATA  | 2.90E-07 | NO DATA  | 1.90E-06 | 1.79E-04 | 1.21E-05 |
| RU      | 105  | 4.13E-10 | NO DATA  | 1.50E-10 | NO DATA  | 3.63E-10 | 4.30E-06 | 2.69E-05 |
| RU      | 106  | 3.68E-05 | NO DATA  | 4.57E-06 | NO DATA  | 4.97E-05 | 3.87E-03 | 1.16E-04 |
| AG      | 110M | 4.56E-06 | 3.08E-06 | 2.47E-06 | NO DATA  | 5.74E-06 | 1.48E-03 | 2.71E-05 |
| TE      | 125M | 1.82E-06 | 6.29E-07 | 2.47E-07 | 5.20E-07 | NO DATA  | 1.29E-04 | 9.13E-06 |
| TE      | 127M | 6.72E-06 | 2.31E-06 | 8.16E-07 | 1.64E-06 | 1.72E-05 | 4.00E-04 | 1.93E-05 |
| TE      | 127  | 7.49E-10 | 2.57E-10 | 1.65E-10 | 5.30E-10 | 1.91E-09 | 2.71E-06 | 1.52E-05 |
| TE      | 129M | 5.19E-06 | 1.85E-06 | 8.22E-07 | 1.71E-06 | 1.36E-05 | 4.76E-04 | 4.91E-05 |
| TE      | 129  | 2.64E-11 | 9.45E-12 | 6.44E-12 | 1.93E-11 | 6.94E-11 | 7.93E-07 | 6.89E-06 |
| TE      | 131M | 3.63E-08 | 1.60E-08 | 1.37E-08 | 2.64E-08 | 1.08E-07 | 5.56E-05 | 8.32E-05 |
| TE      | 131  | 5.87E-12 | 2.28E-12 | 1.78E-12 | 4.59E-12 | 1.59E-11 | 5.55E-07 | 3.60E-07 |
| TE      | 132  | 1.30E-07 | 7.36E-08 | 7.12E-08 | 8.58E-08 | 4.79E-07 | 1.02E-04 | 3.72E-05 |
| I       | 130  | 2.21E-06 | 4.43E-06 | 2.28E-06 | 4.99E-04 | 6.61E-06 | NO DATA  | 1.38E-06 |
| I       | 131  | 1.30E-05 | 1.30E-05 | 7.37E-06 | 4.39E-03 | 2.13E-05 | NO DATA  | 7.68E-07 |
| I       | 132  | 5.72E-07 | 1.10E-06 | 5.07E-07 | 5.23E-05 | 1.69E-06 | NO DATA  | 8.65E-07 |
| I       | 133  | 4.48E-06 | 5.49E-06 | 2.08E-06 | 1.04E-03 | 9.13E-06 | NO DATA  | 1.48E-06 |
| I       | 134  | 3.17E-07 | 5.84E-07 | 2.69E-07 | 1.37E-05 | 8.92E-07 | NO DATA  | 2.58E-07 |
| I       | 135  | 1.33E-06 | 2.36E-06 | 1.12E-06 | 2.14E-04 | 3.62E-06 | NO DATA  | 1.20E-06 |
| CS      | 134  | 1.76E-04 | 2.74E-04 | 6.07E-05 | NO DATA  | 8.93E-05 | 3.27E-05 | 1.04E-06 |
| CS      | 136  | 1.76E-05 | 4.62E-05 | 3.14E-05 | NO DATA  | 2.58E-05 | 3.93E-06 | 1.13E-06 |
| CS      | 137  | 2.45E-04 | 2.23E-04 | 3.47E-05 | NO DATA  | 7.63E-05 | 2.81E-05 | 9.78E-07 |
| CS      | 138  | 1.71E-07 | 2.27E-07 | 1.50E-07 | NO DATA  | 1.68E-07 | 1.84E-08 | 7.29E-08 |
| BA      | 139  | 4.98E-10 | 2.66E-13 | 1.45E-11 | NO DATA  | 2.33E-13 | 1.56E-06 | 1.56E-05 |
| BA      | 140  | 2.00E-05 | 1.75E-08 | 1.17E-06 | NO DATA  | 5.71E-09 | 4.71E-04 | 2.75E-05 |
| BA      | 141  | 5.29E-11 | 2.95E-14 | 1.72E-12 | NO DATA  | 2.56E-14 | 7.89E-07 | 7.44E-08 |
| BA      | 142  | 1.35E-11 | 9.73E-15 | 7.54E-13 | NO DATA  | 7.87E-15 | 4.44E-07 | 7.41E-10 |
| LA      | 140  | 1.74E-07 | 6.08E-08 | 2.04E-08 | NO DATA  | NO DATA  | 4.94E-05 | 6.10E-05 |
| LA      | 142  | 3.50E-10 | 1.11E-10 | 3.49E-11 | NO DATA  | NO DATA  | 2.35E-06 | 2.05E-05 |
| CE      | 141  | 1.06E-05 | 5.28E-06 | 7.83E-07 | NO DATA  | 2.31E-06 | 1.47E-04 | 1.53E-05 |
| CE      | 143  | 9.89E-08 | 5.37E-08 | 7.77E-09 | NO DATA  | 2.26E-08 | 3.12E-05 | 3.44E-05 |
| CE      | 144  | 1.83E-03 | 5.72E-04 | 9.77E-05 | NO DATA  | 3.17E-04 | 3.23E-03 | 1.05E-04 |
| PR      | 143  | 4.99E-06 | 1.50E-06 | 2.47E-07 | NO DATA  | 8.11E-07 | 1.17E-04 | 2.63E-05 |
| PR      | 144  | 1.61E-11 | 4.99E-12 | 8.10E-13 | NO DATA  | 2.64E-12 | 4.23E-07 | 5.32E-08 |
| ND      | 147  | 2.92E-06 | 2.36E-06 | 1.84E-07 | NO DATA  | 1.30E-06 | 8.87E-05 | 2.22E-05 |
| W       | 187  | 4.41E-09 | 2.61E-09 | 1.17E-09 | NO DATA  | NO DATA  | 1.11E-05 | 2.46E-05 |
| NP      | 239  | 1.26E-07 | 9.04E-09 | 6.35E-09 | NO DATA  | 2.63E-08 | 1.57E-05 | 1.73E-05 |

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**TABLE A.2-4\***  
INHALATION DOSE FACTORS FOR INFANT  
(MREM PER PCI INHALED)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | NO DATA  | 4.62E-07 | 4.62E-07 | 4.62E-07 | 4.62E-07 | 4.62E-07 | 4.62E-07 |
| C       | 14  | 1.89E-05 | 3.79E-06 | 3.79E-06 | 3.79E-06 | 3.79E-06 | 3.79E-06 | 3.79E-06 |
| NA      | 24  | 7.54E-06 | 7.54E-06 | 7.54E-06 | 7.54E-06 | 7.54E-06 | 7.54E-06 | 7.54E-06 |
| P       | 32  | 1.45E-03 | 8.03E-05 | 5.53E-05 | NO DATA  | NO DATA  | NO DATA  | 1.15E-05 |
| CR      | 51  | NO DATA  | NO DATA  | 6.39E-08 | 4.11E-08 | 9.45E-09 | 9.17E-06 | 2.55E-07 |
| MN      | 54  | NO DATA  | 1.81E-05 | 3.56E-06 | NO DATA  | 3.56E-06 | 7.14E-04 | 5.04E-06 |
| MN      | 56  | NO DATA  | 1.10E-09 | 1.58E-10 | NO DATA  | 7.86E-10 | 8.95E-06 | 5.12E-05 |
| FE      | 55  | 1.41E-05 | 8.39E-06 | 2.38E-06 | NO DATA  | NO DATA  | 6.21E-05 | 7.82E-07 |
| FE      | 59  | 9.69E-06 | 1.68E-05 | 6.77E-06 | NO DATA  | NO DATA  | 7.25E-04 | 1.77E-05 |
| CO      | 58  | NO DATA  | 8.71E-07 | 1.30E-06 | NO DATA  | NO DATA  | 5.55E-04 | 7.95E-06 |
| CO      | 60  | NO DATA  | 5.73E-06 | 8.41E-06 | NO DATA  | NO DATA  | 3.22E-03 | 2.28E-05 |
| NI      | 63  | 2.42E-04 | 1.46E-05 | 8.29E-06 | NO DATA  | NO DATA  | 1.49E-04 | 1.73E-06 |
| NI      | 65  | 1.71E-09 | 2.03E-10 | 8.79E-11 | NO DATA  | NO DATA  | 5.80E-06 | 3.58E-05 |
| CU      | 64  | NO DATA  | 1.34E-09 | 5.53E-10 | NO DATA  | 2.84E-09 | 6.64E-06 | 1.07E-05 |
| ZN      | 65  | 1.38E-05 | 4.47E-05 | 2.22E-05 | NO DATA  | 2.32E-05 | 4.62E-04 | 3.67E-05 |
| ZN      | 69  | 3.85E-11 | 6.91E-11 | 5.13E-12 | NO DATA  | 2.87E-11 | 1.05E-06 | 9.44E-06 |
| BR      | 83  | NO DATA  | NO DATA  | 2.72E-07 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| BR      | 84  | NO DATA  | NO DATA  | 2.86E-07 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| BR      | 85  | NO DATA  | NO DATA  | 1.46E-08 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| RB      | 86  | NO DATA  | 1.36E-04 | 6.30E-05 | NO DATA  | NO DATA  | NO DATA  | 2.17E-06 |
| RB      | 88  | NO DATA  | 3.98E-07 | 2.05E-07 | NO DATA  | NO DATA  | NO DATA  | 2.42E-07 |
| RB      | 89  | NO DATA  | 2.29E-07 | 1.47E-07 | NO DATA  | NO DATA  | NO DATA  | 4.87E-08 |
| SR      | 89  | 2.84E-04 | NO DATA  | 8.15E-06 | NO DATA  | NO DATA  | 1.45E-03 | 4.57E-05 |
| SR      | 90  | 2.92E-02 | NO DATA  | 1.85E-03 | NO DATA  | NO DATA  | 8.03E-03 | 9.36E-05 |
| SR      | 91  | 6.83E-08 | NO DATA  | 2.47E-09 | NO DATA  | NO DATA  | 3.76E-05 | 5.24E-05 |
| SR      | 92  | 7.50E-09 | NO DATA  | 2.79E-10 | NO DATA  | NO DATA  | 1.70E-05 | 1.00E-04 |
| Y       | 90  | 2.35E-06 | NO DATA  | 6.30E-08 | NO DATA  | NO DATA  | 1.92E-04 | 7.43E-05 |
| Y       | 91M | 2.91E-10 | NO DATA  | 9.90E-12 | NO DATA  | NO DATA  | 1.99E-06 | 1.68E-06 |
| Y       | 91  | 4.20E-04 | NO DATA  | 1.12E-05 | NO DATA  | NO DATA  | 1.75E-03 | 5.02E-05 |
| Y       | 92  | 1.17E-08 | NO DATA  | 3.29E-10 | NO DATA  | NO DATA  | 1.75E-05 | 9.04E-05 |
| Y       | 93  | 1.07E-07 | NO DATA  | 2.91E-09 | NO DATA  | NO DATA  | 5.46E-05 | 1.19E-04 |
| ZR      | 95  | 8.24E-05 | 1.99E-05 | 1.45E-05 | NO DATA  | 2.22E-05 | 1.25E-03 | 1.55E-05 |
| ZR      | 97  | 1.07E-07 | 1.83E-08 | 8.36E-09 | NO DATA  | 1.85E-08 | 7.88E-05 | 1.00E-04 |
| NB      | 95  | 1.12E-05 | 4.59E-06 | 2.70E-06 | NO DATA  | 3.37E-06 | 3.42E-04 | 9.05E-06 |
| MO      | 99  | NO DATA  | 1.18E-07 | 2.31E-08 | NO DATA  | 1.89E-07 | 9.63E-05 | 3.48E-05 |
| TC      | 99M | 9.98E-13 | 2.06E-12 | 2.66E-11 | NO DATA  | 2.22E-11 | 5.79E-07 | 1.45E-06 |

\*Taken from Regulatory Guide 1.109 (Rev. 1)

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**TABLE A.2-4\* (cont'd)**  
INHALATION DOSE FACTORS FOR INFANT  
(MREM PER PCI INHALED)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 4.65E-14 | 5.88E-14 | 5.80E-13 | NO DATA  | 6.99E-13 | 4.17E-07 | 6.03E-07 |
| RU      | 103  | 1.44E-06 | NO DATA  | 4.85E-07 | NO DATA  | 3.03E-06 | 3.94E-04 | 1.15E-05 |
| RU      | 105  | 8.74E-10 | NO DATA  | 2.93E-10 | NO DATA  | 6.42E-10 | 1.12E-05 | 3.46E-05 |
| RU      | 106  | 6.20E-05 | NO DATA  | 7.77E-06 | NO DATA  | 7.61E-05 | 8.26E-03 | 1.17E-04 |
| AG      | 110M | 7.13E-06 | 5.16E-06 | 3.57E-06 | NO DATA  | 7.80E-06 | 2.62E-03 | 2.36E-05 |
| TE      | 125M | 3.40E-06 | 1.42E-06 | 4.70E-07 | 1.16E-06 | NO DATA  | 3.19E-04 | 9.22E-06 |
| TE      | 127M | 1.19E-05 | 4.93E-06 | 1.48E-06 | 3.48E-06 | 2.68E-05 | 9.37E-04 | 1.95E-05 |
| TE      | 127  | 1.59E-09 | 6.81E-10 | 3.49E-10 | 1.32E-09 | 3.47E-09 | 7.39E-06 | 1.74E-05 |
| TE      | 129M | 1.01E-05 | 4.35E-06 | 1.59E-06 | 3.91E-06 | 2.27E-05 | 1.20E-03 | 4.93E-05 |
| TE      | 129  | 5.63E-11 | 2.48E-11 | 1.34E-11 | 4.82E-11 | 1.25E-10 | 2.14E-06 | 1.88E-05 |
| TE      | 131M | 7.62E-08 | 3.93E-08 | 2.59E-08 | 6.38E-08 | 1.89E-07 | 1.42E-04 | 8.51E-05 |
| TE      | 131  | 1.24E-11 | 5.87E-12 | 3.57E-12 | 1.13E-11 | 2.85E-11 | 1.47E-06 | 5.87E-06 |
| TE      | 132  | 2.66E-07 | 1.69E-07 | 1.26E-07 | 1.99E-07 | 7.39E-07 | 2.43E-04 | 3.15E-05 |
| I       | 130  | 4.54E-06 | 9.91E-06 | 3.98E-06 | 1.14E-03 | 1.09E-05 | NO DATA  | 1.42E-06 |
| I       | 131  | 2.71E-05 | 3.17E-05 | 1.40E-05 | 1.06E-02 | 3.70E-05 | NO DATA  | 7.56E-07 |
| I       | 132  | 1.21E-06 | 2.53E-06 | 8.99E-07 | 1.21E-04 | 2.82E-06 | NO DATA  | 1.36E-06 |
| I       | 133  | 9.46E-06 | 1.37E-05 | 4.00E-06 | 2.54E-03 | 1.60E-05 | NO DATA  | 1.54E-06 |
| I       | 134  | 6.58E-07 | 1.34E-06 | 4.75E-07 | 3.18E-05 | 1.49E-06 | NO DATA  | 9.21E-07 |
| I       | 135  | 2.76E-06 | 5.43E-06 | 1.98E-06 | 4.97E-04 | 6.05E-06 | NO DATA  | 1.31E-06 |
| CS      | 134  | 2.83E-04 | 5.02E-04 | 5.32E-05 | NO DATA  | 1.36E-04 | 5.69E-05 | 9.53E-07 |
| CS      | 136  | 3.45E-05 | 9.61E-05 | 3.78E-05 | NO DATA  | 4.03E-05 | 8.40E-06 | 1.02E-06 |
| CS      | 137  | 3.92E-04 | 4.37E-04 | 3.25E-05 | NO DATA  | 1.23E-04 | 5.09E-05 | 9.53E-07 |
| CS      | 138  | 3.61E-07 | 5.58E-07 | 2.84E-07 | NO DATA  | 2.93E-07 | 4.67E-08 | 6.26E-07 |
| BA      | 139  | 1.06E-09 | 7.03E-13 | 3.07E-11 | NO DATA  | 4.23E-13 | 4.25E-06 | 3.64E-05 |
| BA      | 140  | 4.00E-05 | 4.00E-08 | 2.07E-06 | NO DATA  | 9.59E-09 | 1.14E-03 | 2.74E-05 |
| BA      | 141  | 1.12E-10 | 7.70E-14 | 3.55E-12 | NO DATA  | 4.64E-14 | 2.12E-06 | 3.39E-06 |
| BA      | 142  | 2.84E-11 | 2.36E-14 | 1.40E-12 | NO DATA  | 1.36E-14 | 1.11E-06 | 4.95E-07 |
| LA      | 140  | 3.61E-07 | 1.43E-07 | 3.68E-08 | NO DATA  | NO DATA  | 1.20E-04 | 6.06E-05 |
| LA      | 142  | 7.36E-10 | 2.69E-10 | 6.46E-11 | NO DATA  | NO DATA  | 5.87E-06 | 4.25E-05 |
| CE      | 141  | 1.98E-05 | 1.19E-05 | 1.42E-06 | NO DATA  | 3.75E-06 | 3.69E-04 | 1.54E-05 |
| CE      | 143  | 2.09E-07 | 1.38E-07 | 1.58E-08 | NO DATA  | 4.03E-08 | 8.30E-05 | 3.55E-05 |
| CE      | 144  | 2.28E-03 | 8.65E-04 | 1.26E-04 | NO DATA  | 3.84E-04 | 7.03E-03 | 1.06E-04 |
| PR      | 143  | 1.00E-05 | 3.74E-06 | 4.99E-07 | NO DATA  | 1.41E-06 | 3.09E-04 | 2.66E-05 |
| PR      | 144  | 3.42E-11 | 1.32E-11 | 1.72E-12 | NO DATA  | 4.80E-12 | 1.15E-06 | 3.06E-06 |
| ND      | 147  | 5.67E-06 | 5.81E-06 | 3.57E-07 | NO DATA  | 2.25E-06 | 2.30E-04 | 2.23E-05 |
| W       | 187  | 9.26E-09 | 6.44E-09 | 2.23E-09 | NO DATA  | NO DATA  | 2.83E-05 | 2.54E-05 |
| NP      | 239  | 2.65E-07 | 2.37E-08 | 1.34E-08 | NO DATA  | 4.73E-08 | 4.25E-05 | 1.78E-05 |

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**TABLE A.2-5\***  
EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND  
(mrem/hr per pCi/m<sup>2</sup>)

| <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    |
| 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    |

\*Taken from Regulatory Guide 1.109 (Rev. 1)

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**TABLE A.2-5\* (cont'd)**  
EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND  
(mrem/hr per pCi/m<sup>2</sup>)

| <u>ELEMENT</u> | <u>TOTAL BODY</u> | <u>SKIN</u> |
|----------------|-------------------|-------------|
| 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 A.3-1\***  
INGESTION DOSE FACTORS FOR ADULTS  
(MREM PER PCI INGESTED)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | NO DATA  | 1.05E-07 | 1.05E-07 | 1.05E-07 | 1.05E-07 | 1.05E-07 | 1.05E-07 |
| C       | 14  | 2.84E-06 | 5.68E-07 | 5.68E-07 | 5.68E-07 | 5.68E-07 | 5.68E-07 | 5.68E-07 |
| NA      | 24  | 1.70E-06 | 1.70E-06 | 1.70E-06 | 1.70E-06 | 1.70E-06 | 1.70E-06 | 1.70E-06 |
| P       | 32  | 1.93E-04 | 1.20E-05 | 7.46E-06 | NO DATA  | NO DATA  | NO DATA  | 2.17E-05 |
| CR      | 51  | NO DATA  | NO DATA  | 2.66E-09 | 1.59E-09 | 5.86E-10 | 3.53E-09 | 6.69E-07 |
| MN      | 54  | NO DATA  | 4.57E-06 | 8.72E-07 | NO DATA  | 1.36E-06 | NO DATA  | 1.40E-05 |
| MN      | 56  | NO DATA  | 1.15E-07 | 2.04E-08 | NO DATA  | 1.46E-07 | NO DATA  | 3.67E-06 |
| FE      | 55  | 2.75E-06 | 1.90E-06 | 4.43E-07 | NO DATA  | NO DATA  | 1.06E-06 | 1.09E-06 |
| FE      | 59  | 4.34E-06 | 1.02E-05 | 3.91E-06 | NO DATA  | NO DATA  | 2.85E-06 | 3.40E-05 |
| CO      | 58  | NO DATA  | 7.45E-07 | 1.67E-06 | NO DATA  | NO DATA  | NO DATA  | 1.51E-05 |
| CO      | 60  | NO DATA  | 2.14E-06 | 4.72E-06 | NO DATA  | NO DATA  | NO DATA  | 4.02E-05 |
| NI      | 63  | 1.30E-04 | 9.01E-06 | 4.36E-06 | NO DATA  | NO DATA  | NO DATA  | 1.88E-06 |
| NI      | 65  | 5.28E-07 | 6.86E-08 | 3.13E-08 | NO DATA  | NO DATA  | NO DATA  | 1.74E-06 |
| CU      | 64  | NO DATA  | 8.33E-08 | 3.91E-08 | NO DATA  | 2.10E-07 | NO DATA  | 7.10E-06 |
| ZN      | 65  | 4.84E-06 | 1.54E-05 | 6.96E-06 | NO DATA  | 1.03E-05 | NO DATA  | 9.70E-06 |
| ZN      | 69  | 1.03E-08 | 1.97E-08 | 1.37E-09 | NO DATA  | 1.28E-08 | NO DATA  | 2.96E-09 |
| BR      | 83  | NO DATA  | NO DATA  | 4.02E-08 | NO DATA  | NO DATA  | NO DATA  | 5.79E-08 |
| BR      | 84  | NO DATA  | NO DATA  | 5.21E-08 | NO DATA  | NO DATA  | NO DATA  | 4.09E-13 |
| BR      | 85  | NO DATA  | NO DATA  | 2.14E-09 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| RB      | 86  | NO DATA  | 2.11E-05 | 9.83E-06 | NO DATA  | NO DATA  | NO DATA  | 4.16E-06 |
| RB      | 88  | NO DATA  | 6.05E-08 | 3.21E-08 | NO DATA  | NO DATA  | NO DATA  | 8.36E-19 |
| RB      | 89  | NO DATA  | 4.01E-08 | 2.82E-08 | NO DATA  | NO DATA  | NO DATA  | 2.33E-21 |
| SR      | 89  | 3.08E-04 | NO DATA  | 8.84E-06 | NO DATA  | NO DATA  | NO DATA  | 4.94E-05 |
| SR      | 90  | 7.58E-03 | NO DATA  | 1.86E-03 | NO DATA  | NO DATA  | NO DATA  | 2.19E-04 |
| SR      | 91  | 5.67E-06 | NO DATA  | 2.29E-07 | NO DATA  | NO DATA  | NO DATA  | 2.70E-05 |
| SR      | 92  | 2.15E-06 | NO DATA  | 9.30E-08 | NO DATA  | NO DATA  | NO DATA  | 4.26E-05 |
| Y       | 90  | 9.62E-09 | NO DATA  | 2.58E-10 | NO DATA  | NO DATA  | NO DATA  | 1.02E-04 |
| Y       | 91M | 9.09E-11 | NO DATA  | 3.52E-12 | NO DATA  | NO DATA  | NO DATA  | 2.67E-10 |
| Y       | 91  | 1.41E-07 | NO DATA  | 3.77E-09 | NO DATA  | NO DATA  | NO DATA  | 7.76E-05 |
| Y       | 92  | 8.45E-10 | NO DATA  | 2.47E-11 | NO DATA  | NO DATA  | NO DATA  | 1.48E-05 |
| Y       | 93  | 2.68E-09 | NO DATA  | 7.40E-11 | NO DATA  | NO DATA  | NO DATA  | 8.50E-05 |
| ZR      | 95  | 3.04E-08 | 9.75E-09 | 6.60E-09 | NO DATA  | 1.53E-08 | NO DATA  | 3.09E-05 |
| ZR      | 97  | 1.68E-09 | 3.39E-10 | 1.55E-10 | NO DATA  | 5.12E-10 | NO DATA  | 1.05E-04 |
| NB      | 95  | 6.22E-09 | 3.46E-09 | 1.86E-09 | NO DATA  | 3.42E-09 | NO DATA  | 2.10E-05 |
| MO      | 99  | NO DATA  | 4.31E-06 | 8.20E-07 | NO DATA  | 9.76E-06 | NO DATA  | 9.99E-06 |
| TC      | 99M | 2.47E-10 | 6.98E-10 | 8.89E-09 | NO DATA  | 1.06E-08 | 3.42E-10 | 4.13E-07 |

\*Taken from Regulatory Guide 1.109 (Rev. 1)

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**TABLE A.3-1\* (cont'd)**  
INGESTION DOSE FACTORS FOR ADULTS  
(MREM PER PCI INGESTED)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 2.54E-10 | 3.66E-10 | 3.59E-09 | NO DATA  | 6.59E-09 | 1.87E-10 | 1.10E-21 |
| RU      | 103  | 1.85E-07 | NO DATA  | 7.97E-08 | NO DATA  | 7.06E-07 | NO DATA  | 2.16E-05 |
| RU      | 105  | 1.54E-08 | NO DATA  | 6.08E-09 | NO DATA  | 1.99E-07 | NO DATA  | 9.42E-06 |
| RU      | 106  | 2.75E-06 | NO DATA  | 3.48E-07 | NO DATA  | 5.31E-06 | NO DATA  | 1.78E-04 |
| AG      | 110M | 1.60E-07 | 1.48E-07 | 8.79E-08 | NO DATA  | 2.91E-07 | NO DATA  | 6.04E-05 |
| TE      | 125M | 2.68E-06 | 9.71E-07 | 3.59E-07 | 8.06E-07 | 1.09E-05 | NO DATA  | 1.07E-05 |
| TE      | 127M | 6.77E-06 | 2.42E-06 | 8.25E-07 | 1.73E-06 | 2.75E-05 | NO DATA  | 2.27E-05 |
| TE      | 127  | 1.10E-07 | 3.95E-08 | 2.38E-08 | 8.15E-08 | 4.48E-07 | NO DATA  | 8.68E-06 |
| TE      | 129M | 1.15E-05 | 4.29E-06 | 1.82E-06 | 3.95E-06 | 4.80E-05 | NO DATA  | 5.79E-05 |
| TE      | 129  | 3.14E-08 | 1.18E-08 | 7.65E-09 | 2.41E-08 | 1.32E-07 | NO DATA  | 2.37E-08 |
| TE      | 131M | 1.73E-06 | 8.46E-07 | 7.05E-07 | 1.34E-06 | 8.57E-06 | NO DATA  | 8.40E-05 |
| TE      | 131  | 1.97E-08 | 8.23E-09 | 6.22E-09 | 1.62E-08 | 8.63E-08 | NO DATA  | 2.79E-09 |
| TE      | 132  | 2.52E-06 | 1.63E-06 | 1.53E-06 | 1.80E-06 | 1.57E-05 | NO DATA  | 7.71E-05 |
| I       | 130  | 7.56E-07 | 2.23E-06 | 8.80E-07 | 1.89E-04 | 3.48E-06 | NO DATA  | 1.92E-06 |
| I       | 131  | 4.16E-06 | 5.95E-06 | 3.41E-06 | 1.95E-03 | 1.02E-05 | NO DATA  | 1.57E-06 |
| I       | 132  | 2.03E-07 | 5.43E-07 | 1.90E-07 | 1.90E-05 | 8.65E-07 | NO DATA  | 1.02E-07 |
| I       | 133  | 1.42E-06 | 2.47E-06 | 7.53E-07 | 3.63E-04 | 4.31E-06 | NO DATA  | 2.22E-06 |
| I       | 134  | 1.06E-07 | 2.88E-07 | 1.03E-07 | 4.99E-06 | 4.58E-07 | NO DATA  | 2.51E-10 |
| I       | 135  | 4.43E-07 | 1.16E-06 | 4.28E-07 | 7.65E-05 | 1.86E-06 | NO DATA  | 1.31E-06 |
| CS      | 134  | 6.22E-05 | 1.48E-04 | 1.21E-04 | NO DATA  | 4.79E-05 | 1.59E-05 | 2.59E-06 |
| CS      | 136  | 6.51E-06 | 2.57E-05 | 1.85E-05 | NO DATA  | 1.43E-05 | 1.96E-06 | 2.92E-06 |
| CS      | 137  | 7.97E-05 | 1.09E-04 | 7.14E-05 | NO DATA  | 3.70E-05 | 1.23E-05 | 2.11E-06 |
| CS      | 138  | 5.52E-08 | 1.09E-07 | 5.40E-08 | NO DATA  | 8.01E-08 | 7.91E-09 | 4.65E-13 |
| BA      | 139  | 9.70E-08 | 6.91E-11 | 2.84E-09 | NO DATA  | 6.46E-11 | 3.92E-11 | 1.72E-07 |
| BA      | 140  | 2.03E-05 | 2.55E-08 | 1.33E-06 | NO DATA  | 8.67E-09 | 1.46E-08 | 4.18E-05 |
| BA      | 141  | 4.71E-08 | 3.56E-11 | 1.59E-09 | NO DATA  | 3.31E-11 | 2.02E-11 | 2.22E-17 |
| BA      | 142  | 2.13E-08 | 2.19E-11 | 1.34E-09 | NO DATA  | 1.85E-11 | 1.24E-11 | 3.00E-26 |
| LA      | 140  | 2.50E-09 | 1.26E-09 | 3.33E-10 | NO DATA  | NO DATA  | NO DATA  | 9.25E-05 |
| LA      | 142  | 1.28E-10 | 5.82E-11 | 1.45E-11 | NO DATA  | NO DATA  | NO DATA  | 4.25E-07 |
| CE      | 141  | 9.36E-09 | 6.33E-09 | 7.18E-10 | NO DATA  | 2.94E-09 | NO DATA  | 2.42E-05 |
| CE      | 143  | 1.65E-09 | 1.22E-06 | 1.35E-10 | NO DATA  | 5.37E-10 | NO DATA  | 4.56E-05 |
| CE      | 144  | 4.88E-07 | 2.04E-07 | 2.62E-08 | NO DATA  | 1.21E-07 | NO DATA  | 1.65E-04 |
| PR      | 143  | 9.20E-09 | 3.69E-09 | 4.56E-10 | NO DATA  | 2.13E-09 | NO DATA  | 4.03E-05 |
| PR      | 144  | 3.01E-11 | 1.25E-11 | 1.53E-12 | NO DATA  | 7.05E-12 | NO DATA  | 4.33E-18 |
| ND      | 147  | 6.29E-09 | 7.27E-09 | 4.35E-10 | NO DATA  | 4.25E-09 | NO DATA  | 3.49E-05 |
| W       | 187  | 1.03E-07 | 8.61E-08 | 3.01E-08 | NO DATA  | NO DATA  | NO DATA  | 2.82E-05 |

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TABLE A.3-1\* (cont'd)  
INGESTION DOSE FACTORS FOR ADULTS  
(MREM PER PCI INGESTED)

| NUCLIDE |       | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-------|----------|----------|----------|----------|----------|----------|----------|
| NP      | 239   | 1.19E-09 | 1.17E-10 | 6.45E-11 | NO DATA  | 3.65E-10 | NO DATA  | 2.40E-05 |
| Sb      | 124** | 2.80E-06 | 5.29E-08 | 1.11E-06 | 6.79E-09 | NO DATA  | 2.18E-06 | 7.95E-05 |
| Sb      | 125** | 1.79E-06 | 2.00E-08 | 4.26E-07 | 1.82E-09 | NO DATA  | 1.38E-06 | 1.97E-05 |
| Sb      | 126** | 1.15E-06 | 2.34E-08 | 4.15E-07 | 7.04E-09 | NO DATA  | 7.05E-07 | 9.40E-05 |
| Co      | 57**  | NO DATA  | 1.75E-07 | 2.91E-07 | NO DATA  | NO DATA  | NO DATA  | 4.44E-06 |

\*\*Taken from Regulatory Guide 1.109 (Rev. 0)

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**TABLE A-3.2**  
INGESTION DOSE FACTORS FOR TEENAGERS  
(MREM PER PCI INGESTED)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-ILLI  |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | NO DATA  | 1.06E-07 | 1.06E-07 | 1.06E-07 | 1.06E-07 | 1.06E-07 | 1.06E-07 |
| C       | 14  | 4.06E-06 | 8.12E-07 | 8.12E-07 | 8.12E-07 | 8.12E-07 | 8.12E-07 | 8.12E-07 |
| NA      | 24  | 2.30E-06 | 2.30E-06 | 2.30E-06 | 2.30E-06 | 2.30E-06 | 2.30E-06 | 2.30E-06 |
| P       | 32  | 2.76E-04 | 1.71E-05 | 1.07E-05 | NO DATA  | NO DATA  | NO DATA  | 2.32E-05 |
| CR      | 51  | NO DATA  | NO DATA  | 3.60E-09 | 2.00E-09 | 7.89E-10 | 5.14E-09 | 6.05E-07 |
| MN      | 54  | NO DATA  | 5.90E-06 | 1.17E-06 | NO DATA  | 1.76E-06 | NO DATA  | 1.21E-05 |
| MN      | 56  | NO DATA  | 1.58E-07 | 2.81E-08 | NO DATA  | 2.00E-07 | NO DATA  | 1.04E-05 |
| FE      | 55  | 3.78E-06 | 2.68E-06 | 6.25E-07 | NO DATA  | NO DATA  | 1.70E-06 | 1.16E-06 |
| FE      | 59  | 5.87E-06 | 1.37E-05 | 5.29E-06 | NO DATA  | NO DATA  | 4.32E-06 | 3.24E-05 |
| CO      | 58  | NO DATA  | 9.72E-07 | 2.24E-06 | NO DATA  | NO DATA  | NO DATA  | 1.34E-05 |
| CO      | 60  | NO DATA  | 2.81E-06 | 6.33E-06 | NO DATA  | NO DATA  | NO DATA  | 3.66E-05 |
| NI      | 63  | 1.77E-04 | 1.25E-05 | 6.00E-06 | NO DATA  | NO DATA  | NO DATA  | 1.99E-06 |
| NI      | 65  | 7.49E-07 | 9.57E-08 | 4.36E-08 | NO DATA  | NO DATA  | NO DATA  | 5.19E-06 |
| CU      | 64  | NO DATA  | 1.15E-07 | 5.41E-08 | NO DATA  | 2.91E-07 | NO DATA  | 8.92E-06 |
| ZN      | 65  | 5.76E-06 | 2.00E-05 | 9.33E-06 | NO DATA  | 1.28E-05 | NO DATA  | 8.47E-06 |
| ZN      | 69  | 1.47E-08 | 2.80E-08 | 1.96E-09 | NO DATA  | 1.83E-08 | NO DATA  | 5.16E-08 |
| BR      | 83  | NO DATA  | NO DATA  | 5.74E-08 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| BR      | 84  | NO DATA  | NO DATA  | 7.22E-08 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| BR      | 85  | NO DATA  | NO DATA  | 3.05E-09 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| RB      | 86  | NO DATA  | 2.98E-05 | 1.40E-05 | NO DATA  | NO DATA  | NO DATA  | 4.41E-06 |
| RB      | 88  | NO DATA  | 8.52E-08 | 4.54E-08 | NO DATA  | NO DATA  | NO DATA  | 7.30E-15 |
| RB      | 89  | NO DATA  | 5.50E-08 | 3.89E-08 | NO DATA  | NO DATA  | NO DATA  | 8.43E-17 |
| SR      | 89  | 4.40E-04 | NO DATA  | 1.26E-05 | NO DATA  | NO DATA  | NO DATA  | 5.24E-05 |
| SR      | 90  | 8.30E-03 | NO DATA  | 2.05E-03 | NO DATA  | NO DATA  | NO DATA  | 2.33E-04 |
| SR      | 91  | 8.07E-06 | NO DATA  | 3.21E-07 | NO DATA  | NO DATA  | NO DATA  | 3.66E-05 |
| SR      | 92  | 3.05E-06 | NO DATA  | 1.30E-07 | NO DATA  | NO DATA  | NO DATA  | 7.77E-05 |
| Y       | 90  | 1.37E-08 | NO DATA  | 3.69E-10 | NO DATA  | NO DATA  | NO DATA  | 1.13E-04 |
| Y       | 91M | 1.29E-10 | NO DATA  | 4.93E-12 | NO DATA  | NO DATA  | NO DATA  | 6.09E-09 |
| Y       | 91  | 2.01E-07 | NO DATA  | 5.39E-09 | NO DATA  | NO DATA  | NO DATA  | 8.24E-05 |
| Y       | 92  | 1.21E-09 | NO DATA  | 3.50E-11 | NO DATA  | NO DATA  | NO DATA  | 3.32E-05 |
| Y       | 93  | 3.83E-09 | NO DATA  | 1.05E-10 | NO DATA  | NO DATA  | NO DATA  | 1.17E-04 |
| ZR      | 95  | 4.12E-08 | 1.30E-08 | 8.94E-09 | NO DATA  | 1.91E-08 | NO DATA  | 3.00E-05 |
| ZR      | 97  | 2.37E-09 | 4.69E-10 | 2.16E-10 | NO DATA  | 7.11E-10 | NO DATA  | 1.27E-04 |
| NB      | 95  | 8.22E-09 | 4.56E-09 | 2.51E-09 | NO DATA  | 4.42E-09 | NO DATA  | 1.95E-05 |
| MO      | 99  | NO DATA  | 6.03E-06 | 1.15E-06 | NO DATA  | 1.38E-05 | NO DATA  | 1.08E-05 |
| TC      | 99M | 3.32E-10 | 9.26E-10 | 1.20E-08 | NO DATA  | 1.38E-08 | 5.14E-10 | 6.08E-07 |

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**TABLE A-3.2 (cont'd)**  
INGESTION DOSE FACTORS FOR TEENAGERS  
(MREM PER PCI INGESTED)

|    | NUCLIDE | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|----|---------|----------|----------|----------|----------|----------|----------|----------|
| TC | 101     | 3.60E-10 | 5.12E-10 | 5.03E-09 | NO DATA  | 9.26E-09 | 3.12E-10 | 8.75E-17 |
| RU | 103     | 2.55E-07 | NO DATA  | 1.09E-07 | NO DATA  | 8.99E-07 | NO DATA  | 2.13E-05 |
| RU | 105     | 2.18E-08 | NO DATA  | 8.46E-09 | NO DATA  | 2.75E-07 | NO DATA  | 1.76E-05 |
| RU | 106     | 3.92E-06 | NO DATA  | 4.94E-07 | NO DATA  | 7.56E-06 | NO DATA  | 1.88E-04 |
| AG | 110M    | 2.05E-07 | 1.94E-07 | 1.18E-07 | NO DATA  | 3.70E-07 | NO DATA  | 5.45E-05 |
| TE | 125M    | 3.83E-06 | 1.38E-06 | 5.12E-07 | 1.07E-06 | NO DATA  | NO DATA  | 1.13E-05 |
| TE | 127M    | 9.67E-06 | 3.43E-06 | 1.15E-06 | 2.30E-06 | 3.92E-05 | NO DATA  | 2.41E-05 |
| TE | 127     | 1.58E-07 | 5.60E-08 | 3.40E-08 | 1.09E-07 | 6.40E-07 | NO DATA  | 1.22E-05 |
| TE | 129M    | 1.63E-05 | 6.05E-06 | 2.58E-06 | 5.26E-06 | 6.82E-05 | NO DATA  | 6.12E-05 |
| TE | 129     | 4.48E-08 | 1.67E-08 | 1.09E-08 | 3.20E-08 | 1.88E-07 | NO DATA  | 2.45E-07 |
| TE | 131M    | 2.44E-06 | 1.17E-06 | 9.76E-07 | 1.76E-06 | 1.22E-05 | NO DATA  | 9.39E-05 |
| TE | 131     | 2.79E-08 | 1.15E-08 | 8.72E-09 | 2.15E-08 | 1.22E-07 | NO DATA  | 2.29E-09 |
| TE | 132     | 3.49E-06 | 2.21E-06 | 2.08E-06 | 2.33E-06 | 2.12E-05 | NO DATA  | 7.00E-05 |
| I  | 130     | 1.03E-06 | 2.98E-06 | 1.19E-06 | 2.43E-04 | 4.59E-06 | NO DATA  | 2.29E-06 |
| I  | 131     | 5.85E-06 | 8.19E-06 | 4.40E-06 | 2.39E-03 | 1.41E-05 | NO DATA  | 1.62E-06 |
| I  | 132     | 2.79E-07 | 7.30E-07 | 2.62E-07 | 2.46E-05 | 1.15E-06 | NO DATA  | 3.18E-07 |
| I  | 133     | 2.01E-06 | 3.41E-06 | 1.04E-06 | 4.76E-04 | 5.98E-06 | NO DATA  | 2.58E-06 |
| I  | 134     | 1.46E-07 | 3.87E-07 | 1.39E-07 | 6.45E-06 | 6.10E-07 | NO DATA  | 5.10E-09 |
| I  | 135     | 6.10E-07 | 1.57E-06 | 5.82E-07 | 1.01E-04 | 2.48E-06 | NO DATA  | 1.74E-06 |
| CS | 134     | 8.37E-05 | 1.97E-04 | 9.14E-05 | NO DATA  | 6.26E-05 | 2.39E-05 | 2.45E-06 |
| CS | 136     | 8.59E-06 | 3.38E-05 | 2.27E-05 | NO DATA  | 1.84E-05 | 2.90E-06 | 2.72E-06 |
| CS | 137     | 1.12E-04 | 1.49E-04 | 5.19E-05 | NO DATA  | 5.07E-05 | 1.97E-05 | 2.12E-06 |
| CS | 138     | 7.76E-08 | 1.49E-07 | 7.45E-08 | NO DATA  | 1.10E-07 | 1.28E-08 | 6.76E-11 |
| BA | 139     | 1.39E-07 | 9.78E-11 | 4.05E-09 | NO DATA  | 9.22E-11 | 6.74E-11 | 1.24E-06 |
| BA | 140     | 2.84E-05 | 3.48E-08 | 1.83E-06 | NO DATA  | 1.18E-08 | 2.34E-08 | 4.38E-05 |
| BA | 141     | 6.71E-08 | 5.01E-11 | 2.24E-09 | NO DATA  | 4.65E-11 | 3.43E-11 | 1.43E-13 |
| BA | 142     | 2.99E-08 | 2.99E-11 | 1.84E-09 | NO DATA  | 2.53E-11 | 1.99E-11 | 9.18E-20 |
| LA | 140     | 3.48E-09 | 1.71E-09 | 4.55E-10 | NO DATA  | NO DATA  | NO DATA  | 9.82E-05 |
| LA | 142     | 1.79E-10 | 7.95E-11 | 1.98E-11 | NO DATA  | NO DATA  | NO DATA  | 2.42E-06 |
| CE | 141     | 1.33E-08 | 8.88E-09 | 1.02E-09 | NO DATA  | 4.18E-09 | NO DATA  | 2.54E-05 |
| CE | 143     | 2.35E-09 | 1.71E-06 | 1.91E-10 | NO DATA  | 7.67E-10 | NO DATA  | 5.14E-05 |
| CE | 144     | 6.96E-07 | 2.88E-07 | 3.74E-08 | NO DATA  | 1.72E-07 | NO DATA  | 1.75E-04 |
| PR | 143     | 1.31E-08 | 5.23E-09 | 6.52E-10 | NO DATA  | 3.04E-09 | NO DATA  | 4.31E-05 |
| PR | 144     | 4.30E-11 | 1.76E-11 | 2.18E-12 | NO DATA  | 1.01E-11 | NO DATA  | 4.74E-14 |
| ND | 147     | 9.38E-09 | 1.02E-08 | 6.11E-10 | NO DATA  | 5.99E-09 | NO DATA  | 3.68E-05 |
| W  | 187     | 1.46E-07 | 1.19E-07 | 4.17E-08 | NO DATA  | NO DATA  | NO DATA  | 3.22E-05 |

|                 |                                 |                |
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**TABLE A-3.2 (cont'd)**  
INGESTION DOSE FACTORS FOR TEENAGERS  
(MREM PER PCI INGESTED)

| NUCLIDE |       | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-------|----------|----------|----------|----------|----------|----------|----------|
| NP      | 239   | 1.76E-09 | 1.66E-10 | 9.22E-11 | NO DATA  | 5.21E-10 | NO DATA  | 2.67E-05 |
| Sb      | 124** | 3.87E-06 | 7.13E-08 | 1.51E-06 | 8.78E-09 | NO DATA  | 3.38E-06 | 7.80E-05 |
| Sb      | 125** | 2.48E-06 | 2.71E-08 | 5.80E-07 | 2.37E-09 | NO DATA  | 2.18E-06 | 1.93E-05 |
| Sb      | 126** | 1.59E-06 | 3.25E-08 | 5.71E-07 | 8.99E-09 | NO DATA  | 1.14E-06 | 9.41E-05 |
| Co      | 57**  | NO DATA  | 2.38E-07 | 3.99E-07 | NO DATA  | NO DATA  | NO DATA  | 4.44E-06 |

**\*\*Taken from Regulatory Guide 1.109 (Rev. 0)**

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**TABLE A.3-3**  
INGESTION DOSE FACTORS FOR CHILD  
(MREM PER PCI INGESTED)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | NO DATA  | 2.03E-07 | 2.03E-07 | 2.03E-07 | 2.03E-07 | 2.03E-07 | 2.03E-07 |
| C       | 14  | 1.21E-05 | 2.42E-06 | 2.42E-06 | 2.42E-06 | 2.42E-06 | 2.42E-06 | 2.42E-06 |
| NA      | 24  | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 | 5.80E-06 |
| P       | 32  | 8.25E-04 | 3.86E-05 | 3.18E-05 | NO DATA  | NO DATA  | NO DATA  | 2.28E-05 |
| CR      | 51  | NO DATA  | NO DATA  | 8.90E-09 | 4.94E-09 | 1.35E-09 | 9.02E-09 | 4.72E-07 |
| MN      | 54  | NO DATA  | 1.07E-05 | 2.85E-06 | NO DATA  | 3.00E-06 | NO DATA  | 8.98E-06 |
| MN      | 56  | NO DATA  | 3.34E-07 | 7.54E-08 | NO DATA  | 4.04E-07 | NO DATA  | 4.84E-05 |
| FE      | 55  | 1.15E-05 | 6.10E-06 | 1.89E-06 | NO DATA  | NO DATA  | 3.45E-06 | 1.13E-06 |
| FE      | 59  | 1.65E-05 | 2.67E-05 | 1.33E-05 | NO DATA  | NO DATA  | 7.74E-06 | 2.78E-05 |
| CO      | 58  | NO DATA  | 1.80E-06 | 5.51E-06 | NO DATA  | NO DATA  | NO DATA  | 1.05E-05 |
| CO      | 60  | NO DATA  | 5.29E-06 | 1.56E-05 | NO DATA  | NO DATA  | NO DATA  | 2.93E-05 |
| NI      | 63  | 5.38E-04 | 2.88E-05 | 1.83E-05 | NO DATA  | NO DATA  | NO DATA  | 1.94E-06 |
| NI      | 65  | 2.22E-06 | 2.09E-07 | 1.22E-07 | NO DATA  | NO DATA  | NO DATA  | 2.56E-05 |
| CU      | 64  | NO DATA  | 2.45E-07 | 1.48E-07 | NO DATA  | 5.92E-07 | NO DATA  | 1.15E-05 |
| ZN      | 65  | 1.37E-05 | 3.65E-05 | 2.27E-05 | NO DATA  | 2.30E-05 | NO DATA  | 6.41E-06 |
| ZN      | 69  | 4.38E-08 | 6.33E-08 | 5.85E-09 | NO DATA  | 3.84E-08 | NO DATA  | 3.99E-06 |
| BR      | 83  | NO DATA  | NO DATA  | 1.71E-07 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| BR      | 84  | NO DATA  | NO DATA  | 1.98E-07 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| BR      | 85  | NO DATA  | NO DATA  | 9.12E-09 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| RB      | 86  | NO DATA  | 6.70E-05 | 4.12E-05 | NO DATA  | NO DATA  | NO DATA  | 4.31E-06 |
| RB      | 88  | NO DATA  | 1.90E-07 | 1.32E-07 | NO DATA  | NO DATA  | NO DATA  | 9.32E-09 |
| RB      | 89  | NO DATA  | 1.17E-07 | 1.04E-07 | NO DATA  | NO DATA  | NO DATA  | 1.02E-09 |
| SR      | 89  | 1.32E-03 | NO DATA  | 3.77E-05 | NO DATA  | NO DATA  | NO DATA  | 5.11E-05 |
| SR      | 90  | 1.70E-02 | NO DATA  | 4.31E-03 | NO DATA  | NO DATA  | NO DATA  | 2.29E-04 |
| SR      | 91  | 2.40E-05 | NO DATA  | 9.06E-07 | NO DATA  | NO DATA  | NO DATA  | 5.30E-05 |
| SR      | 92  | 9.03E-06 | NO DATA  | 3.62E-07 | NO DATA  | NO DATA  | NO DATA  | 1.71E-04 |
| Y       | 90  | 4.11E-08 | NO DATA  | 1.10E-09 | NO DATA  | NO DATA  | NO DATA  | 1.17E-04 |
| Y       | 91M | 3.82E-10 | NO DATA  | 1.39E-11 | NO DATA  | NO DATA  | NO DATA  | 7.48E-07 |
| Y       | 91  | 6.02E-07 | NO DATA  | 1.61E-08 | NO DATA  | NO DATA  | NO DATA  | 8.02E-05 |
| Y       | 92  | 3.60E-09 | NO DATA  | 1.03E-10 | NO DATA  | NO DATA  | NO DATA  | 1.04E-04 |
| Y       | 93  | 1.14E-08 | NO DATA  | 3.13E-10 | NO DATA  | NO DATA  | NO DATA  | 1.70E-04 |
| ZR      | 95  | 1.16E-07 | 2.55E-08 | 2.27E-08 | NO DATA  | 3.65E-08 | NO DATA  | 2.66E-05 |
| ZR      | 97  | 6.99E-09 | 1.01E-09 | 5.96E-10 | NO DATA  | 1.45E-09 | NO DATA  | 1.53E-04 |
| NB      | 95  | 2.25E-08 | 8.76E-09 | 6.26E-09 | NO DATA  | 8.23E-09 | NO DATA  | 1.62E-05 |
| MO      | 99  | NO DATA  | 1.33E-05 | 3.29E-06 | NO DATA  | 2.84E-05 | NO DATA  | 1.10E-05 |
| TC      | 99M | 9.23E-10 | 1.81E-09 | 3.00E-08 | NO DATA  | 2.63E-08 | 9.19E-10 | 1.03E-06 |

\*Taken from Regulatory Guide 1.109 (Rev. 1)

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**TABLE A.3-3 (cont'd)**  
INGESTION DOSE FACTORS FOR CHILD  
(MREM PER PCI INGESTED)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-ILLI  |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 1.07E-09 | 1.12E-09 | 1.42E-08 | NO DATA  | 1.91E-08 | 5.92E-10 | 3.56E-09 |
| RU      | 103  | 7.31E-07 | NO DATA  | 2.81E-07 | NO DATA  | 1.84E-06 | NO DATA  | 1.89E-05 |
| RU      | 105  | 6.45E-08 | NO DATA  | 2.34E-08 | NO DATA  | 5.67E-07 | NO DATA  | 4.21E-05 |
| RU      | 106  | 1.17E-05 | NO DATA  | 1.46E-06 | NO DATA  | 1.58E-05 | NO DATA  | 1.82E-04 |
| AG      | 110M | 5.39E-07 | 3.64E-07 | 2.91E-07 | NO DATA  | 6.78E-07 | NO DATA  | 4.33E-05 |
| TE      | 125M | 1.14E-05 | 3.09E-06 | 1.52E-06 | 3.20E-06 | NO DATA  | NO DATA  | 1.10E-05 |
| TE      | 127M | 2.89E-05 | 7.78E-06 | 3.43E-06 | 6.91E-06 | 8.24E-05 | NO DATA  | 2.34E-05 |
| TE      | 127  | 4.71E-07 | 1.27E-07 | 1.01E-07 | 3.26E-07 | 1.34E-06 | NO DATA  | 1.84E-05 |
| TE      | 129M | 4.87E-05 | 1.36E-05 | 7.56E-06 | 1.57E-05 | 1.43E-04 | NO DATA  | 5.94E-05 |
| TE      | 129  | 1.34E-07 | 3.74E-08 | 3.18E-08 | 9.56E-08 | 3.92E-07 | NO DATA  | 8.34E-06 |
| TE      | 131M | 7.20E-06 | 2.49E-06 | 2.65E-06 | 5.12E-06 | 2.41E-05 | NO DATA  | 1.01E-04 |
| TE      | 131  | 8.30E-08 | 2.53E-08 | 2.47E-08 | 6.35E-08 | 2.51E-07 | NO DATA  | 4.36E-07 |
| TE      | 132  | 1.01E-05 | 4.47E-06 | 5.40E-06 | 6.51E-06 | 4.15E-05 | NO DATA  | 4.50E-05 |
| I       | 130  | 2.92E-06 | 5.90E-06 | 3.04E-06 | 6.50E-04 | 8.82E-06 | NO DATA  | 2.76E-06 |
| I       | 131  | 1.72E-05 | 1.73E-05 | 9.83E-06 | 5.72E-03 | 2.84E-05 | NO DATA  | 1.54E-06 |
| I       | 132  | 8.00E-07 | 1.47E-06 | 6.76E-07 | 6.82E-05 | 2.25E-06 | NO DATA  | 1.73E-06 |
| I       | 133  | 5.92E-06 | 7.32E-06 | 2.77E-06 | 1.36E-03 | 1.22E-05 | NO DATA  | 2.95E-06 |
| I       | 134  | 4.19E-07 | 7.78E-07 | 3.58E-07 | 1.79E-05 | 1.19E-06 | NO DATA  | 5.16E-07 |
| I       | 135  | 1.75E-06 | 3.15E-06 | 1.49E-06 | 2.79E-04 | 4.83E-06 | NO DATA  | 2.40E-06 |
| CS      | 134  | 2.34E-04 | 3.84E-04 | 8.10E-05 | NO DATA  | 1.19E-04 | 4.27E-05 | 2.07E-06 |
| CS      | 136  | 2.35E-05 | 6.46E-05 | 4.18E-05 | NO DATA  | 3.44E-05 | 5.13E-06 | 2.27E-06 |
| CS      | 137  | 3.27E-04 | 3.13E-04 | 4.62E-05 | NO DATA  | 1.02E-04 | 3.67E-05 | 1.96E-06 |
| CS      | 138  | 2.28E-07 | 3.17E-07 | 2.01E-07 | NO DATA  | 2.23E-07 | 2.40E-08 | 1.46E-07 |
| BA      | 139  | 4.14E-07 | 2.21E-10 | 1.20E-08 | NO DATA  | 1.93E-10 | 1.30E-10 | 2.39E-05 |
| BA      | 140  | 8.31E-05 | 7.28E-08 | 4.85E-06 | NO DATA  | 2.37E-08 | 4.34E-08 | 4.21E-05 |
| BA      | 141  | 2.00E-07 | 1.12E-10 | 6.51E-09 | NO DATA  | 9.69E-11 | 6.58E-10 | 1.14E-07 |
| BA      | 142  | 8.74E-08 | 6.29E-11 | 4.88E-09 | NO DATA  | 5.09E-11 | 3.70E-11 | 1.14E-09 |
| LA      | 140  | 1.01E-08 | 3.53E-09 | 1.19E-09 | NO DATA  | NO DATA  | NO DATA  | 9.84E-05 |
| LA      | 142  | 5.24E-10 | 1.67E-10 | 5.23E-11 | NO DATA  | NO DATA  | NO DATA  | 3.31E-05 |
| CE      | 141  | 3.97E-08 | 1.98E-08 | 2.94E-09 | NO DATA  | 8.68E-09 | NO DATA  | 2.47E-05 |
| CE      | 143  | 6.99E-09 | 3.79E-06 | 5.49E-10 | NO DATA  | 1.59E-09 | NO DATA  | 5.55E-05 |
| CE      | 144  | 2.08E-06 | 6.52E-07 | 1.11E-07 | NO DATA  | 3.61E-07 | NO DATA  | 1.70E-04 |
| PR      | 143  | 3.93E-08 | 1.18E-08 | 1.95E-09 | NO DATA  | 6.39E-09 | NO DATA  | 4.24E-05 |
| PR      | 144  | 1.29E-10 | 3.99E-11 | 6.49E-12 | NO DATA  | 2.11E-11 | NO DATA  | 8.59E-08 |
| ND      | 147  | 2.79E-08 | 2.26E-08 | 1.75E-09 | NO DATA  | 1.24E-08 | NO DATA  | 3.58E-05 |
| W       | 187  | 4.29E-07 | 2.54E-07 | 1.14E-07 | NO DATA  | NO DATA  | NO DATA  | 3.57E-05 |

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**TABLE A.3-3 (cont'd)**  
INGESTION DOSE FACTORS FOR CHILD  
(MREM PER PCI INGESTED)

| NUCLIDE |       | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-------|----------|----------|----------|----------|----------|----------|----------|
| NP      | 239   | 5.25E-09 | 3.77E-10 | 2.65E-10 | NO DATA  | 1.09E-09 | NO DATA  | 2.79E-05 |
| Sb      | 124** | 1.11E-05 | 1.44E-07 | 3.89E-06 | 2.45E-08 | NO DATA  | 6.16E-06 | 6.94E-05 |
| Sb      | 125** | 7.16E-06 | 5.52E-08 | 1.50E-06 | 6.63E-09 | NO DATA  | 3.99E-06 | 1.71E-05 |
| Sb      | 126** | 4.40E-06 | 6.73E-08 | 1.58E-06 | 2.58E-08 | NO DATA  | 2.10E-06 | 8.87E-05 |
| Co      | 57**  | NO DATA  | 4.93E-07 | 9.98E-07 | NO DATA  | NO DATA  | NO DATA  | 4.04E-06 |

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**TABLE A.3-4\***  
INGESTION DOSE FACTORS FOR INFANT  
(MREM PER PCI INGESTED)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | NO DATA  | 3.08E-07 | 3.08E-07 | 3.08E-07 | 3.08E-07 | 3.08E-07 | 3.08E-07 |
| C       | 14  | 2.37E-05 | 5.06E-06 | 5.06E-06 | 5.06E-06 | 5.06E-06 | 5.06E-06 | 5.06E-06 |
| NA      | 24  | 1.01E-05 | 1.01E-05 | 1.01E-05 | 1.01E-05 | 1.01E-05 | 1.01E-05 | 1.01E-05 |
| P       | 32  | 1.70E-03 | 1.00E-04 | 6.59E-05 | NO DATA  | NO DATA  | NO DATA  | 2.30E-05 |
| CR      | 51  | NO DATA  | NO DATA  | 1.41E-08 | 9.20E-09 | 2.01E-09 | 1.79E-08 | 4.11E-07 |
| MN      | 54  | NO DATA  | 1.99E-05 | 4.51E-06 | NO DATA  | 4.41E-06 | NO DATA  | 7.31E-06 |
| MN      | 56  | NO DATA  | 8.18E-07 | 1.41E-07 | NO DATA  | 7.03E-07 | NO DATA  | 7.43E-05 |
| FE      | 55  | 1.39E-05 | 8.98E-06 | 2.40E-06 | NO DATA  | NO DATA  | 4.39E-06 | 1.14E-06 |
| FE      | 59  | 3.08E-05 | 5.38E-05 | 2.12E-05 | NO DATA  | NO DATA  | 1.59E-05 | 2.57E-05 |
| CO      | 58  | NO DATA  | 3.60E-06 | 8.98E-06 | NO DATA  | NO DATA  | NO DATA  | 8.97E-06 |
| CO      | 60  | NO DATA  | 1.08E-05 | 2.55E-05 | NO DATA  | NO DATA  | NO DATA  | 2.57E-05 |
| NI      | 63  | 6.34E-04 | 3.92E-05 | 2.20E-05 | NO DATA  | NO DATA  | NO DATA  | 1.95E-06 |
| NI      | 65  | 4.70E-06 | 5.32E-07 | 2.42E-07 | NO DATA  | NO DATA  | NO DATA  | 4.05E-05 |
| CU      | 64  | NO DATA  | 6.09E-07 | 2.82E-07 | NO DATA  | 1.03E-06 | NO DATA  | 1.25E-05 |
| ZN      | 65  | 1.84E-05 | 6.31E-05 | 2.91E-05 | NO DATA  | 3.06E-05 | NO DATA  | 5.33E-05 |
| ZN      | 69  | 9.33E-08 | 1.68E-07 | 1.25E-08 | NO DATA  | 6.98E-08 | NO DATA  | 1.37E-05 |
| BR      | 83  | NO DATA  | NO DATA  | 3.63E-07 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| BR      | 84  | NO DATA  | NO DATA  | 3.82E-07 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| BR      | 85  | NO DATA  | NO DATA  | 1.94E-08 | NO DATA  | NO DATA  | NO DATA  | LT E-24  |
| RB      | 86  | NO DATA  | 1.70E-04 | 8.40E-05 | NO DATA  | NO DATA  | NO DATA  | 4.35E-06 |
| RB      | 88  | NO DATA  | 4.98E-07 | 2.73E-07 | NO DATA  | NO DATA  | NO DATA  | 4.85E-07 |
| RB      | 89  | NO DATA  | 2.86E-07 | 1.97E-07 | NO DATA  | NO DATA  | NO DATA  | 9.74E-08 |
| SR      | 89  | 2.51E-03 | NO DATA  | 7.20E-05 | NO DATA  | NO DATA  | NO DATA  | 5.16E-05 |
| SR      | 90  | 1.85E-02 | NO DATA  | 4.71E-03 | NO DATA  | NO DATA  | NO DATA  | 2.31E-04 |
| SR      | 91  | 5.00E-05 | NO DATA  | 1.81E-06 | NO DATA  | NO DATA  | NO DATA  | 5.92E-05 |
| SR      | 92  | 1.92E-05 | NO DATA  | 7.13E-07 | NO DATA  | NO DATA  | NO DATA  | 2.07E-04 |
| Y       | 90  | 8.69E-08 | NO DATA  | 2.33E-09 | NO DATA  | NO DATA  | NO DATA  | 1.20E-04 |
| Y       | 91M | 8.10E-10 | NO DATA  | 2.76E-11 | NO DATA  | NO DATA  | NO DATA  | 2.70E-06 |
| Y       | 91  | 1.13E-06 | NO DATA  | 3.01E-08 | NO DATA  | NO DATA  | NO DATA  | 8.10E-05 |
| Y       | 92  | 7.65E-09 | NO DATA  | 2.15E-10 | NO DATA  | NO DATA  | NO DATA  | 1.46E-04 |
| Y       | 93  | 2.43E-08 | NO DATA  | 6.62E-10 | NO DATA  | NO DATA  | NO DATA  | 1.92E-04 |
| ZR      | 95  | 2.06E-07 | 5.02E-08 | 3.56E-08 | NO DATA  | 5.41E-08 | NO DATA  | 2.50E-05 |
| ZR      | 97  | 1.48E-08 | 2.54E-09 | 1.16E-09 | NO DATA  | 2.56E-09 | NO DATA  | 1.62E-04 |
| NB      | 95  | 4.20E-08 | 1.73E-08 | 1.00E-08 | NO DATA  | 1.24E-08 | NO DATA  | 1.46E-05 |
| MO      | 99  | NO DATA  | 3.40E-05 | 6.63E-06 | NO DATA  | 5.08E-05 | NO DATA  | 1.12E-05 |
| TC      | 99M | 1.92E-09 | 3.96E-09 | 5.10E-08 | NO DATA  | 4.26E-08 | 2.07E-09 | 1.15E-06 |

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**TABLE A.3-4\* (cont'd)**  
INGESTION DOSE FACTORS FOR INFANT  
(MREM PER PCI INGESTED)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 2.27E-09 | 2.86E-09 | 2.83E-08 | NO DATA  | 3.40E-08 | 1.56E-09 | 4.86E-07 |
| RU      | 103  | 1.48E-06 | NO DATA  | 4.95E-07 | NO DATA  | 3.08E-06 | NO DATA  | 1.80E-05 |
| RU      | 105  | 1.36E-07 | NO DATA  | 4.58E-08 | NO DATA  | 1.00E-06 | NO DATA  | 5.41E-05 |
| RU      | 106  | 2.41E-05 | NO DATA  | 3.01E-06 | NO DATA  | 2.85E-05 | NO DATA  | 1.83E-04 |
| AG      | 110M | 9.96E-07 | 7.27E-07 | 4.81E-07 | NO DATA  | 1.04E-06 | NO DATA  | 3.77E-05 |
| TE      | 125M | 2.33E-05 | 7.79E-06 | 3.15E-06 | 7.84E-06 | NO DATA  | NO DATA  | 1.11E-05 |
| TE      | 127M | 5.85E-05 | 1.94E-05 | 7.08E-06 | 1.69E-05 | 1.44E-04 | NO DATA  | 2.36E-05 |
| TE      | 127  | 1.00E-06 | 3.35E-07 | 2.15E-07 | 8.14E-07 | 2.44E-06 | NO DATA  | 2.10E-05 |
| TE      | 129M | 1.00E-04 | 3.43E-05 | 1.54E-05 | 3.84E-05 | 2.50E-04 | NO DATA  | 5.97E-05 |
| TE      | 129  | 2.84E-07 | 9.79E-08 | 6.63E-08 | 2.38E-07 | 7.07E-07 | NO DATA  | 2.27E-05 |
| TE      | 131M | 1.52E-05 | 6.12E-06 | 5.05E-06 | 1.24E-05 | 4.21E-05 | NO DATA  | 1.03E-04 |
| TE      | 131  | 1.76E-07 | 6.50E-08 | 4.94E-08 | 1.57E-07 | 4.50E-07 | NO DATA  | 7.11E-06 |
| TE      | 132  | 2.08E-05 | 1.03E-05 | 9.61E-06 | 1.52E-05 | 6.44E-05 | NO DATA  | 3.81E-05 |
| I       | 130  | 6.00E-06 | 1.32E-05 | 5.30E-06 | 1.48E-03 | 1.45E-05 | NO DATA  | 2.83E-06 |
| I       | 131  | 3.59E-05 | 4.23E-05 | 1.86E-05 | 1.39E-02 | 4.94E-05 | NO DATA  | 1.51E-06 |
| I       | 132  | 1.66E-06 | 3.37E-06 | 1.20E-06 | 1.58E-04 | 3.76E-06 | NO DATA  | 2.73E-06 |
| I       | 133  | 1.25E-05 | 1.82E-05 | 5.33E-06 | 3.31E-03 | 2.14E-05 | NO DATA  | 3.08E-06 |
| I       | 134  | 8.69E-07 | 1.78E-06 | 6.33E-07 | 4.15E-05 | 1.99E-06 | NO DATA  | 1.84E-06 |
| I       | 135  | 3.64E-06 | 7.24E-06 | 2.64E-06 | 6.49E-04 | 8.07E-06 | NO DATA  | 2.62E-06 |
| CS      | 134  | 3.77E-04 | 7.03E-04 | 7.10E-05 | NO DATA  | 1.81E-04 | 7.42E-05 | 1.91E-06 |
| CS      | 136  | 4.59E-05 | 1.35E-04 | 5.04E-05 | NO DATA  | 5.38E-05 | 1.10E-05 | 2.05E-06 |
| CS      | 137  | 5.22E-04 | 6.11E-04 | 4.33E-05 | NO DATA  | 1.64E-04 | 6.64E-05 | 1.91E-06 |
| CS      | 138  | 4.81E-07 | 7.82E-07 | 3.79E-07 | NO DATA  | 3.90E-07 | 6.09E-08 | 1.25E-06 |
| BA      | 139  | 8.81E-07 | 5.84E-10 | 2.55E-08 | NO DATA  | 3.51E-10 | 3.54E-10 | 5.58E-05 |
| BA      | 140  | 1.71E-04 | 1.71E-07 | 8.81E-06 | NO DATA  | 4.06E-08 | 1.05E-07 | 4.20E-05 |
| BA      | 141  | 4.25E-07 | 2.91E-10 | 1.34E-08 | NO DATA  | 1.75E-10 | 1.77E-10 | 5.19E-06 |
| BA      | 142  | 1.84E-07 | 1.53E-10 | 9.06E-09 | NO DATA  | 8.81E-11 | 9.26E-11 | 7.59E-07 |
| LA      | 140  | 2.11E-08 | 8.32E-09 | 2.14E-09 | NO DATA  | NO DATA  | NO DATA  | 9.77E-05 |
| LA      | 142  | 1.10E-09 | 4.04E-10 | 9.67E-11 | NO DATA  | NO DATA  | NO DATA  | 6.86E-05 |
| CE      | 141  | 7.87E-08 | 4.80E-08 | 5.65E-09 | NO DATA  | 1.48E-08 | NO DATA  | 2.48E-05 |
| CE      | 143  | 1.48E-08 | 9.82E-06 | 1.12E-09 | NO DATA  | 2.86E-09 | NO DATA  | 5.73E-05 |
| CE      | 144  | 2.98E-06 | 1.22E-06 | 1.67E-07 | NO DATA  | 4.93E-07 | NO DATA  | 1.71E-04 |
| PR      | 143  | 8.13E-08 | 3.04E-08 | 4.03E-09 | NO DATA  | 1.13E-08 | NO DATA  | 4.29E-05 |
| PR      | 144  | 2.74E-10 | 1.06E-10 | 1.38E-11 | NO DATA  | 3.84E-11 | NO DATA  | 4.93E-06 |
| ND      | 147  | 5.53E-08 | 5.68E-08 | 3.48E-09 | NO DATA  | 2.19E-08 | NO DATA  | 3.60E-05 |
| W       | 187  | 9.03E-07 | 6.28E-07 | 2.17E-07 | NO DATA  | NO DATA  | NO DATA  | 3.69E-05 |

|                 |                                 |                 |
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**TABLE A.3-4\* (cont'd)**  
INGESTION DOSE FACTORS FOR INFANT  
(MREM PER PCI INGESTED)

| NUCLIDE |       | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-------|----------|----------|----------|----------|----------|----------|----------|
| NP      | 239   | 1.11E-08 | 9.93E-10 | 5.61E-10 | NO DATA  | 1.98E-09 | NO DATA  | 2.87E-05 |
| Sb      | 124** | 2.14E-05 | 3.15E-07 | 6.63E-06 | 5.68E-08 | NO DATA  | 1.34E-05 | 6.60E-05 |
| Sb      | 125** | 1.23E-05 | 1.19E-07 | 2.53E-06 | 1.54E-08 | NO DATA  | 7.72E-06 | 1.64E-05 |
| Sb      | 126** | 8.06E-06 | 1.58E-07 | 2.91E-06 | 6.19E-08 | NO DATA  | 5.07E-06 | 8.35E-06 |
| Co      | 57**  | NO DATA  | 1.15E-06 | 1.87E-06 | NO DATA  | NO DATA  | NO DATA  | 3.92E-06 |

**\*\*Taken from Regulatory Guide 1.109 (Rev. 0)**

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**TABLE A.3-5\***

## STABLE ELEMENT TRANSFER DATA

| <u>Element</u> | <u>B<sub>iv</sub></u><br><u>Veg/soil</u> | <u>F<sub>m</sub> (Cow)</u><br><u>Milk (d/l)</u> | <u>F<sub>f</sub></u><br><u>Meat (d/kg)</u> |
|----------------|------------------------------------------|-------------------------------------------------|--------------------------------------------|
| H              | 4.8E 00                                  | 1.0E-02 +                                       | 1.20E-02                                   |
| C              | 5.5E 00                                  | 1.2E-02 +                                       | 3.1E-02                                    |
| Na             | 5.2E-02                                  | 4.0E-02                                         | 3.0E-02                                    |
| P              | 1.1E 00                                  | 2.5E-02                                         | 4.6E-02                                    |
| Cr             | 2.5E-04                                  | 2.2E-03                                         | 2.4E-03                                    |
| Mn             | 2.9E-02                                  | 2.5E-04                                         | 8.0E-04                                    |
| Fe             | 6.6E-04                                  | 1.2E-03 +                                       | 4.0E-02                                    |
| Co             | 9.4E-03                                  | 1.0E-03                                         | 1.3E-02                                    |
| Ni             | 1.9E-02                                  | 6.7E-03                                         | 5.3E-02                                    |
| Cu             | 1.2E-01                                  | 1.4E-02 +                                       | 8.0E-03                                    |
| Zn             | 4.0E-01                                  | 3.9E-02                                         | 3.0E-02                                    |
| Rb             | 1.3E-01                                  | 3.0E-02                                         | 3.1E-02                                    |
| Sr             | 1.7E-02                                  | 8.0E-04 +                                       | 6.0E-04                                    |
| Y              | 2.6E-03                                  | 1.0E-05                                         | 4.6E-03                                    |
| Zr             | 1.7E-04                                  | 5.0E-06                                         | 3.4E-02                                    |
| Nb             | 9.4E-03                                  | 2.5E-03                                         | 2.8E-01                                    |
| Mo             | 1.2E-01                                  | 7.5E-03                                         | 8.0E-03                                    |
| Tc             | 2.5E-01                                  | 2.5E-02                                         | 4.0E-01                                    |
| Ru             | 5.0E-02                                  | 1.0E-06                                         | 4.0E-01                                    |
| Rh             | 1.3E 01                                  | 1.0E-02                                         | 1.5E-03                                    |
| Ag             | 1.5E-01                                  | 5.0E-02                                         | 1.7E-02                                    |
| Te             | 1.3E 00                                  | 1.0E-03                                         | 7.7E-02                                    |
| I              | 2.0E-02                                  | 6.0E-03 +                                       | 2.9E-03                                    |
| Cs             | 1.0E-02                                  | 1.2E-02 +                                       | 4.0E-03                                    |
| Ba             | 5.0E-03                                  | 4.0E-04                                         | 3.2E-03                                    |
| La             | 2.5E-03                                  | 5.0E-06                                         | 2.0E-04                                    |
| Ce             | 2.5E-03                                  | 1.0E-04                                         | 1.2E-03                                    |
| Pr             | 2.5E-03                                  | 5.0E-06                                         | 4.7E-03                                    |
| Nd             | 2.4E-03                                  | 5.0E-06                                         | 3.3E-03                                    |
| W              | 1.8E-02                                  | 5.0E-04                                         | 1.3E-03                                    |
| Np             | 2.5E-03                                  | 5.0E-06                                         | 2.0E-04                                    |

+ F<sub>m</sub> (Goat) values for milk (d/l)

| <u>Element</u> | <u>Milk (d/l)</u> |
|----------------|-------------------|
| H              | 1.7E-01           |
| C              | 1.0E-01           |
| P              | 2.5E-01           |
| Fe             | 1.3E-04           |
| Cu             | 1.3E-02           |
| Sr             | 1.4E-02           |
| I              | 6.0E-02           |
| Cs             | 3.0E-01           |

\*Taken from Regulatory Guide 1.109 (Rev. 1)

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**TABLE A.4-1**  
SITE RELATED DOSE COMMITMENT FACTOR AIT  
MREM/HR PER  $\mu$ CI/ML  
ADULT

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 8.96E 00 | 8.96E 00 | 8.96E 00 | 8.96E 00 | 8.96E 00 | 8.96E 00 |
| C       | 14  | 3.15E 04 | 6.30E 03 | 6.30E 03 | 6.30E 03 | 6.30E 03 | 6.30E 03 | 6.30E 03 |
| NA      | 24  | 5.48E 02 | 5.48E 02 | 5.48E 02 | 5.48E 02 | 5.48E 02 | 5.48E 02 | 5.48E 02 |
| P       | 32  | 4.62E 07 | 2.87E 06 | 1.79E 06 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.20E 06 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 1.49E 00 | 8.94E-01 | 3.29E-01 | 1.98E 00 | 3.76E 02 |
| MN      | 54  | 0.00E-01 | 4.76E 03 | 9.08E 02 | 0.00E-01 | 1.42E 03 | 0.00E-01 | 1.46E 04 |
| MN      | 56  | 0.00E-01 | 1.20E 02 | 2.12E 01 | 0.00E-01 | 1.52E 02 | 0.00E-01 | 3.82E 03 |
| FE      | 55  | 8.87E 02 | 6.13E 02 | 1.43E 02 | 0.00E-01 | 0.00E-01 | 3.42E 02 | 3.52E 02 |
| FE      | 59  | 1.40E 03 | 3.29E 03 | 1.26E 03 | 0.00E-01 | 0.00E-01 | 9.19E 02 | 1.10E 04 |
| CO      | 58  | 0.00E-01 | 1.51E 02 | 3.39E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.06E 03 |
| CO      | 60  | 0.00E-01 | 4.34E 02 | 9.58E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.16E 03 |
| NI      | 63  | 4.19E 04 | 2.94E 03 | 1.41E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.07E 02 |
| NI      | 65  | 1.70E 02 | 2.21E 01 | 1.01E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.61E 02 |
| CU      | 64  | 0.00E-01 | 1.69E 01 | 7.93E 00 | 0.00E-01 | 4.26E-01 | 0.00E-01 | 1.44E 03 |
| ZN      | 65  | 2.36E 04 | 7.50E 04 | 3.39E 04 | 0.00E-01 | 5.02E 04 | 0.00E-01 | 4.73E 04 |
| ZN      | 69  | 5.02E 01 | 9.60E 01 | 6.67E 00 | 0.00E-01 | 6.24E-01 | 0.00E-01 | 1.44E 01 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 4.38E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.30E 01 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 5.67E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.45E-04 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 2.33E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.09E-15 |
| RB      | 86  | 0.00E-01 | 1.03E 05 | 4.79E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.03E 04 |
| RB      | 88  | 0.00E-01 | 2.95E 02 | 1.56E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.07E-09 |
| RB      | 89  | 0.00E-01 | 1.95E 02 | 1.37E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.13E-11 |
| SR      | 89  | 4.78E 04 | 0.00E-01 | 1.37E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.66E 03 |
| SR      | 90  | 1.18E 06 | 0.00E-01 | 2.88E 05 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.40E 04 |
| SR      | 91  | 8.79E 02 | 0.00E-01 | 3.55E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.19E 03 |
| SR      | 92  | 3.33E 02 | 0.00E-01 | 1.44E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.60E 03 |
| Y       | 90  | 1.38E 00 | 0.00E-01 | 3.69E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.46E 04 |
| Y       | 91M | 1.30E-02 | 0.00E-01 | 5.04E-04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.82E-02 |
| Y       | 91  | 2.02E 01 | 0.00E-01 | 5.39E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.11E 04 |
| Y       | 92  | 1.21E-01 | 0.00E-01 | 3.53E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.12E 03 |
| Y       | 93  | 3.83E-01 | 0.00E-01 | 1.06E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.22E 04 |
| ZR      | 95  | 2.77E 00 | 8.88E-01 | 6.01E-01 | 0.00E-01 | 1.39E 00 | 0.00E-01 | 2.82E 03 |
| ZR      | 97  | 1.53E-01 | 3.09E-02 | 1.41E-02 | 0.00E-01 | 4.67E-02 | 0.00E-01 | 9.57E 03 |
| NB      | 95  | 4.47E 02 | 2.49E 02 | 1.34E 02 | 0.00E-01 | 2.46E 02 | 0.00E-01 | 1.51E 06 |
| MO      | 99  | 0.00E-01 | 4.62E 02 | 8.79E 01 | 0.00E-01 | 1.05E 03 | 0.00E-01 | 1.07E 03 |
| TC      | 99M | 2.94E-02 | 8.32E-02 | 1.06E 00 | 0.00E-01 | 1.26E 00 | 4.07E-02 | 4.92E 01 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.4-1 (cont'd)**  
SITE RELATED DOSE COMMITMENT FACTOR AIT  
MREM/HR PER  $\mu$ CI/ML  
ADULT

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 3.03E-02 | 4.36E-02 | 4.28E-01 | 0.00E-01 | 7.85E-01 | 2.23E-02 | 1.31E-13 |
| RU      | 103  | 1.98E 01 | 0.00E-01 | 8.54E 00 | 0.00E-01 | 7.57E 01 | 0.00E-01 | 2.31E 03 |
| RU      | 105  | 1.65E 00 | 0.00E-01 | 6.52E-01 | 0.00E-01 | 2.13E 01 | 0.00E-01 | 1.01E 03 |
| RU      | 106  | 2.95E 02 | 0.00E-01 | 3.73E 01 | 0.00E-01 | 5.69E 02 | 0.00E-01 | 1.91E 04 |
| AG      | 110M | 1.42E 01 | 1.31E 01 | 7.80E 00 | 0.00E-01 | 2.58E 01 | 0.00E-01 | 5.36E 03 |
| TE      | 125M | 2.79E 03 | 1.01E 03 | 3.74E 02 | 8.39E 02 | 1.13E 04 | 0.00E-01 | 1.11E 04 |
| TE      | 127M | 7.05E 03 | 2.52E 03 | 8.59E 02 | 1.80E 03 | 2.86E 04 | 0.00E-01 | 2.36E 04 |
| TE      | 127  | 1.14E 02 | 4.11E 01 | 2.48E 01 | 8.48E 01 | 4.66E 02 | 0.00E-01 | 9.03E 03 |
| TE      | 129M | 1.20E 04 | 4.47E 03 | 1.89E 03 | 4.11E 03 | 5.00E 04 | 0.00E-01 | 6.03E 04 |
| TE      | 129  | 3.27E 01 | 1.23E 01 | 7.96E 00 | 2.51E 01 | 1.37E 02 | 0.00E-01 | 2.47E 01 |
| TE      | 131M | 1.80E 03 | 8.81E 02 | 7.34E 02 | 1.39E 03 | 8.92E 03 | 0.00E-01 | 8.74E 04 |
| TE      | 131  | 2.05E 01 | 8.57E 00 | 6.47E 00 | 1.69E 01 | 8.98E 01 | 0.00E-01 | 2.90E 00 |
| TE      | 132  | 2.62E 03 | 1.70E 03 | 1.59E 03 | 1.87E 03 | 1.63E 04 | 0.00E-01 | 8.02E 04 |
| I       | 130  | 9.01E 01 | 2.66E 02 | 1.05E 02 | 2.25E 04 | 4.15E 02 | 0.00E-01 | 2.29E 02 |
| I       | 131  | 4.96E 02 | 7.09E 02 | 4.06E 02 | 2.32E 05 | 1.22E 03 | 0.00E-01 | 1.87E 02 |
| I       | 132  | 2.42E 01 | 6.47E 01 | 2.26E 01 | 2.26E 03 | 1.03E 02 | 0.00E-01 | 1.22E 01 |
| I       | 133  | 1.69E 02 | 2.94E 02 | 8.97E 01 | 4.32E 04 | 5.13E 02 | 0.00E-01 | 2.64E 02 |
| I       | 134  | 1.26E 01 | 3.43E 01 | 1.23E 01 | 5.94E 02 | 5.46E 01 | 0.00E-01 | 2.99E-02 |
| I       | 135  | 5.28E 01 | 1.38E 02 | 5.10E 01 | 9.11E 03 | 2.22E 02 | 0.00E-01 | 1.56E 02 |
| CS      | 134  | 3.03E 05 | 7.21E 05 | 5.89E 05 | 0.00E-01 | 2.33E 05 | 7.75E 04 | 1.26E 04 |
| CS      | 136  | 3.17E 04 | 1.25E 05 | 9.01E 04 | 0.00E-01 | 6.97E 04 | 9.55E 03 | 1.42E 04 |
| CS      | 137  | 3.88E 05 | 5.31E 05 | 3.48E 05 | 0.00E-01 | 1.80E 05 | 5.99E 04 | 1.03E 04 |
| CS      | 138  | 2.69E 02 | 5.31E 02 | 2.63E 02 | 0.00E-01 | 3.90E 02 | 3.85E 01 | 2.27E-03 |
| BA      | 139  | 9.00E 00 | 6.41E-03 | 2.64E-01 | 0.00E-01 | 5.99E-03 | 3.64E-03 | 1.60E 01 |
| BA      | 140  | 1.88E 03 | 2.37E 00 | 1.23E 02 | 0.00E-01 | 8.05E-01 | 1.35E 00 | 3.88E 03 |
| BA      | 141  | 4.37E 00 | 3.30E-03 | 1.48E-01 | 0.00E-01 | 3.07E-03 | 1.87E-03 | 2.06E-09 |
| BA      | 142  | 1.98E 00 | 2.03E-03 | 1.24E-01 | 0.00E-01 | 1.72E-03 | 1.15E-03 | 2.78E-18 |
| LA      | 140  | 3.58E-01 | 1.80E-01 | 4.76E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.32E 04 |
| LA      | 142  | 1.83E-02 | 8.33E-03 | 2.07E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.08E 01 |
| CE      | 141  | 8.01E-01 | 5.42E-01 | 6.15E-02 | 0.00E-01 | 2.52E-01 | 0.00E-01 | 2.07E 03 |
| CE      | 143  | 1.41E-01 | 1.04E 02 | 1.16E-02 | 0.00E-01 | 4.60E-02 | 0.00E-01 | 3.90E 03 |
| CE      | 144  | 4.18E 01 | 1.75E 01 | 2.24E 00 | 0.00E-01 | 1.04E 01 | 0.00E-01 | 1.41E 04 |
| PR      | 143  | 1.32E 00 | 5.28E-01 | 6.52E-02 | 0.00E-01 | 3.05E-01 | 0.00E-01 | 5.77E 03 |
| PR      | 144  | 4.31E-03 | 1.79E-03 | 2.19E-04 | 0.00E-01 | 1.01E-03 | 0.00E-01 | 6.19E-10 |
| ND      | 147  | 9.00E-01 | 1.04E 00 | 6.22E-02 | 0.00E-01 | 6.08E-01 | 0.00E-01 | 4.99E 03 |
| W       | 187  | 3.04E 02 | 2.55E 02 | 8.90E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.34E 04 |

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**TABLE A.4-1 (cont'd)**  
SITE RELATED DOSE COMMITMENT FACTOR AIT  
MREM/HR PER  $\mu$ CI/ML  
ADULT

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| NP      | 239 | 1.28E-01 | 1.25E-02 | 6.91E-03 | 0.00E-01 | 3.91E-02 | 0.00E-01 | 2.57E 03 |
| Sb      | 124 | 2.40E 02 | 4.53E 00 | 9.50E 01 | 5.81E-01 | 0.00E-01 | 1.87E 02 | 6.81E 03 |
| Sb      | 125 | 1.53E 02 | 1.71E 00 | 3.65E 01 | 1.56E-01 | 0.00E-01 | 1.18E 02 | 1.69E 03 |
| Sb      | 126 | 9.85E 01 | 2.00E 00 | 3.55E 01 | 6.03E-01 | 0.00E-01 | 6.04E 01 | 8.05E 03 |
| Co      | 57  | 0.00E-01 | 3.55E 01 | 5.90E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.01E 02 |

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**TABLE A.4-2**  
SITE RELATED DOSE COMMITMENT FACTOR AIT  
MREM/HR PER  $\mu$ CI/ML  
TEEN

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 6.34E 00 | 6.34E 00 | 6.34E 00 | 6.34E 00 | 6.34E 00 | 6.34E 00 |
| C       | 14  | 3.43E 04 | 6.86E 03 | 6.86E 03 | 6.86E 03 | 6.86E 03 | 6.86E 03 | 6.86E 03 |
| NA      | 24  | 5.53E 02 | 5.53E 02 | 5.53E 02 | 5.53E 02 | 5.53E 02 | 5.53E 02 | 5.53E 02 |
| P       | 32  | 5.04E 07 | 3.12E 06 | 1.95E 06 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.23E 06 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 1.52E 00 | 8.46E-00 | 3.34E-00 | 2.17E 00 | 2.56E 02 |
| MN      | 54  | 0.00E-01 | 4.65E 03 | 9.22E 02 | 0.00E-01 | 1.39E 03 | 0.00E-01 | 9.53E 03 |
| MN      | 56  | 0.00E-01 | 1.24E 02 | 2.21E 01 | 0.00E-01 | 1.58E 02 | 0.00E-01 | 8.19E 03 |
| FE      | 55  | 9.09E 02 | 6.45E 02 | 1.50E 02 | 0.00E-01 | 0.00E-01 | 4.09E 02 | 2.79E 02 |
| FE      | 59  | 1.41E 03 | 3.30E 03 | 1.27E 03 | 0.00E-01 | 0.00E-01 | 1.04E 03 | 7.79E 03 |
| CO      | 58  | 0.00E-01 | 1.45E 02 | 3.35E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.00E 03 |
| CO      | 60  | 0.00E-01 | 4.20E 02 | 9.45E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.47E 03 |
| NI      | 63  | 4.26E 04 | 3.01E 03 | 1.44E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.79E 02 |
| NI      | 65  | 1.80E 02 | 2.30E 01 | 1.05E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.25E 03 |
| CU      | 64  | 0.00E-01 | 1.72E 01 | 8.08E 00 | 0.00E-01 | 4.35E 01 | 0.00E-01 | 1.33E 03 |
| ZN      | 65  | 2.13E 04 | 7.41E 04 | 3.46E 04 | 0.00E-01 | 4.74E 04 | 0.00E-01 | 3.14E 04 |
| ZN      | 69  | 5.45E 01 | 1.04E 02 | 7.26E 00 | 0.00E-01 | 6.78E 01 | 0.00E-01 | 1.91E 02 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 4.73E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.24E-16 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 5.95E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.24E-16 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 2.51E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.24E-16 |
| RB      | 86  | 0.00E-01 | 1.10E 05 | 5.19E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.63E 04 |
| RB      | 88  | 0.00E-01 | 3.16E 02 | 1.68E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.71E-05 |
| RB      | 89  | 0.00E-01 | 2.04E 02 | 1.44E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.12E-07 |
| SR      | 89  | 4.97E 04 | 0.00E-01 | 1.42E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.91E 03 |
| SR      | 90  | 9.37E 05 | 0.00E-01 | 2.31E 05 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.63E 04 |
| SR      | 91  | 9.11E 02 | 0.00E-01 | 3.62E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.13E 03 |
| SR      | 92  | 3.44E 02 | 0.00E-01 | 1.47E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.77E 03 |
| Y       | 90  | 1.42E 00 | 0.00E-01 | 3.83E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.17E 04 |
| Y       | 91M | 1.34E-01 | 0.00E-01 | 5.11E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.32E-01 |
| Y       | 91  | 2.09E 01 | 0.00E-01 | 5.59E-00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.55E 03 |
| Y       | 92  | 1.26E-00 | 0.00E-01 | 3.63E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.44E 03 |
| Y       | 93  | 3.97E-00 | 0.00E-01 | 1.09E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.21E 04 |
| ZR      | 95  | 2.64E 00 | 8.34E-01 | 5.74E-00 | 0.00E-01 | 1.23E 00 | 0.00E-01 | 1.92E 03 |
| ZR      | 97  | 1.52E-00 | 3.01E-02 | 1.39E-01 | 0.00E-01 | 4.56E-01 | 0.00E-01 | 8.15E 03 |
| NB      | 95  | 4.50E 02 | 2.50E 02 | 1.37E 02 | 0.00E-01 | 2.42E 02 | 0.00E-01 | 1.07E 06 |
| MO      | 99  | 0.00E-01 | 4.61E 02 | 8.78E 01 | 0.00E-01 | 1.05E 03 | 0.00E-01 | 8.25E 02 |
| TC      | 99M | 2.84E-01 | 7.92E-02 | 1.03E 00 | 0.00E-01 | 1.18E 00 | 4.39E-01 | 5.20E 01 |

|                 |                                 |                 |
|-----------------|---------------------------------|-----------------|
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**TABLE A.4-2 (cont'd)**  
SITE RELATED DOSE COMMITMENT FACTOR AIT  
MREM/HR PER  $\mu$ CI/ML  
TEEN

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 3.08E-01 | 4.38E-02 | 4.30E-00 | 0.00E-01 | 7.92E-00 | 2.67E-01 | 7.48E-09 |
| RU      | 103  | 1.95E 01 | 0.00E-01 | 8.33E 00 | 0.00E-01 | 6.87E 01 | 0.00E-01 | 1.63E 03 |
| RU      | 105  | 1.67E 00 | 0.00E-01 | 6.46E-00 | 0.00E-01 | 2.10E 01 | 0.00E-01 | 1.34E 03 |
| RU      | 106  | 2.99E 02 | 0.00E-01 | 3.77E 01 | 0.00E-01 | 5.77E 02 | 0.00E-01 | 1.44E 04 |
| AG      | 110M | 1.28E 01 | 1.21E 01 | 7.36E 00 | 0.00E-01 | 2.31E 01 | 0.00E-01 | 3.40E 03 |
| TE      | 125M | 3.02E 03 | 1.09E 03 | 4.03E 02 | 8.43E 02 | 0.00E-01 | 0.00E-01 | 8.90E 03 |
| TE      | 127M | 7.62E 03 | 2.70E 03 | 9.06E 02 | 1.81E 03 | 3.09E 04 | 0.00E-01 | 1.90E 04 |
| TE      | 127  | 1.24E 02 | 4.41E 01 | 2.68E 01 | 8.59E 01 | 5.04E 02 | 0.00E-01 | 9.61E 03 |
| TE      | 129M | 1.28E 04 | 4.77E 03 | 2.03E 03 | 4.14E 03 | 5.37E 04 | 0.00E-01 | 4.82E 04 |
| TE      | 129  | 3.53E 01 | 1.32E 01 | 8.59E 00 | 2.52E 01 | 1.48E 02 | 0.00E-01 | 1.93E 02 |
| TE      | 131M | 1.92E 03 | 9.22E 02 | 7.69E 02 | 1.39E 03 | 9.61E 03 | 0.00E-01 | 7.40E 04 |
| TE      | 131  | 2.20E 01 | 9.06E 00 | 6.87E 00 | 1.69E 01 | 9.61E 01 | 0.00E-01 | 1.80E 00 |
| TE      | 132  | 2.75E 03 | 1.74E 03 | 1.64E 03 | 1.84E 03 | 1.67E 04 | 0.00E-01 | 5.51E 04 |
| I       | 130  | 8.81E 01 | 2.55E 02 | 1.02E 02 | 2.08E 04 | 3.92E 02 | 0.00E-01 | 1.96E 02 |
| I       | 131  | 5.00E 02 | 7.00E 02 | 3.76E 02 | 2.04E 05 | 1.21E 03 | 0.00E-01 | 1.39E 02 |
| I       | 132  | 2.39E 01 | 6.24E 01 | 2.24E 01 | 2.10E 03 | 9.83E 01 | 0.00E-01 | 2.72E 01 |
| I       | 133  | 1.72E 02 | 2.92E 02 | 8.89E 01 | 4.07E 04 | 5.11E 02 | 0.00E-01 | 2.21E 02 |
| I       | 134  | 1.25E 01 | 3.31E 01 | 1.19E 01 | 5.51E 02 | 5.22E 01 | 0.00E-01 | 4.36E-01 |
| I       | 135  | 5.22E 01 | 1.34E 02 | 4.98E 01 | 8.64E 03 | 2.12E 02 | 0.00E-01 | 1.49E 02 |
| CS      | 134  | 3.10E 05 | 7.30E 05 | 3.39E 05 | 0.00E-01 | 2.32E 05 | 8.86E 04 | 9.08E 03 |
| CS      | 136  | 3.18E 04 | 1.25E 05 | 8.41E 04 | 0.00E-01 | 6.82E 04 | 1.07E 04 | 1.01E 04 |
| CS      | 137  | 4.15E 05 | 5.52E 05 | 1.92E 05 | 0.00E-01 | 1.88E 05 | 7.30E 04 | 7.86E 03 |
| CS      | 138  | 2.88E 02 | 5.52E 02 | 2.76E 02 | 0.00E-01 | 4.08E 02 | 4.74E 01 | 2.51E-01 |
| BA      | 139  | 9.10E 00 | 6.40E-03 | 2.65E-00 | 0.00E-01 | 6.03E-02 | 4.41E-02 | 8.11E 01 |
| BA      | 140  | 1.86E 03 | 2.28E 00 | 1.20E 02 | 0.00E-01 | 7.72E-00 | 1.53E 00 | 2.87E 03 |
| BA      | 141  | 4.39E 00 | 3.28E-03 | 1.47E-00 | 0.00E-01 | 3.04E-02 | 2.24E-02 | 9.36E-06 |
| BA      | 142  | 1.96E 00 | 1.96E-03 | 1.20E-00 | 0.00E-01 | 1.66E-02 | 1.30E-02 | 6.01E-12 |
| LA      | 140  | 3.61E-00 | 1.77E-01 | 4.72E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.02E 04 |
| LA      | 142  | 1.86E-01 | 8.25E-03 | 2.05E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.51E 02 |
| CE      | 141  | 7.98E-00 | 5.32E-01 | 6.12E-01 | 0.00E-01 | 2.51E-00 | 0.00E-01 | 1.52E 03 |
| CE      | 143  | 1.41E-00 | 1.03E 02 | 1.15E-01 | 0.00E-01 | 4.60E-01 | 0.00E-01 | 3.08E 03 |
| CE      | 144  | 4.17E 01 | 1.73E 01 | 2.24E 00 | 0.00E-01 | 1.03E 01 | 0.00E-01 | 1.05E 04 |
| PR      | 143  | 1.36E 00 | 5.43E-01 | 6.76E-01 | 0.00E-01 | 3.15E-00 | 0.00E-01 | 4.47E 03 |
| PR      | 144  | 4.46E-02 | 1.83E-03 | 2.26E-03 | 0.00E-01 | 1.05E-02 | 0.00E-01 | 4.92E-06 |
| ND      | 147  | 9.73E-00 | 1.06E 00 | 6.34E-01 | 0.00E-01 | 6.21E-00 | 0.00E-01 | 3.82E 03 |
| W       | 187  | 3.28E 02 | 2.67E 02 | 9.37E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.24E 04 |

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**TABLE A.4-2 (cont'd)**  
SITE RELATED DOSE COMMITMENT FACTOR AIT  
MREM/HR PER  $\mu$ CI/ML  
TEEN

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| NP      | 239 | 1.34E-00 | 1.27E-02 | 7.04E-02 | 0.00E-01 | 3.98E-01 | 0.00E-01 | 2.04E 03 |
| Sb      | 124 | 2.32E 02 | 4.28E 00 | 9.05E 01 | 5.26E-00 | 0.00E-01 | 2.03E 02 | 4.68E 03 |
| Sb      | 125 | 1.49E 02 | 1.63E 00 | 3.48E 01 | 1.42E-00 | 0.00E-01 | 1.31E 02 | 1.16E 03 |
| Sb      | 126 | 9.53E 01 | 1.95E 00 | 3.42E 01 | 5.39E-00 | 0.00E-01 | 6.84E 01 | 5.64E 03 |
| Co      | 57  | 0.00E-01 | 3.55E 01 | 5.96E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.63E 02 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.4-3**  
SITE RELATED DOSE COMMITMENT FACTOR AIT  
MREM/HR PER  $\mu$ Ci/ML  
CHILD

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 1.19E 01 | 1.19E 01 | 1.19E 01 | 1.19E 01 | 1.19E 01 | 1.19E 01 |
| C       | 14  | 4.45E 04 | 8.90E 03 | 8.90E 03 | 8.90E 03 | 8.90E 03 | 8.90E 03 | 8.90E 03 |
| NA      | 24  | 7.93E 02 | 7.93E 02 | 7.93E 02 | 7.93E 02 | 7.93E 02 | 7.93E 02 | 7.93E 02 |
| P       | 32  | 6.49E 07 | 3.04E 06 | 2.50E 06 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.79E 06 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 1.92E 00 | 1.06E 00 | 2.91E-00 | 1.94E 00 | 1.02E 02 |
| MN      | 54  | 0.00E-01 | 3.99E 03 | 1.06E 03 | 0.00E-01 | 1.12E 03 | 0.00E-01 | 3.35E 03 |
| MN      | 56  | 0.00E-01 | 1.25E 02 | 2.81E 01 | 0.00E-01 | 1.51E 02 | 0.00E-01 | 1.80E 04 |
| FE      | 55  | 1.57E 03 | 8.34E 02 | 2.59E 02 | 0.00E-01 | 0.00E-01 | 4.72E 02 | 1.55E 02 |
| FE      | 59  | 2.26E 03 | 3.65E 03 | 1.82E 03 | 0.00E-01 | 0.00E-01 | 1.06E 03 | 3.80E 03 |
| CO      | 58  | 0.00E-01 | 1.75E 02 | 5.37E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.02E 03 |
| CO      | 60  | 0.00E-01 | 5.16E 02 | 1.52E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.86E 03 |
| NI      | 63  | 7.36E 04 | 3.94E 03 | 2.50E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.65E 02 |
| NI      | 65  | 3.04E 02 | 2.86E 01 | 1.67E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.50E 03 |
| CU      | 64  | 0.00E-01 | 2.39E 01 | 1.44E 01 | 0.00E-01 | 5.77E 01 | 0.00E-01 | 1.12E 03 |
| ZN      | 65  | 2.23E 04 | 5.95E 04 | 3.70E 04 | 0.00E-01 | 3.75E 04 | 0.00E-01 | 1.05E 04 |
| ZN      | 69  | 7.15E 01 | 1.03E 02 | 9.54E 00 | 0.00E-01 | 6.26E 01 | 0.00E-01 | 6.51E 03 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 6.64E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.89E-16 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 7.69E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.89E-16 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 3.54E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.89E-16 |
| RB      | 86  | 0.00E-01 | 1.09E 05 | 6.72E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.03E 03 |
| RB      | 88  | 0.00E-01 | 3.10E 02 | 2.15E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.52E 01 |
| RB      | 89  | 0.00E-01 | 1.91E 02 | 1.70E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.66E 00 |
| SR      | 89  | 1.08E 05 | 0.00E-01 | 3.08E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.18E 03 |
| SR      | 90  | 1.39E 06 | 0.00E-01 | 3.52E 05 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.87E 04 |
| SR      | 91  | 1.96E 03 | 0.00E-01 | 7.41E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.33E 03 |
| SR      | 92  | 7.38E 02 | 0.00E-01 | 2.96E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.40E 04 |
| Y       | 90  | 3.20E 00 | 0.00E-01 | 8.56E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.10E 03 |
| Y       | 91M | 2.97E-01 | 0.00E-01 | 1.08E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.82E 01 |
| Y       | 91  | 4.68E 01 | 0.00E-01 | 1.25E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.24E 03 |
| Y       | 92  | 2.80E-00 | 0.00E-01 | 8.01E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.09E 03 |
| Y       | 93  | 8.87E-00 | 0.00E-01 | 2.44E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.32E 04 |
| ZR      | 95  | 7.05E 00 | 1.55E 00 | 1.38E 00 | 0.00E-01 | 2.22E 00 | 0.00E-01 | 1.62E 03 |
| ZR      | 97  | 4.25E-00 | 6.13E-02 | 3.62E-01 | 0.00E-01 | 8.81E-01 | 0.00E-01 | 9.29E 03 |
| NB      | 95  | 5.32E 02 | 2.07E 02 | 1.48E 02 | 0.00E-01 | 1.95E 02 | 0.00E-01 | 3.83E 05 |
| MO      | 99  | 0.00E-01 | 8.78E 02 | 2.17E 02 | 0.00E-01 | 1.87E 03 | 0.00E-01 | 7.26E 02 |
| TC      | 99M | 6.46E-01 | 1.27E-01 | 2.10E 00 | 0.00E-01 | 1.84E 00 | 6.43E-01 | 7.20E 01 |

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**TABLE A.4-3 (cont'd)**  
SITE RELATED DOSE COMMITMENT FACTOR AIT  
MREM/HR PER  $\mu$ Ci/ML  
CHILD

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 7.48E-01 | 7.83E-02 | 9.93E-00 | 0.00E-01 | 1.34E 00 | 4.14E-01 | 2.49E-01 |
| RU      | 103  | 4.83E 01 | 0.00E-01 | 1.85E 01 | 0.00E-01 | 1.21E 02 | 0.00E-01 | 1.25E 03 |
| RU      | 105  | 4.26E 00 | 0.00E-01 | 1.54E 00 | 0.00E-01 | 3.74E 01 | 0.00E-01 | 2.78E 03 |
| RU      | 106  | 7.72E 02 | 0.00E-01 | 9.64E 01 | 0.00E-01 | 1.04E 03 | 0.00E-01 | 1.20E 04 |
| AG      | 110M | 3.23E 01 | 2.18E 01 | 1.74E 01 | 0.00E-01 | 4.06E 01 | 0.00E-01 | 2.60E 03 |
| TE      | 125M | 4.25E 03 | 1.15E 03 | 5.67E 02 | 1.19E 03 | 0.00E-01 | 0.00E-01 | 4.10E 03 |
| TE      | 127M | 1.08E 04 | 2.90E 03 | 1.28E 03 | 2.58E 03 | 3.07E 04 | 0.00E-01 | 8.72E 03 |
| TE      | 127  | 1.76E 02 | 4.73E 01 | 3.77E 01 | 1.22E 02 | 5.00E 02 | 0.00E-01 | 6.86E 03 |
| TE      | 129M | 1.82E 04 | 5.07E 03 | 1.70E 03 | 5.85E 03 | 5.33E 04 | 0.00E-01 | 2.21E 04 |
| TE      | 129  | 5.00E 01 | 1.39E 01 | 1.19E 01 | 3.56E 01 | 1.46E 02 | 0.00E-01 | 3.11E 03 |
| TE      | 131M | 2.68E 03 | 9.28E 02 | 9.88E 02 | 1.91E 03 | 8.98E 03 | 0.00E-01 | 3.77E 04 |
| TE      | 131  | 3.09E 01 | 9.43E 00 | 9.21E 00 | 2.37E 01 | 9.36E 01 | 0.00E-01 | 1.63E 02 |
| TE      | 132  | 3.77E 03 | 1.67E 03 | 2.01E 03 | 2.43E 03 | 1.55E 04 | 0.00E-01 | 1.68E 04 |
| I       | 130  | 2.04E 02 | 4.13E 02 | 2.13E 02 | 4.55E 04 | 6.17E 02 | 0.00E-01 | 1.93E 02 |
| I       | 131  | 1.20E 03 | 1.21E 03 | 6.88E 02 | 4.00E 05 | 1.99E 03 | 0.00E-01 | 1.08E 02 |
| I       | 132  | 5.60E 01 | 1.03E 02 | 4.73E 01 | 4.77E 03 | 1.57E 02 | 0.00E-01 | 1.21E 02 |
| I       | 133  | 4.14E 02 | 5.12E 02 | 1.94E 02 | 9.51E 04 | 8.53E 02 | 0.00E-01 | 2.06E 02 |
| I       | 134  | 2.93E 01 | 5.44E 01 | 2.50E 01 | 1.25E 03 | 8.32E 01 | 0.00E-01 | 3.61E 01 |
| I       | 135  | 1.22E 02 | 2.20E 02 | 1.04E 02 | 1.95E 04 | 3.38E 02 | 0.00E-01 | 1.68E 02 |
| CS      | 134  | 3.82E 05 | 6.26E 05 | 1.32E 05 | 0.00E-01 | 1.94E 05 | 6.97E 04 | 3.38E 03 |
| CS      | 136  | 3.83E 04 | 1.05E 05 | 6.82E 04 | 0.00E-01 | 5.61E 04 | 8.37E 03 | 3.70E 03 |
| CS      | 137  | 5.33E 05 | 5.11E 05 | 7.54E 04 | 0.00E-01 | 1.66E 05 | 5.99E 04 | 3.20E 03 |
| CS      | 138  | 3.72E 02 | 5.17E 02 | 3.28E 02 | 0.00E-01 | 3.64E 02 | 3.92E 01 | 2.38E 02 |
| BA      | 139  | 2.54E 01 | 1.35E-02 | 7.35E-00 | 0.00E-01 | 1.18E-01 | 7.97E-02 | 1.47E 03 |
| BA      | 140  | 5.09E 03 | 4.46E 00 | 2.97E 02 | 0.00E-01 | 1.45E 00 | 2.66E 00 | 2.58E 03 |
| BA      | 141  | 1.23E 01 | 6.86E-03 | 3.99E-00 | 0.00E-01 | 5.94E-02 | 4.03E-01 | 6.99E 00 |
| BA      | 142  | 5.36E 00 | 3.85E-03 | 2.99E-00 | 0.00E-01 | 3.12E-02 | 2.27E-02 | 6.99E-02 |
| LA      | 140  | 7.86E-00 | 2.75E-01 | 9.26E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.66E 03 |
| LA      | 142  | 4.08E-01 | 1.30E-02 | 4.07E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.58E 03 |
| CE      | 141  | 2.34E 00 | 1.17E 00 | 1.73E-00 | 0.00E-01 | 5.11E-00 | 0.00E-01 | 1.46E 03 |
| CE      | 143  | 4.12E-00 | 2.23E 02 | 3.24E-01 | 0.00E-01 | 9.37E-01 | 0.00E-01 | 3.27E 03 |
| CE      | 144  | 1.23E 02 | 3.84E 01 | 6.54E 00 | 0.00E-01 | 2.13E 01 | 0.00E-01 | 1.00E 04 |
| PR      | 143  | 3.06E 00 | 9.18E-01 | 1.52E-00 | 0.00E-01 | 4.97E-00 | 0.00E-01 | 3.30E 03 |
| PR      | 144  | 1.00E-01 | 3.10E-03 | 5.05E-03 | 0.00E-01 | 1.64E-02 | 0.00E-01 | 6.68E 00 |
| ND      | 147  | 2.17E 00 | 1.76E 00 | 1.36E-00 | 0.00E-01 | 9.65E-00 | 0.00E-01 | 2.79E 03 |
| W       | 187  | 4.30E 02 | 2.55E 02 | 1.14E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.58E 04 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.4-3 (cont'd)**  
SITE RELATED DOSE COMMITMENT FACTOR AIT  
MREM/HR PER  $\mu$ Ci/ML  
CHILD

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| NP      | 239 | 3.47E-00 | 2.49E-02 | 1.75E-01 | 0.00E-01 | 7.19E-01 | 0.00E-01 | 1.84E 03 |
| Sb      | 124 | 6.54E 02 | 8.49E 00 | 2.29E 02 | 1.44E 00 | 0.00E-01 | 3.63E 02 | 4.09E 03 |
| Sb      | 125 | 4.22E 02 | 3.25E 00 | 8.84E 01 | 3.91E-00 | 0.00E-01 | 2.35E 02 | 1.01E 03 |
| Sb      | 126 | 2.59E 02 | 3.97E 00 | 9.31E 01 | 1.52E 00 | 0.00E-01 | 1.24E 02 | 5.23E 03 |
| Co      | 57  | 0.00E-01 | 4.81E 01 | 9.73E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.94E 02 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.4-4**  
SITE RELATED DOSE COMMITMENT FACTOR AIT  
MREM/HR PER  $\mu$ CI/ML  
INFANT

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 1.16E 01 | 1.16E 01 | 1.16E 01 | 1.16E 01 | 1.16E 01 | 1.16E 01 |
| C       | 14  | 8.92E 02 | 1.90E 02 | 1.90E 02 | 1.90E 02 | 1.90E 02 | 1.90E 02 | 1.90E 02 |
| NA      | 24  | 3.80E 02 | 3.80E 02 | 3.80E 02 | 3.80E 02 | 3.80E 02 | 3.80E 02 | 3.80E 02 |
| P       | 32  | 6.40E 04 | 3.76E 03 | 2.48E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.65E 02 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 5.30E-01 | 3.46E-01 | 7.56E-02 | 6.73E-01 | 1.55E 01 |
| MN      | 54  | 0.00E-01 | 7.49E 02 | 1.70E 02 | 0.00E-01 | 1.66E 02 | 0.00E-01 | 2.75E 02 |
| MN      | 56  | 0.00E-01 | 3.08E 01 | 5.30E 00 | 0.00E-01 | 2.64E 01 | 0.00E-01 | 2.80E 03 |
| FE      | 55  | 5.23E 02 | 3.38E 02 | 9.03E 01 | 0.00E-01 | 0.00E-01 | 1.65E 02 | 4.29E 01 |
| FE      | 59  | 1.16E 03 | 2.02E 03 | 7.98E 02 | 0.00E-01 | 0.00E-01 | 5.98E 02 | 9.67E 02 |
| CO      | 58  | 0.00E-01 | 1.35E 02 | 3.38E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.37E 02 |
| CO      | 60  | 0.00E-01 | 4.06E 02 | 9.59E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.67E 02 |
| NI      | 63  | 2.39E 04 | 1.47E 03 | 8.28E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.34E 01 |
| NI      | 65  | 1.77E 02 | 2.00E 01 | 9.10E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.52E 03 |
| CU      | 64  | 0.00E-01 | 2.29E 01 | 1.06E 01 | 0.00E-01 | 3.87E 01 | 0.00E-01 | 4.70E 02 |
| ZN      | 65  | 6.92E 02 | 2.37E 03 | 1.09E 03 | 0.00E-01 | 1.15E 03 | 0.00E-01 | 2.01E 03 |
| ZN      | 69  | 3.51E 00 | 6.32E 00 | 4.70E-01 | 0.00E-01 | 2.63E 00 | 0.00E-01 | 5.15E 02 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 1.37E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.76E-17 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 1.44E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.76E-17 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 7.30E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.76E-17 |
| RB      | 86  | 0.00E-01 | 6.40E 03 | 3.16E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.64E 02 |
| RB      | 88  | 0.00E-01 | 1.87E 01 | 1.03E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.82E 01 |
| RB      | 89  | 0.00E-01 | 1.08E 01 | 7.41E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.66E 00 |
| SR      | 89  | 9.44E 04 | 0.00E-01 | 2.71E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.94E 03 |
| SR      | 90  | 6.96E 05 | 0.00E-01 | 1.77E 05 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.69E 03 |
| SR      | 91  | 1.88E 03 | 0.00E-01 | 6.81E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.23E 03 |
| SR      | 92  | 7.22E 02 | 0.00E-01 | 2.68E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.79E 03 |
| Y       | 90  | 3.27E 00 | 0.00E-01 | 8.77E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.51E 03 |
| Y       | 91M | 3.05E-02 | 0.00E-01 | 1.04E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.02E 02 |
| Y       | 91  | 4.25E 01 | 0.00E-01 | 1.13E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.05E 03 |
| Y       | 92  | 2.88E-01 | 0.00E-01 | 8.09E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.49E 03 |
| Y       | 93  | 9.14E-01 | 0.00E-01 | 2.49E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.22E 03 |
| ZR      | 95  | 7.75E 00 | 1.89E 00 | 1.34E 00 | 0.00E-01 | 2.04E 00 | 0.00E-01 | 9.41E 02 |
| ZR      | 97  | 5.57E-01 | 9.56E-02 | 4.36E-02 | 0.00E-01 | 9.63E-02 | 0.00E-01 | 6.09E 03 |
| NB      | 95  | 1.58E 00 | 6.51E-01 | 3.76E-01 | 0.00E-01 | 4.66E-01 | 0.00E-01 | 5.49E 02 |
| MO      | 99  | 0.00E-01 | 1.28E 03 | 2.49E 02 | 0.00E-01 | 1.91E 03 | 0.00E-01 | 4.21E 02 |
| TC      | 99M | 7.22E-02 | 1.49E-01 | 1.92E 00 | 0.00E-01 | 1.60E 00 | 7.79E-02 | 4.33E 01 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.4-4 (cont'd)**  
SITE RELATED DOSE COMMITMENT FACTOR AIT  
MREM/HR PER  $\mu$ CI/ML  
INFANT

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 8.54E-02 | 1.08E-01 | 1.06E 00 | 0.00E-01 | 1.28E 00 | 5.87E-02 | 1.83E 01 |
| RU      | 103  | 5.57E 01 | 0.00E-01 | 1.86E 01 | 0.00E-01 | 1.16E 02 | 0.00E-01 | 6.77E 02 |
| RU      | 105  | 5.12E 00 | 0.00E-01 | 1.72E 00 | 0.00E-01 | 3.76E 01 | 0.00E-01 | 2.04E 03 |
| RU      | 106  | 9.07E 02 | 0.00E-01 | 1.13E 02 | 0.00E-01 | 1.07E 03 | 0.00E-01 | 6.88E 03 |
| AG      | 110M | 3.75E 01 | 2.73E 01 | 1.81E 01 | 0.00E-01 | 3.91E 01 | 0.00E-01 | 1.42E 03 |
| TE      | 125M | 8.77E 02 | 2.93E 02 | 1.19E 02 | 2.95E 02 | 0.00E-01 | 0.00E-01 | 4.18E 02 |
| TE      | 127M | 2.20E 03 | 7.30E 02 | 2.66E 02 | 6.36E 02 | 5.42E 03 | 0.00E-01 | 8.88E 02 |
| TE      | 127  | 3.76E 01 | 1.26E 01 | 8.09E 00 | 3.06E 01 | 9.18E 01 | 0.00E-01 | 7.90E 02 |
| TE      | 129M | 3.76E 03 | 1.29E 03 | 5.79E 02 | 1.44E 03 | 9.41E 03 | 0.00E-01 | 2.25E 03 |
| TE      | 129  | 1.07E 01 | 3.68E 00 | 2.49E 00 | 8.95E 00 | 2.66E 01 | 0.00E-01 | 8.54E 02 |
| TE      | 131M | 5.72E 02 | 2.30E 02 | 1.90E 02 | 4.66E 02 | 1.58E 03 | 0.00E-01 | 3.87E 03 |
| TE      | 131  | 6.62E 00 | 2.45E 00 | 1.86E 00 | 5.91E 00 | 1.69E 01 | 0.00E-01 | 2.67E 02 |
| TE      | 132  | 7.82E 02 | 3.87E 02 | 3.62E 02 | 5.72E 02 | 2.42E 03 | 0.00E-01 | 1.43E 03 |
| I       | 130  | 2.26E 02 | 4.97E 02 | 1.99E 02 | 5.57E 04 | 5.45E 02 | 0.00E-01 | 1.06E 02 |
| I       | 131  | 1.35E 03 | 1.59E 03 | 7.00E 02 | 5.23E 05 | 1.86E 03 | 0.00E-01 | 5.68E 01 |
| I       | 132  | 6.24E 01 | 1.27E 02 | 4.51E 01 | 5.94E 03 | 1.41E 02 | 0.00E-01 | 1.03E 02 |
| I       | 133  | 4.70E 02 | 6.85E 02 | 2.01E 02 | 1.25E 05 | 8.05E 02 | 0.00E-01 | 1.16E 02 |
| I       | 134  | 3.27E 01 | 6.70E 01 | 2.38E 01 | 1.56E 03 | 7.49E 01 | 0.00E-01 | 6.92E 01 |
| I       | 135  | 1.37E 02 | 2.72E 02 | 9.93E 01 | 2.44E 04 | 3.04E 02 | 0.00E-01 | 9.86E 01 |
| CS      | 134  | 1.42E 04 | 2.64E 04 | 2.67E 03 | 0.00E-01 | 6.81E 03 | 2.42E 03 | 7.19E 01 |
| CS      | 136  | 1.73E 03 | 5.08E 03 | 1.90E 03 | 0.00E-01 | 2.02E 03 | 4.14E 02 | 7.71E 01 |
| CS      | 137  | 1.96E 04 | 2.30E 04 | 1.63E 03 | 0.00E-01 | 6.17E 03 | 2.50E 03 | 7.19E 01 |
| CS      | 138  | 1.81E 01 | 2.94E 01 | 1.43E 01 | 0.00E-01 | 1.47E 01 | 2.29E 00 | 4.70E 01 |
| BA      | 139  | 3.31E 01 | 2.20E-02 | 9.59E-01 | 0.00E-01 | 1.32E-02 | 1.33E-02 | 2.10E 03 |
| BA      | 140  | 6.43E 03 | 6.43E 00 | 3.31E 02 | 0.00E-01 | 1.53E 00 | 3.95E 00 | 1.58E 03 |
| BA      | 141  | 1.60E 01 | 1.09E-02 | 5.04E-01 | 0.00E-01 | 6.58E-03 | 6.66E-03 | 1.95E 02 |
| BA      | 142  | 6.92E 00 | 5.76E-03 | 3.41E-01 | 0.00E-01 | 3.31E-03 | 3.48E-03 | 2.86E 01 |
| LA      | 140  | 7.94E-01 | 3.13E-01 | 8.05E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.68E 03 |
| LA      | 142  | 4.14E-02 | 1.52E-02 | 3.64E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.58E 03 |
| CE      | 141  | 2.96E 00 | 1.81E 00 | 2.13E-01 | 0.00E-01 | 5.57E-01 | 0.00E-01 | 9.33E 02 |
| CE      | 143  | 5.57E-01 | 3.69E 02 | 4.21E-02 | 0.00E-01 | 1.08E-01 | 0.00E-01 | 2.16E 03 |
| CE      | 144  | 1.12E 02 | 4.59E 01 | 6.28E 00 | 0.00E-01 | 1.85E 01 | 0.00E-01 | 6.43E 03 |
| PR      | 143  | 3.06E 00 | 1.14E 00 | 1.52E-01 | 0.00E-01 | 4.25E-01 | 0.00E-01 | 1.61E 03 |
| PR      | 144  | 1.03E-02 | 3.99E-03 | 5.19E-04 | 0.00E-01 | 1.44E-03 | 0.00E-01 | 1.85E 02 |
| ND      | 147  | 2.08E 00 | 2.14E 00 | 1.31E-01 | 0.00E-01 | 8.24E-01 | 0.00E-01 | 1.35E 03 |
| W       | 187  | 3.40E 01 | 2.36E 01 | 8.16E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.39E 03 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.4-4 (cont'd)**  
SITE RELATED DOSE COMMITMENT FACTOR AIT  
MREM/HR PER  $\mu$ CI/ML  
INFANT

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| NP      | 239 | 4.18E-01 | 3.74E-02 | 2.11E-02 | 0.00E-01 | 7.45E-02 | 0.00E-01 | 1.08E 03 |
| Sb      | 124 | 8.05E 02 | 1.19E 01 | 2.49E 02 | 2.14E 00 | 0.00E-01 | 5.04E 02 | 2.48E 03 |
| Sb      | 125 | 4.63E 02 | 4.48E 00 | 9.52E 01 | 5.79E-00 | 0.00E-01 | 2.90E 02 | 6.17E 02 |
| Sb      | 126 | 3.03E 02 | 5.94E 00 | 1.09E 02 | 2.33E 00 | 0.00E-01 | 1.91E 02 | 3.14E 03 |
| Co      | 57  | 0.00E-01 | 4.33E 01 | 7.03E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.47E 02 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-1**  
INHALATION DOSE PARAMETER FOR THE CHILD, PI  
MREM/YR per  $\mu\text{Ci}/\text{M}^3$

|        |          |         |          |
|--------|----------|---------|----------|
| H-3    | 1.12E 03 | RU-103  | 6.62E 05 |
| C-14   | 3.59E 04 | RU-105  | 9.95E 04 |
| NA-24  | 1.61E 04 | RU-106  | 1.43E 07 |
| P-32   | 2.60E 06 | AG-110M | 5.48E 06 |
| CR-51  | 1.70E 04 | TE-125M | 4.77E 05 |
| MN-54  | 1.58E 06 | TE-127M | 1.48E 06 |
| MN-56  | 1.23E 05 | TE-127  | 5.62E 04 |
| FE-55  | 1.11E 05 | TE-129M | 1.76E 06 |
| FE-59  | 1.27E 06 | TE-129  | 2.55E 04 |
| CO-58  | 1.11E 06 | TE-131M | 3.08E 05 |
| CO-60  | 7.07E 06 | TE-131  | 2.05E 03 |
| NI-63  | 8.21E 05 | TE-132  | 3.77E 05 |
| NI-65  | 8.40E 04 | I-130   | 1.85E 06 |
| CU-64  | 3.67E 04 | I-131   | 1.62E 07 |
| ZN-65  | 9.95E 05 | I-132   | 1.94E 05 |
| ZN-69  | 1.02E 04 | I-133   | 3.85E 06 |
| BR-83  | 4.74E 02 | I-134   | 5.07E 04 |
| BR-84  | 5.48E 02 | I-135   | 7.92E 05 |
| BR-85  | 2.53E 01 | CS-134  | 1.01E 06 |
| RB-86  | 1.98E 05 | CS-136  | 1.71E 05 |
| RB-88  | 5.62E 02 | CS-137  | 9.07E 05 |
| RB-89  | 3.45E 02 | CS-138  | 8.40E 02 |
| SR-89  | 2.16E 06 | BA-139  | 5.77E 04 |
| SR-90  | 1.01E 08 | BA-140  | 1.74E 06 |
| SR-91  | 1.74E 05 | BA-141  | 2.92E 03 |
| SR-92  | 2.42E 05 | BA-142  | 1.64E 03 |
| Y-90   | 2.68E 05 | LA-140  | 2.26E 05 |
| Y-91M  | 2.81E 03 | LA-142  | 7.59E 04 |
| Y-92   | 2.39E 05 | CE-141  | 5.44E 05 |
| Y-93   | 3.89E 05 | CE-143  | 1.27E 05 |
| ZR-95  | 2.23E 06 | PR-143  | 4.33E 05 |
| ZR-97  | 3.51E 05 | PR-144  | 1.57E 03 |
| NB-95  | 6.14E 05 | ND-147  | 3.28E 05 |
| MO-99  | 1.35E 05 | W-187   | 9.10E 04 |
| TC-99M | 4.81E 03 | NP-239  | 6.40E 04 |
| TC-101 | 5.85E 02 |         |          |

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**TABLE A.5-2**  
INHALATION PATHWAY FACTOR  
MREM/YR PER  $\mu\text{Ci}/\text{M}^3$   
ADULT (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E 01 | 1.26E 03 | 1.26E 03 | 1.26E 03 | 1.26E 03 | 1.26E 03 | 1.26E 03 |
| C       | 14  | 1.82E 04 | 3.41E 03 | 3.41E 03 | 3.41E 03 | 3.41E 03 | 3.41E 03 | 3.41E 03 |
| NA      | 24  | 1.02E 04 | 1.02E 04 | 1.02E 04 | 1.02E 04 | 1.02E 04 | 1.02E 04 | 1.02E 04 |
| P       | 32  | 1.32E 06 | 7.71E 04 | 5.01E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.64E 04 |
| CR      | 51  | 0.00E 01 | 0.00E 01 | 1.00E 02 | 5.95E 01 | 2.28E 01 | 1.44E 04 | 3.32E 03 |
| MN      | 54  | 0.00E 01 | 3.96E 04 | 6.30E 03 | 0.00E-01 | 9.84E 03 | 1.40E 06 | 7.74E 04 |
| MN      | 56  | 0.00E 01 | 1.24E 00 | 1.83E-00 | 0.00E-01 | 1.30E 00 | 9.44E 03 | 2.02E 04 |
| FE      | 55  | 2.46E 04 | 1.70E 04 | 3.94E 03 | 0.00E-01 | 0.00E-01 | 7.21E 04 | 6.03E 03 |
| FE      | 59  | 1.18E 04 | 2.78E 04 | 1.06E 04 | 0.00E-01 | 0.00E-01 | 1.02E 06 | 1.88E 05 |
| CO      | 58  | 0.00E 01 | 1.58E 03 | 2.07E 03 | 0.00E-01 | 0.00E-01 | 9.28E 05 | 1.06E 05 |
| CO      | 60  | 0.00E 01 | 1.15E 04 | 1.48E 04 | 0.00E-01 | 0.00E-01 | 5.97E 06 | 2.85E 05 |
| NI      | 63  | 4.32E 05 | 3.14E 04 | 1.45E 04 | 0.00E-01 | 0.00E-01 | 1.78E 05 | 1.34E 04 |
| NI      | 65  | 1.54E 00 | 2.10E-01 | 9.12E-02 | 0.00E-01 | 0.00E-01 | 5.60E 03 | 1.23E 04 |
| CU      | 64  | 0.00E 01 | 1.46E 00 | 6.15E-01 | 0.00E-01 | 4.62E 00 | 6.78E 03 | 4.90E 04 |
| ZN      | 65  | 3.24E 04 | 1.03E 05 | 4.66E 04 | 0.00E-01 | 6.90E 04 | 8.64E 05 | 5.34E 04 |
| ZN      | 69  | 3.38E-02 | 6.51E-02 | 4.52E-03 | 0.00E-01 | 4.22E-02 | 9.20E 02 | 1.63E 01 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 2.41E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.32E 02 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 3.13E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.64E-03 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 1.28E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.00E-15 |
| RB      | 86  | 0.00E-01 | 1.35E 05 | 5.90E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.66E 04 |
| RB      | 88  | 0.00E-01 | 3.87E 02 | 1.93E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.34E-09 |
| RB      | 89  | 0.00E-01 | 2.56E 02 | 1.70E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.28E-12 |
| SR      | 89  | 3.04E 05 | 0.00E-01 | 8.72E 03 | 0.00E-01 | 0.00E-01 | 1.40E 06 | 3.50E 05 |
| SR      | 90  | 9.92E 07 | 0.00E-01 | 6.10E 06 | 0.00E-01 | 0.00E-01 | 9.60E 06 | 7.22E 05 |
| SR      | 91  | 6.19E 01 | 0.00E-01 | 2.50E 00 | 0.00E-01 | 0.00E-01 | 3.65E 04 | 1.91E 05 |
| SR      | 92  | 6.74E 00 | 0.00E-01 | 2.91E-01 | 0.00E-01 | 0.00E-01 | 1.65E 04 | 4.30E 04 |
| Y       | 90  | 2.09E 03 | 0.00E-01 | 5.61E 01 | 0.00E-01 | 0.00E-01 | 1.70E 05 | 5.06E 05 |
| Y       | 91M | 2.61E-01 | 0.00E-01 | 1.02E-02 | 0.00E-01 | 0.00E-01 | 1.92E 03 | 1.33E 00 |
| Y       | 91  | 4.62E 05 | 0.00E-01 | 1.24E 04 | 0.00E-01 | 0.00E-01 | 1.70E 06 | 3.85E 05 |
| Y       | 92  | 1.03E 01 | 0.00E-01 | 3.02E-01 | 0.00E-01 | 0.00E-01 | 1.57E 04 | 7.35E 04 |
| Y       | 93  | 9.44E 01 | 0.00E-01 | 2.61E 00 | 0.00E-01 | 0.00E-01 | 4.85E 04 | 4.22E 05 |
| ZR      | 95  | 1.07E 05 | 3.44E 04 | 2.33E 04 | 0.00E-01 | 5.42E 04 | 1.77E 06 | 1.50E 05 |
| ZR      | 97  | 9.68E 01 | 1.96E 01 | 9.04E 00 | 0.00E-01 | 2.97E 01 | 7.87E 04 | 5.23E 05 |
| NB      | 95  | 1.41E 04 | 7.82E 03 | 4.21E 03 | 0.00E-01 | 7.74E 03 | 5.05E 05 | 1.04E 05 |
| MO      | 99  | 0.00E-01 | 1.21E 02 | 2.30E 01 | 0.00E-01 | 2.91E 02 | 9.12E 04 | 2.48E 05 |
| TC      | 99M | 1.03E-03 | 2.91E-03 | 3.70E-02 | 0.00E-01 | 4.42E-02 | 7.64E 02 | 4.16E 03 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-2 (cont'd)**  
INHALATION PATHWAY FACTOR  
MREM/YR PER  $\mu\text{Ci}/\text{M}^3$   
ADULT (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 4.18E-05 | 6.02E-05 | 5.90E-04 | 0.00E-01 | 1.08E-03 | 3.99E 02 | 1.09E-11 |
| RU      | 103  | 1.53E 03 | 0.00E-01 | 6.58E 02 | 0.00E-01 | 5.83E 03 | 5.05E 05 | 1.10E 05 |
| RU      | 105  | 7.90E-01 | 0.00E-01 | 3.11E-01 | 0.00E-01 | 1.02E 00 | 1.10E 04 | 4.82E 04 |
| RU      | 106  | 6.91E 04 | 0.00E-01 | 8.72E 03 | 0.00E-01 | 1.34E 05 | 9.36E 06 | 9.12E 05 |
| AG      | 110M | 1.08E 04 | 1.00E 04 | 5.94E 03 | 0.00E-01 | 1.97E 04 | 4.63E 06 | 3.02E 05 |
| TE      | 125M | 3.42E 03 | 1.58E 03 | 4.67E 02 | 1.05E 03 | 1.24E 04 | 3.14E 05 | 7.06E 04 |
| TE      | 127M | 1.26E 04 | 5.77E 03 | 1.57E 03 | 3.29E 03 | 4.58E 04 | 9.60E 05 | 1.50E 05 |
| TE      | 127  | 1.40E 00 | 6.42E-01 | 3.10E-01 | 1.06E 00 | 5.10E 00 | 6.51E 03 | 5.74E 04 |
| TE      | 129M | 9.76E 03 | 4.67E 03 | 1.58E 03 | 3.44E 03 | 3.66E 04 | 1.16E 06 | 3.83E 05 |
| TE      | 129  | 4.98E-02 | 2.39E-02 | 1.24E-02 | 3.90E-02 | 1.87E-01 | 1.94E 03 | 1.57E 02 |
| TE      | 131M | 6.99E 01 | 4.36E 01 | 2.90E 01 | 5.50E 01 | 3.09E 02 | 1.46E 05 | 5.56E 05 |
| TE      | 131  | 1.11E-02 | 5.95E-03 | 3.59E-03 | 9.36E-02 | 4.37E-02 | 1.39E-03 | 1.84E 01 |
| TE      | 132  | 2.60E 02 | 2.15E 02 | 1.62E 02 | 1.90E 02 | 1.46E 03 | 2.88E 05 | 5.10E 05 |
| I       | 130  | 4.58E 03 | 1.34E 04 | 5.28E 03 | 1.14E 06 | 2.09E 04 | 0.00E-01 | 7.69E 05 |
| I       | 131  | 2.52E 04 | 3.58E 04 | 2.05E 04 | 1.19E 07 | 6.13E 04 | 0.00E-01 | 6.28E 03 |
| I       | 132  | 1.16E 03 | 3.26E 03 | 1.16E 03 | 1.14E 05 | 5.18E 03 | 0.00E-01 | 4.06E 02 |
| I       | 133  | 8.64E 03 | 1.48E 04 | 4.52E 03 | 2.15E 06 | 2.58E 04 | 0.00E-01 | 8.88E 03 |
| I       | 134  | 6.44E 02 | 1.73E 03 | 6.15E 02 | 2.98E 04 | 2.75E 03 | 0.00E-01 | 1.01E 00 |
| I       | 135  | 2.68E 03 | 6.98E 03 | 2.57E 03 | 4.48E 05 | 1.11E 04 | 0.00E-01 | 5.25E 03 |
| CS      | 134  | 3.73E 05 | 8.48E 05 | 7.28E 05 | 0.00E-01 | 2.87E 05 | 9.76E 04 | 1.04E 04 |
| CS      | 136  | 3.90E 04 | 1.46E 05 | 1.10E 05 | 0.00E-01 | 8.56E 04 | 1.20E 04 | 1.17E 04 |
| CS      | 137  | 4.78E 05 | 6.21E 05 | 4.28E 05 | 0.00E-01 | 2.22E 05 | 7.52E 04 | 8.40E 03 |
| CS      | 138  | 3.31E 02 | 6.21E 02 | 3.24E 02 | 0.00E-01 | 4.80E 02 | 4.86E 01 | 1.86E-03 |
| BA      | 139  | 9.36E-01 | 6.66E-04 | 2.74E-02 | 0.00E-01 | 6.22E-04 | 3.76E 03 | 8.96E 02 |
| BA      | 140  | 3.90E 04 | 4.90E 01 | 2.57E 03 | 0.00E-01 | 1.67E 01 | 1.27E 06 | 2.18E 05 |
| BA      | 141  | 1.00E-01 | 7.53E-05 | 3.36E-03 | 0.00E-01 | 7.00E-05 | 1.94E 03 | 1.16E-07 |
| BA      | 142  | 2.63E-02 | 2.70E-05 | 1.66E-03 | 0.00E-01 | 2.29E-05 | 1.19E 03 | 1.57E-16 |
| LA      | 140  | 3.44E 02 | 1.74E 02 | 4.58E 01 | 0.00E-01 | 0.00E-01 | 1.36E 05 | 4.58E 05 |
| LA      | 142  | 6.83E-01 | 3.10E-01 | 7.72E-02 | 0.00E-01 | 0.00E-01 | 6.33E 03 | 2.11E 03 |
| CE      | 141  | 1.99E 04 | 1.35E 04 | 1.53E 03 | 0.00E-01 | 6.26E 03 | 3.62E 05 | 1.20E 05 |
| CE      | 143  | 1.86E 02 | 1.38E 02 | 1.53E 01 | 0.00E-01 | 6.08E 01 | 7.98E 04 | 2.26E 05 |
| CE      | 144  | 3.43E 06 | 1.43E 06 | 1.84E 05 | 0.00E-01 | 8.48E 05 | 7.78E 06 | 8.16E 05 |
| PR      | 143  | 9.36E 03 | 3.75E 03 | 4.64E 02 | 0.00E-01 | 2.16E 03 | 2.81E 05 | 2.00E 05 |
| PR      | 144  | 3.10E-02 | 1.25E-02 | 1.53E-03 | 0.00E-01 | 7.05E-03 | 1.02E 03 | 2.15E-08 |
| ND      | 147  | 5.27E 03 | 6.10E 03 | 3.65E 02 | 0.00E-01 | 3.56E 03 | 2.21E 05 | 1.73E 05 |
| W       | 187  | 8.48E 00 | 7.08E 00 | 2.48E 00 | 0.00E-01 | 0.00E-01 | 2.90E 04 | 1.55E 05 |
| NP      | 239  | 2.30E 02 | 2.26E 01 | 1.24E 01 | 0.00E-01 | 7.00E 01 | 3.76E 04 | 1.19E 05 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-3**  
INHALATION PATHWAY FACTOR  
MREM/YR PER  $\mu\text{Ci}/\text{M}^3$   
TEEN (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 1.27E 03 | 1.27E 03 | 1.27E 03 | 1.27E 03 | 1.27E 03 | 1.27E 03 |
| C       | 14  | 2.60E 04 | 4.87E 03 | 4.87E 03 | 4.87E 03 | 4.87E 03 | 4.87E 03 | 4.87E 03 |
| NA      | 24  | 1.38E 04 | 1.38E 04 | 1.38E 04 | 1.38E 04 | 1.38E 04 | 1.38E 04 | 1.38E 04 |
| P       | 32  | 1.89E 06 | 1.10E 05 | 7.16E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.28E 04 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 1.35E 02 | 7.50E 01 | 3.07E 01 | 2.10E 04 | 3.00E 03 |
| MN      | 54  | 0.00E-01 | 5.11E 04 | 8.40E 03 | 0.00E-01 | 1.27E 04 | 1.98E 06 | 6.68E 04 |
| MN      | 56  | 0.00E-01 | 1.70E 00 | 2.52E-01 | 0.00E-01 | 1.79E 00 | 1.53E 04 | 5.74E 04 |
| FE      | 55  | 3.34E 04 | 2.38E 04 | 5.54E 03 | 0.00E-01 | 0.00E-01 | 1.24E 05 | 6.39E 03 |
| FE      | 59  | 1.59E 04 | 3.70E 04 | 1.43E 04 | 0.00E-01 | 0.00E-01 | 1.53E 06 | 1.78E 05 |
| CO      | 58  | 0.00E-01 | 2.07E 03 | 2.78E 03 | 0.00E-01 | 0.00E-01 | 1.34E 06 | 9.52E 04 |
| CO      | 60  | 0.00E-01 | 1.51E 04 | 1.98E 04 | 0.00E-01 | 0.00E-01 | 8.72E 06 | 2.59E 05 |
| NI      | 63  | 5.80E 05 | 4.34E 04 | 1.98E 04 | 0.00E-01 | 0.00E-01 | 3.07E 05 | 1.42E 04 |
| NI      | 65  | 2.18E 00 | 2.93E-01 | 1.27E-01 | 0.00E-01 | 0.00E-01 | 9.36E 03 | 3.67E 04 |
| CU      | 64  | 0.00E-01 | 2.03E 00 | 8.48E-01 | 0.00E-01 | 6.41E 00 | 1.11E 04 | 6.14E 04 |
| ZN      | 65  | 3.86E 04 | 1.34E 05 | 6.24E 04 | 0.00E-01 | 8.64E 04 | 1.24E 06 | 4.66E 04 |
| ZN      | 69  | 4.83E-02 | 9.20E-02 | 6.46E-03 | 0.00E-01 | 6.02E-02 | 1.58E 03 | 2.85E 02 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 3.44E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.00E-15 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 4.33E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.00E-15 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 1.83E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.00E-15 |
| RB      | 86  | 0.00E-01 | 1.90E 05 | 8.40E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.77E 04 |
| RB      | 88  | 0.00E-01 | 5.46E 02 | 2.72E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.92E-05 |
| RB      | 89  | 0.00E-01 | 3.52E 02 | 2.33E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.38E-07 |
| SR      | 89  | 4.34E 05 | 0.00E-01 | 1.25E 04 | 0.00E-01 | 0.00E-01 | 2.42E 06 | 3.71E 05 |
| SR      | 90  | 1.08E 08 | 0.00E-01 | 6.68E 06 | 0.00E-01 | 0.00E-01 | 1.65E 07 | 7.65E 05 |
| SR      | 91  | 8.80E 01 | 0.00E-01 | 3.51E 00 | 0.00E-01 | 0.00E-01 | 6.07E 04 | 2.59E 05 |
| SR      | 92  | 9.52E 00 | 0.00E-01 | 4.06E-01 | 0.00E-01 | 0.00E-01 | 2.74E 04 | 1.19E 05 |
| Y       | 90  | 2.98E 03 | 0.00E-01 | 8.00E 01 | 0.00E-01 | 0.00E-01 | 2.93E 05 | 5.59E 05 |
| Y       | 91M | 3.70E-01 | 0.00E-01 | 1.42E-02 | 0.00E-01 | 0.00E-01 | 3.20E 03 | 3.02E 01 |
| Y       | 91  | 6.61E 05 | 0.00E-01 | 1.77E 04 | 0.00E-01 | 0.00E-01 | 2.94E 06 | 4.09E 05 |
| Y       | 92  | 1.47E 01 | 0.00E-01 | 4.29E-01 | 0.00E-01 | 0.00E-01 | 2.68E 04 | 1.65E 05 |
| Y       | 93  | 1.35E 02 | 0.00E-01 | 3.72E 00 | 0.00E-01 | 0.00E-01 | 8.32E 04 | 5.79E 05 |
| ZR      | 95  | 1.46E 05 | 4.58E 04 | 3.15E 04 | 0.00E-01 | 6.74E 04 | 2.69E 06 | 1.49E 05 |
| ZR      | 97  | 1.38E 02 | 2.72E 01 | 1.26E 01 | 0.00E-01 | 4.12E 01 | 1.30E 05 | 6.30E 05 |
| NB      | 95  | 1.86E 04 | 1.03E 04 | 5.66E 03 | 0.00E-01 | 1.00E 04 | 7.51E 05 | 9.68E 04 |
| MO      | 99  | 0.00E-01 | 1.69E 02 | 3.22E 01 | 0.00E-01 | 4.11E 02 | 1.54E 05 | 2.69E 05 |
| TC      | 99M | 1.38E-03 | 3.86E-03 | 4.99E-02 | 0.00E-01 | 5.76E-02 | 1.15E 03 | 6.13E 03 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-3 (cont'd)**  
INHALATION PATHWAY FACTOR  
MREM/YR PER  $\mu\text{Ci}/\text{M}^3$   
TEEN (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 5.92E-05 | 8.40E-05 | 8.24E-04 | 0.00E-01 | 1.52E-03 | 6.67E 02 | 8.72E-07 |
| RU      | 103  | 2.10E 03 | 0.00E-01 | 8.96E 02 | 0.00E-01 | 7.43E 03 | 7.83E 05 | 1.09E 05 |
| RU      | 105  | 1.12E 00 | 0.00E-01 | 4.34E-01 | 0.00E-01 | 1.41E 00 | 1.82E 04 | 9.04E 04 |
| RU      | 106  | 9.84E 04 | 0.00E-01 | 1.24E 04 | 0.00E-01 | 1.90E 05 | 1.61E 07 | 9.60E 05 |
| AG      | 110M | 1.38E 04 | 1.31E 04 | 7.99E 03 | 0.00E-01 | 2.50E 04 | 6.75E 06 | 2.73E 05 |
| TE      | 125M | 4.88E 03 | 2.24E 03 | 6.74E 02 | 1.40E 03 | 0.00E-01 | 5.36E 05 | 7.50E 04 |
| TE      | 127M | 1.80E 04 | 8.16E 03 | 2.18E 03 | 4.38E 03 | 6.54E 04 | 1.66E 06 | 1.59E 05 |
| TE      | 127  | 2.01E 00 | 9.12E-01 | 4.42E-01 | 1.42E 00 | 7.28E 00 | 1.12E 04 | 8.08E 01 |
| TE      | 129M | 1.39E 04 | 6.58E 03 | 2.25E 03 | 4.58E 03 | 5.19E 04 | 1.98E 06 | 4.05E 05 |
| TE      | 129  | 7.10E-02 | 3.38E-02 | 1.76E-02 | 5.18E-02 | 2.66E-01 | 3.30E 03 | 1.62E 03 |
| TE      | 131M | 9.84E 01 | 6.01E 01 | 4.20E 01 | 7.25E 01 | 4.39E 02 | 2.38E 05 | 6.21E 05 |
| TE      | 131  | 1.58E-02 | 8.32E-03 | 5.04E-03 | 1.24E-02 | 6.18E-02 | 2.34E 03 | 1.51E 01 |
| TE      | 132  | 3.60E 02 | 2.90E 02 | 2.19E 02 | 2.46E 02 | 1.95E 03 | 4.49E 05 | 4.63E 05 |
| I       | 130  | 6.24E 03 | 1.79E 04 | 7.17E 03 | 1.49E 06 | 2.75E 04 | 0.00E-01 | 9.12E 03 |
| I       | 131  | 3.54E 04 | 4.91E 04 | 2.64E 04 | 1.46E 07 | 8.40E 04 | 0.00E-01 | 6.49E 03 |
| I       | 132  | 1.59E 03 | 4.38E 03 | 1.58E 03 | 1.51E 05 | 6.92E 03 | 0.00E-01 | 1.27E 03 |
| I       | 133  | 1.22E 04 | 2.05E 04 | 6.22E 03 | 2.92E 06 | 3.59E 04 | 0.00E-01 | 1.03E 04 |
| I       | 134  | 8.88E 02 | 2.32E 03 | 8.40E 02 | 3.95E 04 | 3.66E 03 | 0.00E-01 | 2.04E 01 |
| I       | 135  | 3.70E 03 | 9.44E 03 | 3.49E 03 | 6.21E 05 | 1.49E 04 | 0.00E-01 | 6.95E 03 |
| CS      | 134  | 5.02E 05 | 1.13E 06 | 5.49E 05 | 0.00E-01 | 3.75E 05 | 1.46E 05 | 9.76E 03 |
| CS      | 136  | 5.15E 04 | 1.94E 05 | 1.37E 05 | 0.00E-01 | 1.10E 05 | 1.78E 04 | 1.09E 04 |
| CS      | 137  | 6.70E 05 | 8.48E 05 | 3.11E 05 | 0.00E-01 | 3.04E 05 | 1.21E 05 | 8.48E 03 |
| CS      | 138  | 4.66E 02 | 8.56E 02 | 4.46E 02 | 0.00E-01 | 6.62E 02 | 7.87E 01 | 2.70E-01 |
| BA      | 139  | 1.34E 00 | 9.44E-04 | 3.90E-02 | 0.00E-01 | 8.88E-04 | 6.46E 03 | 6.45E 03 |
| BA      | 140  | 5.47E 04 | 6.70E 01 | 3.52E 03 | 0.00E-01 | 2.28E 01 | 2.03E 06 | 2.29E 05 |
| BA      | 141  | 1.42E-01 | 1.06E-04 | 4.74E-03 | 0.00E-01 | 9.84E-05 | 3.29E 03 | 7.46E-04 |
| BA      | 142  | 3.70E-02 | 3.70E-05 | 2.27E-03 | 0.00E-01 | 3.14E-05 | 1.91E 03 | 4.79E-10 |
| LA      | 140  | 4.79E 02 | 2.36E 02 | 6.26E 01 | 0.00E-01 | 0.00E-01 | 2.14E 05 | 4.87E 05 |
| LA      | 142  | 9.60E-01 | 4.25E-01 | 1.06E-01 | 0.00E-01 | 0.00E-01 | 1.02E 04 | 1.20E 04 |
| CE      | 141  | 2.84E 04 | 1.90E 04 | 2.17E 03 | 0.00E-01 | 8.88E 03 | 6.14E 05 | 1.26E 05 |
| CE      | 143  | 2.66E 02 | 1.94E 02 | 2.16E 01 | 0.00E-01 | 8.64E 01 | 1.30E 05 | 2.55E 05 |
| CE      | 144  | 4.89E 06 | 2.02E 06 | 2.62E 05 | 0.00E-01 | 1.21E 06 | 1.34E 07 | 8.64E 05 |
| PR      | 143  | 1.34E 04 | 5.31E 03 | 6.62E 02 | 0.00E-01 | 3.09E 03 | 4.83E 05 | 2.14E 05 |
| PR      | 144  | 4.30E-02 | 1.76E-02 | 2.18E-03 | 0.00E-01 | 1.01E-02 | 1.75E 03 | 2.35E-04 |
| ND      | 147  | 7.86E 03 | 8.56E 03 | 5.13E 02 | 0.00E-01 | 5.02E 03 | 3.72E 05 | 1.82E 05 |
| W       | 187  | 1.20E 01 | 9.76E 00 | 3.43E 00 | 0.00E-01 | 0.00E-01 | 4.74E 04 | 1.77E 05 |
| NP      | 239  | 3.38E 02 | 3.19E 01 | 1.77E 01 | 0.00E-01 | 1.00E 02 | 6.49E 04 | 1.32E 05 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-4**  
INHALATION PATHWAY FACTOR  
MREM/YR PER  $\mu\text{Ci}/\text{M}^3$   
CHILD (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 1.12E 03 | 1.12E 03 | 1.12E 03 | 1.12E 03 | 1.12E 03 | 1.12E 03 |
| C       | 14  | 3.59E 04 | 6.73E 03 | 6.73E 03 | 6.73E 03 | 6.73E 03 | 6.73E 03 | 6.73E 03 |
| NA      | 24  | 1.61E 04 | 1.61E 04 | 1.61E 04 | 1.61E 04 | 1.61E 04 | 1.61E 04 | 1.61E 04 |
| P       | 32  | 2.60E 06 | 1.14E 05 | 9.88E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.22E 04 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 1.54E 02 | 8.55E 01 | 2.43E 01 | 1.70E 04 | 1.08E 03 |
| MN      | 54  | 0.00E-01 | 4.29E 04 | 9.51E 03 | 0.00E-01 | 1.00E 04 | 1.58E 06 | 2.29E 04 |
| MN      | 56  | 0.00E-01 | 1.66E 00 | 3.12E-01 | 0.00E-01 | 1.67E 00 | 1.31E 04 | 1.23E 05 |
| FE      | 55  | 4.74E 04 | 2.52E 04 | 7.77E 03 | 0.00E-01 | 0.00E-01 | 1.11E 05 | 2.87E 03 |
| FE      | 59  | 2.07E 04 | 3.34E 04 | 1.67E 04 | 0.00E-01 | 0.00E-01 | 1.27E 06 | 7.07E 04 |
| CO      | 58  | 0.00E-01 | 1.77E 03 | 3.16E 03 | 0.00E-01 | 0.00E-01 | 1.11E 06 | 3.44E 04 |
| CO      | 60  | 0.00E-01 | 1.31E 04 | 2.26E 04 | 0.00E-01 | 0.00E-01 | 7.07E 06 | 9.62E 04 |
| NI      | 63  | 8.21E 05 | 4.63E 04 | 2.80E 04 | 0.00E-01 | 0.00E-01 | 2.75E 05 | 6.33E 03 |
| NI      | 65  | 2.99E 00 | 2.96E-01 | 1.64E-01 | 0.00E-01 | 0.00E-01 | 8.18E 03 | 8.40E 04 |
| CU      | 64  | 0.00E-01 | 1.99E 00 | 1.07E 00 | 0.00E-01 | 6.03E 00 | 9.58E 03 | 3.67E 04 |
| ZN      | 65  | 4.26E 04 | 1.13E 05 | 7.03E 04 | 0.00E-01 | 7.14E 04 | 9.95E 05 | 1.63E 04 |
| ZN      | 69  | 6.70E-02 | 9.66E-02 | 8.92E-03 | 0.00E-01 | 5.85E-02 | 1.42E 03 | 1.02E 04 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 4.74E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.70E-15 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 5.48E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.70E-15 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 2.53E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.70E-15 |
| RB      | 86  | 0.00E-01 | 1.98E 05 | 1.14E 05 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.99E 03 |
| RB      | 88  | 0.00E-01 | 5.62E 02 | 3.66E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.72E 01 |
| RB      | 89  | 0.00E-01 | 3.45E 02 | 2.90E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.89E 00 |
| SR      | 89  | 5.99E 05 | 0.00E-01 | 1.72E 04 | 0.00E-01 | 0.00E-01 | 2.16E 06 | 1.67E 05 |
| SR      | 90  | 1.01E 08 | 0.00E-01 | 6.44E 06 | 0.00E-01 | 0.00E-01 | 1.48E 07 | 3.43E 05 |
| SR      | 91  | 1.21E 02 | 0.00E-01 | 4.59E 00 | 0.00E-01 | 0.00E-01 | 5.33E 04 | 1.74E 05 |
| SR      | 92  | 1.31E 01 | 0.00E-01 | 5.25E-01 | 0.00E-01 | 0.00E-01 | 2.40E 04 | 2.42E 05 |
| Y       | 90  | 4.11E 03 | 0.00E-01 | 1.11E 02 | 0.00E-01 | 0.00E-01 | 2.62E 05 | 2.68E 05 |
| Y       | 91M | 5.07E-01 | 0.00E-01 | 1.84E-02 | 0.00E-01 | 0.00E-01 | 2.81E 03 | 1.72E 03 |
| Y       | 91  | 9.14E 05 | 0.00E-01 | 2.44E 04 | 0.00E-01 | 0.00E-01 | 2.63E 06 | 1.84E 05 |
| Y       | 92  | 2.04E 01 | 0.00E-01 | 5.81E-01 | 0.00E-01 | 0.00E-01 | 2.39E 04 | 2.39E 05 |
| Y       | 93  | 1.86E 02 | 0.00E-01 | 5.11E 00 | 0.00E-01 | 0.00E-01 | 7.44E 04 | 3.89E 05 |
| ZR      | 95  | 1.90E 05 | 4.18E 04 | 3.70E 04 | 0.00E-01 | 5.96E 04 | 2.23E 06 | 6.11E 04 |
| ZR      | 97  | 1.88E 02 | 2.72E 01 | 1.60E 01 | 0.00E-01 | 3.88E 01 | 1.13E 05 | 3.51E 05 |
| NB      | 95  | 2.35E 04 | 9.18E 03 | 6.55E 03 | 0.00E-01 | 8.62E 03 | 6.14E 05 | 3.70E 04 |
| MO      | 99  | 0.00E-01 | 1.72E 02 | 4.25E 01 | 0.00E-01 | 3.92E 02 | 1.35E 05 | 1.27E 05 |
| TC      | 99M | 1.78E-03 | 3.48E-03 | 5.77E-02 | 0.00E-01 | 5.07E-02 | 9.51E 02 | 4.81E 03 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-4 (cont'd)**  
INHALATION PATHWAY FACTOR  
MREM/YR PER  $\mu\text{Ci}/\text{M}^3$   
CHILD (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 8.10E-05 | 8.51E-05 | 1.08E-03 | 0.00E-01 | 1.45E-03 | 5.85E 02 | 1.63E 01 |
| RU      | 103  | 2.79E 03 | 0.00E-01 | 1.07E 03 | 0.00E-01 | 7.03E 03 | 6.62E 05 | 4.48E 04 |
| RU      | 105  | 1.53E 00 | 0.00E-01 | 5.55E-01 | 0.00E-01 | 1.34E 00 | 1.59E 04 | 9.95E 04 |
| RU      | 106  | 1.36E 05 | 0.00E-01 | 1.69E 04 | 0.00E-01 | 1.84E 05 | 1.43E 07 | 4.29E 05 |
| AG      | 110M | 1.69E 04 | 1.14E 04 | 9.14E 03 | 0.00E-01 | 2.12E 04 | 5.48E 06 | 1.00E 05 |
| TE      | 125M | 6.73E 03 | 2.33E 03 | 9.14E 02 | 1.92E 03 | 0.00E-01 | 4.77E 05 | 3.38E 04 |
| TE      | 127M | 2.49E 04 | 8.55E 03 | 3.02E 03 | 6.07E 03 | 6.36E 04 | 1.48E 06 | 7.14E 04 |
| TE      | 127  | 2.77E 00 | 9.51E-01 | 6.10E-01 | 1.96E 00 | 7.07E 00 | 1.00E 04 | 5.62E 04 |
| TE      | 129M | 1.92E 04 | 6.85E 03 | 3.04E 03 | 6.33E 03 | 5.03E 04 | 1.76E 06 | 1.82E 05 |
| TE      | 129  | 9.77E-02 | 3.50E-02 | 2.38E-02 | 7.14E-02 | 2.57E-01 | 2.93E 03 | 2.55E 04 |
| TE      | 131M | 1.34E 02 | 5.92E 01 | 5.07E 01 | 9.77E 01 | 4.00E 02 | 2.06E 05 | 3.08E 05 |
| TE      | 131  | 2.17E-02 | 8.44E-03 | 6.59E-03 | 1.70E-02 | 5.88E-02 | 2.05E 03 | 1.33E 03 |
| TE      | 132  | 4.81E 02 | 2.72E 02 | 2.63E 02 | 3.17E 02 | 1.77E 03 | 3.77E 05 | 1.38E 05 |
| I       | 130  | 8.18E 03 | 1.64E 04 | 8.44E 03 | 1.85E 06 | 2.45E 04 | 0.00E-01 | 5.11E 03 |
| I       | 131  | 4.81E 04 | 4.81E 04 | 2.73E 04 | 1.62E 07 | 7.88E 04 | 0.00E-01 | 2.84E 03 |
| I       | 132  | 2.12E 03 | 4.07E 03 | 1.88E 03 | 1.94E 05 | 6.25E 03 | 0.00E-01 | 3.20E 03 |
| I       | 133  | 1.66E 04 | 2.03E 04 | 7.70E 03 | 3.85E 06 | 3.38E 04 | 0.00E-01 | 5.48E 03 |
| I       | 134  | 1.17E 03 | 2.16E 03 | 9.95E 02 | 5.07E 04 | 3.30E 03 | 0.00E-01 | 9.55E 02 |
| I       | 135  | 4.92E 03 | 8.73E 03 | 4.14E 03 | 7.92E 05 | 1.34E 04 | 0.00E-01 | 4.44E 03 |
| CS      | 134  | 6.51E 05 | 1.01E 06 | 2.25E 05 | 0.00E-01 | 3.30E 05 | 1.21E 05 | 3.85E 03 |
| CS      | 136  | 6.51E 04 | 1.71E 05 | 1.16E 05 | 0.00E-01 | 9.55E 04 | 1.45E 04 | 4.18E 03 |
| CS      | 137  | 9.07E 05 | 8.25E 05 | 1.28E 05 | 0.00E-01 | 2.82E 05 | 1.04E 05 | 3.62E 03 |
| CS      | 138  | 6.33E 02 | 8.40E 02 | 5.55E 02 | 0.00E-01 | 6.22E 02 | 6.81E 01 | 2.70E 02 |
| BA      | 139  | 1.84E 00 | 9.84E-04 | 5.36E-02 | 0.00E-01 | 8.62E-04 | 5.77E 03 | 5.77E 04 |
| BA      | 140  | 7.40E 04 | 6.48E 01 | 4.33E 03 | 0.00E-01 | 2.11E 01 | 1.74E 06 | 1.02E 05 |
| BA      | 141  | 1.96E-01 | 1.09E-04 | 6.36E-03 | 0.00E-01 | 9.47E-05 | 2.92E 03 | 2.75E 02 |
| BA      | 142  | 4.99E-02 | 3.60E-05 | 2.79E-03 | 0.00E-01 | 2.91E-05 | 1.64E 03 | 2.74E 00 |
| LA      | 140  | 6.44E 02 | 2.25E 02 | 7.55E 01 | 0.00E-01 | 0.00E-01 | 1.83E 05 | 2.26E 05 |
| LA      | 142  | 1.29E 00 | 4.11E-01 | 1.29E-01 | 0.00E-01 | 0.00E-01 | 8.70E 03 | 7.59E 04 |
| CE      | 141  | 3.92E 04 | 1.95E 04 | 2.90E 03 | 0.00E-01 | 8.55E 03 | 5.44E 05 | 5.66E 04 |
| CE      | 143  | 3.66E 02 | 1.99E 02 | 2.87E 01 | 0.00E-01 | 8.36E 01 | 1.15E 05 | 1.27E 05 |
| CE      | 144  | 6.77E 06 | 2.12E 06 | 3.61E 05 | 0.00E-01 | 1.17E 06 | 1.20E 07 | 3.89E 05 |
| PR      | 143  | 1.85E 04 | 5.55E 03 | 9.14E 02 | 0.00E-01 | 3.00E 03 | 4.33E 05 | 9.73E 04 |
| PR      | 144  | 5.96E-02 | 1.85E-02 | 3.00E-03 | 0.00E-01 | 9.77E-03 | 1.57E 03 | 1.97E 02 |
| ND      | 147  | 1.08E 04 | 8.73E 03 | 6.81E 02 | 0.00E-01 | 4.81E 03 | 3.28E 05 | 8.21E 04 |
| W       | 187  | 1.63E 01 | 9.66E 00 | 4.33E 00 | 0.00E-01 | 0.00E-01 | 4.11E 04 | 9.10E 04 |
| NP      | 239  | 4.66E 02 | 3.34E 01 | 2.35E 01 | 0.00E-01 | 9.73E 01 | 5.81E 04 | 6.40E 04 |

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OFFSITE DOSE CALCULATION MANUAL

TABLE A.5-5  
INHALATION PATHWAY FACTOR  
MREM/YR PER  $\mu\text{Ci}/\text{M}^3$   
INFANT (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-ILLI  |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 6.47E 02 | 6.47E 02 | 6.47E 02 | 6.47E 02 | 6.47E 02 | 6.47E 02 |
| C       | 14  | 2.65E 04 | 5.31E 03 | 5.31E 03 | 5.31E 03 | 5.31E 03 | 5.31E 03 | 5.31E 03 |
| NA      | 24  | 1.06E 04 | 1.06E 04 | 1.06E 04 | 1.06E 04 | 1.06E 04 | 1.06E 04 | 1.06E 04 |
| P       | 32  | 2.03E 06 | 1.12E 05 | 7.74E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.61E 04 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 8.95E 01 | 5.75E 01 | 1.32E 01 | 1.28E 04 | 3.57E 02 |
| MN      | 54  | 0.00E-01 | 2.53E 04 | 4.98E 03 | 0.00E-01 | 4.98E 03 | 1.00E 06 | 7.06E 03 |
| MN      | 56  | 0.00E-01 | 1.54E 00 | 2.21E-01 | 0.00E-01 | 1.10E 00 | 1.25E 04 | 7.17E 04 |
| FE      | 55  | 1.97E 04 | 1.17E 04 | 3.33E 03 | 0.00E-01 | 0.00E-01 | 8.69E 04 | 1.09E 03 |
| FE      | 59  | 1.36E 04 | 2.35E 04 | 9.48E 03 | 0.00E-01 | 0.00E-01 | 1.02E 06 | 2.48E 04 |
| CO      | 58  | 0.00E-01 | 1.22E 03 | 1.82E 03 | 0.00E-01 | 0.00E-01 | 7.77E 05 | 1.11E 04 |
| CO      | 60  | 0.00E-01 | 8.02E 03 | 1.18E 04 | 0.00E-01 | 0.00E-01 | 4.51E 06 | 3.19E 04 |
| NI      | 63  | 3.39E 05 | 2.04E 04 | 1.16E 04 | 0.00E-01 | 0.00E-01 | 2.09E 05 | 2.42E 03 |
| NI      | 65  | 2.39E 00 | 2.84E-01 | 1.23E-01 | 0.00E-01 | 0.00E-01 | 8.12E 03 | 5.01E 04 |
| CU      | 64  | 0.00E-01 | 1.88E 00 | 7.74E-01 | 0.00E-01 | 3.98E 00 | 9.30E 03 | 1.50E 04 |
| ZN      | 65  | 1.93E 04 | 6.26E 04 | 3.11E 04 | 0.00E-01 | 3.25E 04 | 6.47E 05 | 5.14E 04 |
| ZN      | 69  | 5.39E-02 | 9.67E-02 | 7.18E-03 | 0.00E-01 | 4.02E-02 | 1.47E 03 | 1.32E 04 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 3.81E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.40E-15 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 4.00E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.40E-15 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 2.04E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.40E-15 |
| RB      | 86  | 0.00E-01 | 1.90E 05 | 8.82E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.04E 03 |
| RB      | 88  | 0.00E-01 | 5.57E 02 | 2.87E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.39E 02 |
| RB      | 89  | 0.00E-01 | 3.21E 02 | 2.06E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.82E 01 |
| SR      | 89  | 3.98E 05 | 0.00E-01 | 1.14E 04 | 0.00E-01 | 0.00E-01 | 2.03E 06 | 6.40E 04 |
| SR      | 90  | 4.09E 07 | 0.00E-01 | 2.59E 06 | 0.00E-01 | 0.00E-01 | 1.12E 07 | 1.31E 05 |
| SR      | 91  | 9.56E 01 | 0.00E-01 | 3.46E 00 | 0.00E-01 | 0.00E-01 | 5.26E 04 | 7.34E 04 |
| SR      | 92  | 1.05E 01 | 0.00E-01 | 3.91E-01 | 0.00E-01 | 0.00E-01 | 2.38E 04 | 1.40E 05 |
| Y       | 90  | 3.29E 03 | 0.00E-01 | 8.82E 01 | 0.00E-01 | 0.00E-01 | 2.69E 05 | 1.04E 05 |
| Y       | 91M | 4.07E-01 | 0.00E-01 | 1.39E-02 | 0.00E-01 | 0.00E-01 | 2.79E 03 | 2.35E 03 |
| Y       | 91  | 5.88E 05 | 0.00E-01 | 1.57E 04 | 0.00E-01 | 0.00E-01 | 2.45E 06 | 7.03E 04 |
| Y       | 92  | 1.64E 01 | 0.00E-01 | 4.61E-01 | 0.00E-01 | 0.00E-01 | 2.45E 04 | 1.27E-05 |
| Y       | 93  | 1.50E 02 | 0.00E-01 | 4.07E 00 | 0.00E-01 | 0.00E-01 | 7.64E 04 | 1.67E 05 |
| ZR      | 95  | 1.15E 05 | 2.79E 04 | 2.03E 04 | 0.00E-01 | 3.11E 04 | 1.75E 06 | 2.17E 04 |
| ZR      | 97  | 1.50E 02 | 2.56E 01 | 1.17E 01 | 0.00E-01 | 2.59E 01 | 1.10E 05 | 1.40E 05 |
| NB      | 95  | 1.57E 04 | 6.43E 03 | 3.78E 03 | 0.00E-01 | 4.72E 03 | 4.79E 05 | 1.27E 04 |
| MO      | 99  | 0.00E-01 | 1.65E 02 | 3.23E 01 | 0.00E-01 | 2.65E 02 | 1.35E 05 | 4.87E 04 |
| TC      | 99M | 1.40E-04 | 2.88E-03 | 3.72E-02 | 0.00E-01 | 3.11E-02 | 8.11E 02 | 2.03E 03 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-5 (cont'd)**  
INHALATION PATHWAY FACTOR  
MREM/YR PER  $\mu\text{Ci}/\text{M}^3$   
INFANT (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 6.51E-05 | 8.23E-05 | 8.12E-04 | 0.00E-01 | 9.79E-04 | 5.84E 02 | 8.44E 02 |
| RU      | 103  | 2.02E 03 | 0.00E-01 | 6.79E 02 | 0.00E-01 | 4.24E 03 | 5.52E 05 | 1.61E 04 |
| RU      | 105  | 1.22E 00 | 0.00E-01 | 4.10E-01 | 0.00E-01 | 8.99E-01 | 1.57E 04 | 4.84E 04 |
| RU      | 106  | 8.68E 04 | 0.00E-01 | 1.09E 04 | 0.00E-01 | 1.07E 05 | 1.16E 07 | 1.64E 05 |
| AG      | 110M | 9.98E 03 | 7.22E 03 | 5.00E 03 | 0.00E-01 | 1.09E 04 | 3.67E 06 | 3.30E 04 |
| TE      | 125M | 4.76E 03 | 1.99E 03 | 6.58E 02 | 1.62E 03 | 0.00E-01 | 4.47E 05 | 1.29E 04 |
| TE      | 127M | 1.67E 04 | 6.90E 03 | 2.07E 03 | 4.87E 03 | 3.75E 04 | 1.31E 06 | 2.73E 04 |
| TE      | 127  | 2.23E 00 | 9.53E-01 | 4.89E-01 | 1.85E 00 | 4.86E 00 | 1.03E 04 | 2.44E 04 |
| TE      | 129M | 1.41E 04 | 6.09E 03 | 2.23E 03 | 5.47E 03 | 3.18E 04 | 1.68E 06 | 6.90E 04 |
| TE      | 129  | 7.88E-02 | 3.47E-02 | 1.88E-02 | 6.75E-02 | 1.75E-01 | 3.00E 03 | 2.63E 04 |
| TE      | 131M | 1.07E 02 | 5.50E 01 | 3.63E 01 | 8.93E 01 | 2.65E 02 | 1.99E 05 | 1.19E 05 |
| TE      | 131  | 1.74E-02 | 8.22E-03 | 5.00E-03 | 1.58E-02 | 3.99E-02 | 2.06E 03 | 8.22E 03 |
| TE      | 132  | 3.72E 02 | 2.37E 02 | 1.76E 02 | 2.79E 02 | 1.03E 03 | 3.40E 05 | 4.41E 04 |
| I       | 130  | 6.36E 03 | 1.39E 04 | 5.57E 03 | 1.60E 06 | 1.53E 04 | 0.00E-01 | 1.99E 03 |
| I       | 131  | 3.79E 04 | 4.44E 04 | 1.96E 04 | 1.48E 07 | 5.18E 04 | 0.00E-01 | 1.06E 03 |
| I       | 132  | 1.69E 03 | 3.54E 03 | 1.26E 03 | 1.69E 05 | 3.95E 03 | 0.00E-01 | 1.90E 03 |
| I       | 133  | 1.32E 04 | 1.92E 04 | 5.60E 03 | 3.56E 06 | 2.24E 04 | 0.00E-01 | 2.16E 03 |
| I       | 134  | 9.21E 02 | 1.88E 03 | 6.65E 02 | 4.45E 04 | 2.09E 03 | 0.00E-01 | 1.29E 03 |
| I       | 135  | 3.86E 03 | 7.60E 03 | 2.77E 03 | 6.96E 05 | 8.47E 03 | 0.00E-01 | 1.83E 03 |
| CS      | 134  | 3.96E 05 | 7.03E 05 | 7.45E 04 | 0.00E-01 | 1.90E 05 | 7.97E 04 | 1.33E 03 |
| CS      | 136  | 4.83E 04 | 1.35E 05 | 5.29E 04 | 0.00E-01 | 5.64E 04 | 1.18E 04 | 1.43E 03 |
| CS      | 137  | 5.49E 05 | 6.12E 05 | 4.55E 04 | 0.00E-01 | 1.72E 05 | 7.13E 04 | 1.33E 03 |
| CS      | 138  | 5.05E 02 | 7.81E 02 | 3.98E 02 | 0.00E-01 | 4.10E 02 | 6.54E 01 | 8.76E 02 |
| BA      | 139  | 1.48E 00 | 9.84E-04 | 4.30E-02 | 0.00E-01 | 5.92E-04 | 5.95E 03 | 5.10E 04 |
| BA      | 140  | 5.60E 04 | 5.60E 01 | 2.90E 03 | 0.00E-01 | 1.34E 01 | 1.60E 06 | 3.84E 04 |
| BA      | 141  | 1.57E-01 | 1.08E-04 | 4.97E-03 | 0.00E-01 | 6.50E-05 | 2.97E 03 | 4.75E 03 |
| BA      | 142  | 3.98E-02 | 3.30E-05 | 1.96E-03 | 0.00E-01 | 1.90E-05 | 1.55E 03 | 6.93E 02 |
| LA      | 140  | 5.05E 02 | 2.00E 02 | 5.15E 01 | 0.00E-01 | 0.00E-01 | 1.68E 05 | 8.48E 04 |
| LA      | 142  | 1.03E 00 | 3.77E-01 | 9.04E-02 | 0.00E-01 | 0.00E-01 | 8.22E 03 | 5.95E 04 |
| CE      | 141  | 2.77E 04 | 1.67E 04 | 1.99E 03 | 0.00E-01 | 5.25E 03 | 5.17E 05 | 2.16E 04 |
| CE      | 143  | 2.93E 02 | 1.93E 02 | 2.21E 01 | 0.00E-01 | 5.64E 01 | 1.16E 05 | 4.97E 04 |
| CE      | 144  | 3.19E 06 | 1.21E 06 | 1.76E 05 | 0.00E-01 | 5.38E 05 | 9.84E 06 | 1.48E 05 |
| PR      | 143  | 1.40E 04 | 5.24E 03 | 6.99E 02 | 0.00E-01 | 1.97E 03 | 4.33E 05 | 3.72E 04 |
| PR      | 144  | 4.79E-02 | 1.85E-02 | 2.41E-03 | 0.00E-01 | 6.72E-03 | 1.61E 03 | 4.28E 03 |
| ND      | 147  | 7.94E 03 | 8.13E 03 | 5.00E 02 | 0.00E-01 | 3.15E 03 | 3.22E 05 | 3.12E 04 |
| W       | 187  | 1.30E 01 | 9.02E 00 | 3.12E 00 | 0.00E-01 | 0.00E-01 | 3.96E 05 | 3.56E 04 |
| NP      | 239  | 3.71E 02 | 3.32E 01 | 1.88E 01 | 0.00E-01 | 6.62E 01 | 5.95E 04 | 2.49E 04 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-6**  
GRASS-COW-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
ADULT (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 7.63E 02 | 7.63E 02 | 7.63E 02 | 7.63E 02 | 7.63E 02 | 7.63E 02 |
| C       | 14  | 2.63E 08 | 5.27E 07 | 5.27E 07 | 5.27E 07 | 5.27E 07 | 5.27E 07 | 5.27E 07 |
| NA      | 24  | 2.44E 06 | 2.44E 06 | 2.44E 06 | 2.44E 06 | 2.44E 06 | 2.44E 06 | 2.44E 06 |
| P       | 32  | 1.71E 10 | 1.06E 09 | 6.60E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.92E 09 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 2.86E 04 | 0.00E-01 | 6.30E 03 | 3.79E 04 | 7.19E 06 |
| MN      | 54  | 0.00E-01 | 8.41E 06 | 1.61E 06 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.58E 07 |
| MN      | 56  | 0.00E-01 | 4.16E-03 | 7.38E-04 | 0.00E-01 | 5.28E-03 | 0.00E-01 | 1.33E-01 |
| FE      | 55  | 2.51E 07 | 1.73E 07 | 4.04E 06 | 0.00E-01 | 0.00E-01 | 9.67E 06 | 9.95E 06 |
| FE      | 59  | 2.97E 07 | 6.98E 07 | 2.68E 07 | 0.00E-01 | 0.00E-01 | 1.95E 07 | 2.33E 08 |
| CO      | 58  | 0.00E-01 | 4.71E 06 | 1.06E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.56E 07 |
| CO      | 60  | 0.00E-01 | 1.64E 07 | 3.62E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.08E 08 |
| NI      | 63  | 6.73E 09 | 4.71E 08 | 2.26E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.73E 07 |
| NI      | 65  | 4.63E-01 | 6.02E-02 | 2.75E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.53E 00 |
| CU      | 64  | 0.00E-01 | 2.39E 04 | 1.12E 04 | 0.00E-01 | 6.02E 04 | 0.00E-01 | 2.03E 06 |
| ZN      | 65  | 1.37E 09 | 4.37E 09 | 1.97E 09 | 0.00E-01 | 2.92E 09 | 0.00E-01 | 2.75E 09 |
| ZN      | 69  | 5.22E-12 | 9.99E-12 | 6.95E-13 | 0.00E-01 | 6.49E-12 | 0.00E-01 | 1.50E-12 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 86  | 0.00E-01 | 2.59E 09 | 1.21E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.12E 08 |
| RB      | 88  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 89  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| SR      | 89  | 1.45E 09 | 0.00E-01 | 4.16E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.33E 08 |
| SR      | 90  | 4.68E 10 | 0.00E-01 | 1.15E 10 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.35E 09 |
| SR      | 91  | 2.87E 04 | 0.00E-01 | 1.16E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.37E 05 |
| SR      | 92  | 4.90E-01 | 0.00E-01 | 2.12E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.70E 00 |
| Y       | 90  | 7.07E 01 | 0.00E-01 | 1.90E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.50E 05 |
| Y       | 91M | 6.03E-20 | 0.00E-01 | 2.34E-21 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.77E-19 |
| Y       | 91  | 8.59E 03 | 0.00E-01 | 2.30E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.73E 06 |
| Y       | 92  | 5.59E-05 | 0.00E-01 | 1.63E-06 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.79E-01 |
| Y       | 93  | 2.33E-01 | 0.00E-01 | 6.44E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.39E 03 |
| ZR      | 95  | 9.44E 02 | 3.03E 02 | 2.05E 02 | 0.00E-01 | 4.75E 02 | 0.00E-01 | 9.59E 05 |
| ZR      | 97  | 4.33E-01 | 8.75E-05 | 4.00E-02 | 0.00E-01 | 1.32E-00 | 0.00E-01 | 2.71E 04 |
| NB      | 95  | 8.26E 04 | 4.59E 04 | 2.47E 04 | 0.00E-01 | 4.54E 04 | 0.00E-01 | 2.79E 08 |
| MO      | 99  | 0.00E-01 | 2.48E 07 | 4.71E 06 | 0.00E-01 | 5.61E 07 | 0.00E-01 | 5.74E 07 |
| TC      | 99M | 3.33E 00 | 9.40E 00 | 1.20E 02 | 0.00E-01 | 1.43E 02 | 4.60E 00 | 5.56E 03 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-6 (cont'd)**  
GRASS-COW-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
ADULT (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RU      | 103  | 1.02E 03 | 0.00E-01 | 4.38E 02 | 0.00E-01 | 3.88E 03 | 0.00E-01 | 1.19E 05 |
| RU      | 105  | 8.58E-04 | 0.00E-01 | 3.39E-04 | 0.00E-01 | 1.11E-02 | 0.00E-01 | 5.25E-01 |
| RU      | 106  | 2.04E 04 | 0.00E-01 | 2.58E 03 | 0.00E-01 | 3.94E 04 | 0.00E-01 | 1.32E 06 |
| AG      | 110M | 5.82E 07 | 5.39E 07 | 3.20E 07 | 0.00E-01 | 1.06E 08 | 0.00E-01 | 2.20E 10 |
| TE      | 125M | 1.63E 07 | 5.90E 06 | 2.18E 06 | 4.90E 06 | 6.63E 07 | 0.00E-01 | 6.50E 07 |
| TE      | 127M | 4.58E 07 | 1.64E 07 | 5.58E 06 | 1.17E 07 | 1.86E 08 | 0.00E-01 | 1.54E 08 |
| TE      | 127  | 6.54E 02 | 2.35E 02 | 1.41E 02 | 4.84E 02 | 2.66E 03 | 0.00E-01 | 5.16E 04 |
| TE      | 129M | 6.02E 07 | 2.25E 07 | 9.53E 06 | 2.07E 07 | 2.51E 08 | 0.00E-01 | 3.03E 08 |
| TE      | 129  | 2.84E-10 | 1.07E-10 | 6.29E-11 | 2.18E-10 | 1.19E-09 | 0.00E-01 | 2.14E-10 |
| TE      | 131M | 3.61E 05 | 1.77E 05 | 1.47E 05 | 2.80E 05 | 1.79E 06 | 0.00E-01 | 1.73E 07 |
| TE      | 131  | 3.67E-33 | 1.53E-33 | 1.16E-33 | 3.01E-33 | 1.61E-32 | 0.00E-01 | 0.00E-01 |
| TE      | 132  | 2.40E 06 | 1.55E 06 | 1.46E 06 | 1.72E 06 | 1.50E 07 | 0.00E-01 | 7.35E 07 |
| I       | 130  | 4.20E 05 | 1.24E 06 | 4.89E 05 | 1.05E 08 | 1.94E 06 | 0.00E-01 | 1.07E 06 |
| I       | 131  | 2.96E 08 | 4.24E 08 | 2.43E 08 | 1.39E 11 | 7.26E 08 | 0.00E-01 | 1.12E 08 |
| I       | 132  | 1.65E-01 | 4.41E-01 | 1.54E-01 | 1.54E 01 | 7.02E-01 | 0.00E-01 | 8.28E-02 |
| I       | 133  | 3.87E 06 | 6.73E 06 | 2.05E 06 | 9.90E 08 | 1.18E 07 | 0.00E-01 | 6.05E 06 |
| I       | 134  | 2.03E-12 | 5.52E-12 | 1.98E-12 | 9.57E-11 | 8.78E-12 | 0.00E-01 | 4.81E-15 |
| I       | 135  | 1.29E 04 | 3.37E 04 | 1.24E 04 | 2.22E 06 | 5.40E 04 | 0.00E-01 | 3.80E 04 |
| CS      | 134  | 5.65E 09 | 1.35E 10 | 1.10E 10 | 0.00E-01 | 4.35E 09 | 1.45E 09 | 2.35E 08 |
| CS      | 136  | 2.61E 08 | 1.03E 09 | 7.42E 08 | 0.00E-01 | 5.73E 08 | 7.86E 07 | 1.17E 08 |
| CS      | 137  | 7.38E 09 | 1.01E 10 | 6.61E 09 | 0.00E-01 | 3.43E 09 | 1.14E 09 | 1.95E 08 |
| CS      | 138  | 9.16E-24 | 1.81E-23 | 8.97E-24 | 0.00E-01 | 1.33E-23 | 1.31E-24 | 7.72E-29 |
| BA      | 139  | 4.56E-08 | 3.25E-11 | 1.34E-09 | 0.00E-01 | 3.04E-11 | 1.84E-11 | 8.09E-08 |
| BA      | 140  | 2.69E 07 | 3.38E 04 | 1.76E 06 | 0.00E-01 | 1.15E 04 | 1.93E 04 | 5.54E 07 |
| BA      | 141  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 4.52E 00 | 2.28E 00 | 6.02E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.67E 05 |
| LA      | 142  | 9.39E-12 | 4.27E-12 | 1.06E-12 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.12E-08 |
| CE      | 141  | 4.84E 03 | 3.28E 03 | 3.72E 02 | 0.00E-01 | 1.52E 03 | 0.00E-01 | 1.25E 07 |
| CE      | 143  | 4.16E 01 | 3.07E 04 | 3.40E 00 | 0.00E-01 | 1.35E 01 | 0.00E-01 | 1.15E 06 |
| CE      | 144  | 3.58E 05 | 1.50E 05 | 1.92E 04 | 0.00E-01 | 8.87E 04 | 0.00E-01 | 1.21E 08 |
| PR      | 143  | 1.58E 02 | 6.33E 01 | 7.83E 00 | 0.00E-01 | 3.66E 01 | 0.00E-01 | 6.92E 05 |
| PR      | 144  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| ND      | 147  | 9.46E 01 | 1.09E 02 | 6.55E 00 | 0.00E-01 | 6.40E 01 | 0.00E-01 | 5.25E 05 |
| W       | 187  | 6.56E 03 | 5.49E 03 | 1.92E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.80E 06 |
| NP      | 239  | 3.67E 00 | 3.61E-01 | 1.99E-01 | 0.00E-01 | 1.13E 00 | 0.00E-01 | 7.41E 04 |

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OFFSITE DOSE CALCULATION MANUAL

TABLE A.5-7  
GRASS-COW-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
TEEN (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 9.94E 02 | 9.94E 02 | 9.94E 02 | 9.94E 02 | 9.94E 02 | 9.94E 02 |
| C       | 14  | 4.86E 08 | 9.72E 07 | 9.72E 07 | 9.72E 07 | 9.72E 07 | 9.72E 07 | 9.72E 07 |
| NA      | 24  | 4.26E 06 | 4.26E 06 | 4.26E 06 | 4.26E 06 | 4.26E 06 | 4.26E 06 | 4.26E 06 |
| P       | 32  | 3.15E 10 | 1.95E 09 | 1.22E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.65E 09 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 4.99E 04 | 2.77E 04 | 1.09E 04 | 7.13E 04 | 8.39E 06 |
| MN      | 54  | 0.00E-01 | 1.40E 07 | 2.78E 06 | 0.00E-01 | 4.18E 06 | 0.00E-01 | 2.87E 07 |
| MN      | 56  | 0.00E-01 | 7.37E-03 | 1.31E-03 | 0.00E-01 | 9.33E-03 | 0.00E-01 | 4.85E-01 |
| FE      | 55  | 4.45E 07 | 3.16E 07 | 7.36E 06 | 0.00E-01 | 0.00E-01 | 2.00E 07 | 1.37E 07 |
| FE      | 59  | 5.18E 07 | 1.21E 08 | 4.67E 07 | 0.00E-01 | 0.00E-01 | 3.81E 07 | 2.86E 08 |
| CO      | 58  | 0.00E-01 | 7.94E 06 | 1.83E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.09E 08 |
| CO      | 60  | 0.00E-01 | 2.78E 07 | 6.26E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.62E 08 |
| NI      | 63  | 1.18E 10 | 8.35E 08 | 4.01E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.33E 08 |
| NI      | 65  | 8.48E-01 | 1.08E-01 | 4.94E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.88E 00 |
| CU      | 64  | 0.00E-01 | 4.25E 04 | 2.00E 04 | 0.00E-01 | 1.08E 05 | 0.00E-01 | 3.30E 06 |
| ZN      | 65  | 2.11E 09 | 7.31E 09 | 3.41E 09 | 0.00E-01 | 4.68E 09 | 0.00E-01 | 3.10E 09 |
| ZN      | 69  | 9.62E-12 | 1.83E-11 | 1.28E-12 | 0.00E-01 | 1.20E-11 | 0.00E-01 | 3.38E-11 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 86  | 0.00E-01 | 4.73E 09 | 2.22E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.00E 08 |
| RB      | 88  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 89  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| SR      | 89  | 2.67E 09 | 0.00E-01 | 7.66E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.19E 08 |
| SR      | 90  | 6.61E 10 | 0.00E-01 | 1.63E 10 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.86E 09 |
| SR      | 91  | 5.27E 04 | 0.00E-01 | 2.10E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.39E 05 |
| SR      | 92  | 8.96E-01 | 0.00E-01 | 3.82E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.28E 01 |
| Y       | 90  | 1.30E 02 | 0.00E-01 | 3.50E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.07E 06 |
| Y       | 91M | 1.11E-19 | 0.00E-01 | 4.22E-21 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.22E-18 |
| Y       | 91  | 1.58E 04 | 0.00E-01 | 4.24E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.48E 06 |
| Y       | 92  | 1.03E-04 | 0.00E-01 | 2.99E-06 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.83E 00 |
| Y       | 93  | 4.30E-01 | 0.00E-01 | 1.18E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.31E 04 |
| ZR      | 95  | 1.65E 03 | 5.21E 02 | 3.58E 02 | 0.00E-01 | 7.65E 02 | 0.00E-01 | 1.20E 06 |
| ZR      | 97  | 7.89E-01 | 1.56E-01 | 7.19E-02 | 0.00E-01 | 2.37E-01 | 0.00E-01 | 4.23E 04 |
| NB      | 95  | 1.41E 05 | 7.81E 04 | 4.30E 04 | 0.00E-01 | 7.57E 04 | 0.00E-01 | 3.34E 08 |
| MO      | 99  | 0.00E-01 | 4.47E 07 | 8.53E 06 | 0.00E-01 | 1.02E 08 | 0.00E-01 | 8.01E 07 |
| TC      | 99M | 5.77E 00 | 1.61E 01 | 2.08E 02 | 0.00E-01 | 2.40E 02 | 8.93E 00 | 1.06E 04 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-7 (cont'd)**  
GRASS-COW-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
TEEN (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RU      | 103  | 1.81E 03 | 0.00E-01 | 7.74E 02 | 0.00E-01 | 6.38E 03 | 0.00E-01 | 1.51E 05 |
| RU      | 105  | 1.57E-03 | 0.00E-01 | 6.08E-04 | 0.00E-01 | 1.98E-02 | 0.00E-01 | 1.27E 00 |
| RU      | 106  | 3.75E 04 | 0.00E-01 | 4.73E 03 | 0.00E-01 | 7.23E 04 | 0.00E-01 | 1.80E 06 |
| AG      | 110M | 9.63E 07 | 9.11E 07 | 5.54E 07 | 0.00E-01 | 1.74E 08 | 0.00E-01 | 2.56E 10 |
| TE      | 125M | 3.00E 07 | 1.08E 07 | 4.02E 06 | 8.39E 06 | 0.00E-01 | 0.00E-01 | 8.86E 07 |
| TE      | 127M | 8.44E 07 | 2.99E 07 | 1.00E 07 | 2.01E 07 | 3.42E 08 | 0.00E-01 | 2.10E 08 |
| TE      | 127  | 1.21E 03 | 4.29E 02 | 2.61E 02 | 8.36E 02 | 4.91E 03 | 0.00E-01 | 9.35E 04 |
| TE      | 129M | 1.10E 08 | 4.09E 07 | 1.74E 07 | 3.55E 07 | 4.61E 08 | 0.00E-01 | 4.13E 08 |
| TE      | 129  | 5.23E-10 | 1.95E-10 | 1.27E-10 | 3.74E-10 | 2.20E-09 | 0.00E-01 | 2.86E-09 |
| TE      | 131M | 6.57E 05 | 3.15E 05 | 2.63E 05 | 4.74E 05 | 3.29E 06 | 0.00E-01 | 2.53E 07 |
| TE      | 131  | 6.70E-33 | 2.76E-33 | 2.09E-33 | 5.16E-33 | 2.93E-32 | 0.00E-01 | 5.50E-34 |
| TE      | 132  | 4.29E 06 | 2.72E 06 | 2.56E 06 | 2.87E 06 | 2.61E 07 | 0.00E-01 | 8.61E 07 |
| I       | 130  | 7.39E 05 | 2.14E 06 | 8.54E 05 | 1.74E 08 | 3.26E 06 | 0.00E-01 | 1.64E 06 |
| I       | 131  | 5.37E 08 | 7.52E 08 | 4.04E 08 | 2.20E 11 | 1.30E 09 | 0.00E-01 | 1.49E 08 |
| I       | 132  | 2.92E-01 | 7.65E-01 | 2.74E-01 | 2.58E 01 | 1.20E 00 | 0.00E-01 | 3.33E-01 |
| I       | 133  | 7.07E 06 | 1.20E 07 | 3.66E 06 | 1.67E 09 | 2.10E 07 | 0.00E-01 | 9.08E 06 |
| I       | 134  | 3.61E-12 | 9.58E-12 | 3.44E-12 | 1.60E-10 | 1.51E-11 | 0.00E-01 | 1.26E-13 |
| I       | 135  | 2.28E 04 | 5.88E 04 | 2.18E 04 | 3.78E 06 | 9.28E 04 | 0.00E-01 | 6.51E 04 |
| CS      | 134  | 9.82E 09 | 2.31E 10 | 1.07E 10 | 0.00E-01 | 7.34E 09 | 2.80E 09 | 2.87E 08 |
| CS      | 136  | 4.44E 08 | 1.75E 09 | 1.17E 09 | 0.00E-01 | 9.52E 08 | 1.50E 08 | 1.41E 08 |
| CS      | 137  | 1.34E 10 | 1.78E 10 | 6.20E 09 | 0.00E-01 | 6.06E 09 | 2.35E 09 | 2.53E 08 |
| CS      | 138  | 1.66E-23 | 3.19E-23 | 1.60E-23 | 0.00E-01 | 2.36E-23 | 2.74E-24 | 1.45E-26 |
| BA      | 139  | 8.44E-08 | 5.94E-11 | 2.46E-09 | 0.00E-01 | 5.60E-11 | 4.09E-11 | 7.53E-07 |
| BA      | 140  | 4.85E 07 | 5.95E 04 | 3.13E 06 | 0.00E-01 | 2.02E 04 | 4.00E 04 | 7.48E 07 |
| BA      | 141  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 8.12E 00 | 3.99E 00 | 1.06E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.29E 05 |
| LA      | 142  | 1.69E-11 | 7.52E-12 | 1.87E-12 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.29E-07 |
| CE      | 141  | 8.88E 03 | 5.93E 03 | 6.81E 02 | 0.00E-01 | 2.79E 03 | 0.00E-01 | 1.70E 07 |
| CE      | 143  | 7.64E 01 | 5.56E 04 | 6.21E 00 | 0.00E-01 | 2.49E 01 | 0.00E-01 | 1.67E 06 |
| CE      | 144  | 6.58E 05 | 2.72E 05 | 3.54E 04 | 0.00E-01 | 1.63E 05 | 0.00E-01 | 1.66E 08 |
| PR      | 143  | 2.90E 02 | 1.16E 02 | 1.44E 01 | 0.00E-01 | 6.73E 01 | 0.00E-01 | 9.55E 05 |
| PR      | 144  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| ND      | 147  | 1.82E 02 | 1.98E 02 | 1.19E 01 | 0.00E-01 | 1.16E 02 | 0.00E-01 | 7.15E 05 |
| W       | 187  | 1.20E 04 | 9.78E 03 | 3.43E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.65E 06 |
| NP      | 239  | 7.01E 00 | 6.61E-01 | 3.67E-01 | 0.00E-01 | 2.07E 00 | 0.00E-01 | 1.06E 05 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-8**  
GRASS-COW-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
CHILD (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 1.57E 03 | 1.57E 03 | 1.57E 03 | 1.57E 03 | 1.57E 03 | 1.57E 03 |
| C       | 14  | 1.19E 09 | 2.39E 08 | 2.39E 08 | 2.39E 08 | 2.39E 08 | 2.39E 08 | 2.39E 08 |
| NA      | 24  | 8.86E 06 | 8.86E 06 | 8.86E 06 | 8.86E 06 | 8.86E 06 | 8.86E 06 | 8.86E 06 |
| P       | 32  | 7.77E 10 | 3.64E 09 | 3.00E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.15E 09 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 1.02E 05 | 5.65E 04 | 1.54E 04 | 1.03E 05 | 5.40E 06 |
| MN      | 54  | 0.00E-01 | 2.10E 07 | 5.59E 06 | 0.00E-01 | 5.88E 06 | 0.00E-01 | 1.76E 07 |
| MN      | 56  | 0.00E-01 | 1.29E-02 | 2.90E-03 | 0.00E-01 | 1.56E-02 | 0.00E-01 | 1.86E 00 |
| FE      | 55  | 1.12E 08 | 5.93E 07 | 1.84E 07 | 0.00E-01 | 0.00E-01 | 3.35E 07 | 1.10E 07 |
| FE      | 59  | 1.20E 08 | 1.94E 08 | 9.69E 07 | 0.00E-01 | 0.00E-01 | 5.64E 07 | 2.02E 08 |
| CO      | 58  | 0.00E-01 | 1.21E 07 | 3.71E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.07E 07 |
| CO      | 60  | 0.00E-01 | 4.32E 07 | 1.27E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.39E 08 |
| NI      | 63  | 2.96E 10 | 1.59E 09 | 1.01E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.07E 08 |
| NI      | 65  | 2.07E 00 | 1.95E-01 | 1.14E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.39E 01 |
| CU      | 64  | 0.00E-01 | 7.47E 04 | 4.51E 04 | 0.00E-01 | 1.81E 05 | 0.00E-01 | 3.51E 06 |
| ZN      | 65  | 4.13E 09 | 1.10E 10 | 6.85E 09 | 0.00E-01 | 6.94E 09 | 0.00E-01 | 1.93E 09 |
| ZN      | 69  | 2.36E-11 | 3.42E-11 | 3.16E-12 | 0.00E-01 | 2.07E-10 | 0.00E-01 | 2.15E-09 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 86  | 0.00E-01 | 8.77E 09 | 5.39E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.64E 08 |
| RB      | 88  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 89  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| SR      | 89  | 6.62E 09 | 0.00E-01 | 1.89E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.56E 08 |
| SR      | 90  | 1.12E 11 | 0.00E-01 | 2.83E 10 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.50E 09 |
| SR      | 91  | 1.29E 05 | 0.00E-01 | 4.88E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.85E 05 |
| SR      | 92  | 2.19E 00 | 0.00E-01 | 8.78E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.15E 01 |
| Y       | 90  | 3.22E 02 | 0.00E-01 | 8.61E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.15E 05 |
| Y       | 91M | 2.70E-19 | 0.00E-01 | 9.82E-21 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.29E-16 |
| Y       | 91  | 3.90E 04 | 0.00E-01 | 1.04E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.20E 06 |
| Y       | 92  | 2.54E-04 | 0.00E-01 | 7.26E-06 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.33E 00 |
| Y       | 93  | 1.06E 00 | 0.00E-01 | 2.90E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.57E 04 |
| ZR      | 95  | 3.83E 03 | 8.43E 02 | 7.50E 02 | 0.00E-01 | 1.21E 03 | 0.00E-01 | 8.79E 05 |
| ZR      | 97  | 1.92E 00 | 2.77E-01 | 1.64E-01 | 0.00E-01 | 3.98E-01 | 0.00E-01 | 4.20E 04 |
| NB      | 95  | 3.18E 05 | 1.24E 05 | 8.85E 04 | 0.00E-01 | 1.16E 05 | 0.00E-01 | 2.29E 08 |
| MO      | 99  | 0.00E-01 | 8.14E 07 | 2.01E 07 | 0.00E-01 | 1.74E 08 | 0.00E-01 | 6.73E 07 |
| TC      | 99M | 1.32E 01 | 2.59E 01 | 4.30E 02 | 0.00E-01 | 3.77E 02 | 1.32E 01 | 1.48E 04 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-8 (cont'd)**  
GRASS-COW-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
CHILD (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RU      | 103  | 4.28E 03 | 0.00E-01 | 1.65E 03 | 0.00E-01 | 1.08E 04 | 0.00E-01 | 1.11E 05 |
| RU      | 105  | 3.83E-03 | 0.00E-01 | 1.39E-03 | 0.00E-01 | 3.36E-02 | 0.00E-01 | 2.50E 00 |
| RU      | 106  | 9.24E 04 | 0.00E-01 | 1.15E 04 | 0.00E-01 | 1.25E 05 | 0.00E-01 | 1.44E 06 |
| AG      | 110M | 2.09E 08 | 1.41E 08 | 1.13E 08 | 0.00E-01 | 2.63E 08 | 0.00E-01 | 1.68E 10 |
| TE      | 125M | 7.38E 07 | 2.00E 07 | 9.84E 06 | 2.07E 07 | 0.00E-01 | 0.00E-01 | 7.12E 07 |
| TE      | 127M | 2.08E 08 | 5.60E 07 | 2.47E 07 | 4.97E 07 | 5.93E 08 | 0.00E-01 | 1.68E 08 |
| TE      | 127  | 2.98E 03 | 8.03E 02 | 6.39E 02 | 2.06E 03 | 8.47E 03 | 0.00E-01 | 1.16E 05 |
| TE      | 129M | 2.71E 08 | 7.58E 07 | 4.21E 07 | 8.75E 07 | 7.97E 08 | 0.00E-01 | 3.31E 08 |
| TE      | 129  | 1.29E-09 | 3.60E-10 | 3.06E-10 | 9.21E-10 | 3.78E-09 | 0.00E-01 | 8.03E-08 |
| TE      | 131M | 1.60E 06 | 5.53E 05 | 5.89E 05 | 1.14E 06 | 5.36E 06 | 0.00E-01 | 2.24E 07 |
| TE      | 131  | 1.64E-32 | 5.01E-33 | 4.89E-33 | 1.26E-32 | 4.97E-32 | 0.00E-01 | 8.64E-32 |
| TE      | 132  | 1.02E 07 | 4.54E 06 | 5.48E 06 | 6.61E 06 | 4.21E 07 | 0.00E-01 | 4.57E 07 |
| I       | 130  | 1.73E 06 | 3.49E 06 | 1.80E 06 | 3.85E 08 | 5.22E 06 | 0.00E-01 | 1.63E 06 |
| I       | 131  | 1.30E 09 | 1.31E 09 | 7.45E 08 | 4.33E 11 | 2.15E 09 | 0.00E-01 | 1.17E 08 |
| I       | 132  | 6.91E-01 | 1.27E 00 | 5.84E-01 | 5.89E 01 | 1.94E 00 | 0.00E-01 | 1.49E 00 |
| I       | 133  | 1.72E 07 | 2.12E 07 | 8.04E 06 | 3.95E 09 | 3.54E 07 | 0.00E-01 | 8.56E 06 |
| I       | 134  | 8.55E-12 | 1.59E-11 | 7.31E-12 | 3.65E-10 | 2.43E-11 | 0.00E-01 | 1.05E-11 |
| I       | 135  | 5.41E 04 | 9.73E 04 | 4.60E 04 | 8.62E 06 | 1.49E 05 | 0.00E-01 | 7.41E 04 |
| CS      | 134  | 2.27E 10 | 3.72E 10 | 7.84E 09 | 0.00E-01 | 1.15E 10 | 4.13E 09 | 2.00E 08 |
| CS      | 136  | 1.00E 09 | 2.76E 09 | 1.78E 09 | 0.00E-01 | 1.47E 09 | 2.19E 08 | 9.69E 07 |
| CS      | 137  | 3.22E 10 | 3.09E 10 | 4.55E 09 | 0.00E-01 | 1.01E 10 | 3.62E 09 | 1.93E 08 |
| CS      | 138  | 4.03E-23 | 5.60E-23 | 3.55E-23 | 0.00E-01 | 3.94E-23 | 4.24E-24 | 2.58E-23 |
| BA      | 139  | 2.07E-07 | 1.11E-10 | 6.01E-09 | 0.00E-01 | 9.67E-11 | 6.51E-11 | 1.20E-05 |
| BA      | 140  | 1.17E 08 | 1.03E 05 | 6.84E 06 | 0.00E-01 | 3.34E 04 | 6.12E 04 | 5.94E 07 |
| BA      | 141  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 1.94E 01 | 6.80E 00 | 2.29E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.89E 05 |
| LA      | 142  | 4.09E-11 | 1.30E-11 | 4.08E-12 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.58E-06 |
| CE      | 141  | 2.19E 04 | 1.09E 04 | 1.62E 03 | 0.00E-01 | 4.78E 03 | 0.00E-01 | 1.36E 07 |
| CE      | 143  | 1.88E 02 | 1.02E 05 | 1.47E 01 | 0.00E-01 | 4.27E 01 | 0.00E-01 | 1.49E 06 |
| CE      | 144  | 1.62E 06 | 5.09E 05 | 8.66E 04 | 0.00E-01 | 2.82E 05 | 0.00E-01 | 1.33E 08 |
| PR      | 143  | 7.18E 02 | 2.16E 02 | 3.56E 01 | 0.00E-01 | 1.17E 02 | 0.00E-01 | 7.75E 05 |
| PR      | 144  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| ND      | 147  | 4.47E 02 | 3.62E 02 | 2.80E 01 | 0.00E-01 | 1.99E 02 | 0.00E-01 | 5.73E 05 |
| W       | 187  | 2.91E 04 | 1.72E 04 | 7.73E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.42E 06 |
| NP      | 239  | 1.72E 01 | 1.24E 00 | 8.70E-01 | 0.00E-01 | 3.58E 00 | 0.00E-01 | 9.16E 04 |

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TABLE A.5-9  
GRASS-COW-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
INFANT (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 2.38E 03 | 2.38E 03 | 2.38E 03 | 2.38E 03 | 2.38E 03 | 2.38E 03 |
| C       | 14  | 2.34E 09 | 5.00E 08 | 5.00E 08 | 5.00E 08 | 5.00E 08 | 5.00E 08 | 5.00E 08 |
| NA      | 24  | 1.54E 07 | 1.54E 07 | 1.54E 07 | 1.54E 07 | 1.54E 07 | 1.54E 07 | 1.54E 07 |
| P       | 32  | 1.60E 11 | 9.42E 09 | 6.21E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.17E 09 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 1.61E 05 | 1.05E 05 | 2.30E 04 | 2.05E 05 | 4.70E 06 |
| MN      | 54  | 0.00E-01 | 3.90E 07 | 8.84E 06 | 0.00E-01 | 8.64E 06 | 0.00E-01 | 1.43E 07 |
| MN      | 56  | 0.00E-01 | 3.15E-02 | 5.43E-03 | 0.00E-01 | 2.71E-02 | 0.00E-01 | 2.86E 00 |
| FE      | 55  | 1.35E 08 | 8.72E 07 | 2.33E 07 | 0.00E-01 | 0.00E-01 | 4.26E 07 | 1.11E 07 |
| FE      | 59  | 2.24E 08 | 3.92E 08 | 1.54E 08 | 0.00E-01 | 0.00E-01 | 1.16E 08 | 1.87E 08 |
| CO      | 58  | 0.00E-01 | 2.43E 07 | 6.05E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.04E 07 |
| CO      | 60  | 0.00E-01 | 8.82E 07 | 2.08E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.10E 08 |
| NI      | 63  | 3.49E 10 | 2.16E 09 | 1.21E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.07E 08 |
| NI      | 65  | 4.39E 00 | 4.97E-01 | 2.26E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.78E 01 |
| CU      | 64  | 0.00E-01 | 1.86E 05 | 8.60E 04 | 0.00E-01 | 3.14E 05 | 0.00E-01 | 3.81E 06 |
| ZN      | 65  | 5.55E 09 | 1.90E 10 | 8.78E 09 | 0.00E-01 | 9.23E 09 | 0.00E-01 | 1.61E 10 |
| ZN      | 69  | 5.04E-11 | 9.07E-11 | 6.75E-12 | 0.00E-01 | 3.77E-11 | 0.00E-01 | 7.40E-09 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 86  | 0.00E-01 | 2.23E 10 | 1.10E 10 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.70E 08 |
| RB      | 88  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 89  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| SR      | 89  | 1.26E 10 | 0.00E-01 | 3.61E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.59E 08 |
| SR      | 90  | 1.22E 11 | 0.00E-01 | 3.10E 10 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.52E 09 |
| SR      | 91  | 2.69E 05 | 0.00E-01 | 9.75E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.19E 05 |
| SR      | 92  | 4.66E 00 | 0.00E-01 | 1.73E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.02E 01 |
| Y       | 90  | 6.80E 02 | 0.00E-01 | 1.82E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.39E 05 |
| Y       | 91M | 5.72E-19 | 0.00E-01 | 1.95E-20 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.91E-15 |
| Y       | 91  | 7.33E 04 | 0.00E-01 | 1.95E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.25E 06 |
| Y       | 92  | 5.39E-04 | 0.00E-01 | 1.51E-05 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.03E 01 |
| Y       | 93  | 2.25E 00 | 0.00E-01 | 6.13E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.78E 04 |
| ZR      | 95  | 6.81E 03 | 1.66E 03 | 1.18E 03 | 0.00E-01 | 1.79E 03 | 0.00E-01 | 8.26E 05 |
| ZR      | 97  | 4.06E 00 | 6.98E-01 | 3.19E-01 | 0.00E-01 | 7.03E-01 | 0.00E-01 | 4.45E 04 |
| NB      | 95  | 5.94E 05 | 2.45E 05 | 1.41E 05 | 0.00E-01 | 1.75E 05 | 0.00E-01 | 2.06E 08 |
| MO      | 99  | 0.00E-01 | 2.08E 08 | 4.06E 07 | 0.00E-01 | 3.11E 08 | 0.00E-01 | 6.85E 07 |
| TC      | 99M | 2.75E 01 | 5.68E 01 | 7.31E 02 | 0.00E-01 | 6.11E 02 | 2.97E 01 | 1.65E 04 |

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**TABLE A.5-9 (cont'd)**  
GRASS-COW-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
INFANT (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RU      | 103  | 8.67E 03 | 0.00E-01 | 2.90E 03 | 0.00E-01 | 1.80E 04 | 0.00E-01 | 1.05E 05 |
| RU      | 105  | 8.07E-03 | 0.00E-01 | 2.72E-02 | 0.00E-01 | 5.93E-01 | 0.00E-01 | 3.21E 00 |
| RU      | 106  | 1.90E 05 | 0.00E-01 | 2.38E 04 | 0.00E-01 | 2.25E 05 | 0.00E-01 | 1.44E 06 |
| AG      | 110M | 3.86E 08 | 2.82E 08 | 1.86E 08 | 0.00E-01 | 4.03E 08 | 0.00E-01 | 1.46E 10 |
| TE      | 125M | 1.51E 08 | 5.04E 07 | 2.04E 07 | 5.07E 07 | 0.00E-01 | 0.00E-01 | 7.18E 07 |
| TE      | 127M | 4.21E 08 | 1.40E 08 | 5.10E 07 | 1.22E 08 | 1.04E 09 | 0.00E-01 | 1.70E 08 |
| TE      | 127  | 6.32E 03 | 2.12E 03 | 1.36E 03 | 5.15E 03 | 1.54E 04 | 0.00E-01 | 1.33E 05 |
| TE      | 129M | 5.57E 08 | 1.91E 08 | 8.58E 07 | 2.14E 08 | 1.39E 09 | 0.00E-01 | 3.33E 08 |
| TE      | 129  | 2.74E-09 | 9.43E-10 | 6.39E-09 | 2.29E-08 | 6.81E-08 | 0.00E-01 | 2.19E-07 |
| TE      | 131M | 3.38E 06 | 1.36E 06 | 1.12E 06 | 2.76E 06 | 9.36E 06 | 0.00E-01 | 2.29E 07 |
| TE      | 131  | 3.49E-32 | 1.29E-32 | 9.78E-32 | 3.11E-31 | 8.91E-31 | 0.00E-01 | 1.41E-30 |
| TE      | 132  | 2.11E 07 | 1.05E 07 | 9.75E 06 | 1.54E 07 | 6.53E 07 | 0.00E-01 | 3.87E 07 |
| I       | 130  | 3.55E 06 | 7.81E 06 | 3.14E 06 | 8.76E 08 | 8.58E 06 | 0.00E-01 | 1.68E 06 |
| I       | 131  | 2.72E 09 | 3.21E 09 | 1.41E 09 | 1.05E 12 | 3.74E 09 | 0.00E-01 | 1.14E 08 |
| I       | 132  | 1.43E 00 | 2.91E 00 | 1.04E 00 | 1.37E 02 | 3.25E 00 | 0.00E-01 | 2.36E 00 |
| I       | 133  | 3.63E 07 | 5.28E 07 | 1.55E 07 | 9.61E 09 | 6.21E 07 | 0.00E-01 | 8.94E 06 |
| I       | 134  | 1.77E-11 | 3.63E-11 | 1.29E-10 | 8.47E-09 | 4.06E-10 | 0.00E-01 | 3.76E-11 |
| I       | 135  | 1.12E 05 | 2.24E 05 | 8.15E 04 | 2.00E 07 | 2.49E 05 | 0.00E-01 | 8.09E 04 |
| CS      | 134  | 3.65E 10 | 6.80E 10 | 6.87E 09 | 0.00E-01 | 1.75E 10 | 6.21E 09 | 1.85E 08 |
| CS      | 136  | 1.96E 09 | 5.76E 09 | 2.15E 09 | 0.00E-01 | 2.30E 09 | 4.70E 08 | 8.75E 07 |
| CS      | 137  | 5.15E 10 | 6.02E 10 | 4.27E 09 | 0.00E-01 | 1.62E 10 | 6.55E 09 | 1.88E 08 |
| CS      | 138  | 8.50E-23 | 1.38E-22 | 6.70E-22 | 0.00E-01 | 6.89E-22 | 1.08E-23 | 2.21E-22 |
| BA      | 139  | 4.41E-07 | 2.93E-10 | 1.28E-07 | 0.00E-01 | 1.76E-09 | 1.77E-10 | 2.80E-05 |
| BA      | 140  | 2.41E 08 | 2.41E 08 | 1.24E 07 | 0.00E-01 | 5.72E 04 | 1.48E 05 | 5.92E 07 |
| BA      | 141  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 4.06E 01 | 1.60E 01 | 4.12E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.88E 05 |
| LA      | 142  | 8.59E-11 | 3.15E-11 | 7.55E-11 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.36E-06 |
| CE      | 141  | 4.34E 04 | 2.64E 04 | 3.11E 03 | 0.00E-01 | 8.16E 03 | 0.00E-01 | 1.37E 07 |
| CE      | 143  | 3.97E 02 | 2.63E 05 | 3.00E 01 | 0.00E-01 | 7.67E 01 | 0.00E-01 | 1.54E 06 |
| CE      | 144  | 2.33E 06 | 9.52E 05 | 1.30E 05 | 0.00E-01 | 3.85E 05 | 0.00E-01 | 1.33E 08 |
| PR      | 143  | 1.49E 03 | 5.56E 02 | 7.36E 01 | 0.00E-01 | 2.07E 02 | 0.00E-01 | 7.84E 05 |
| PR      | 144  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| ND      | 147  | 8.86E 02 | 9.10E 02 | 5.57E 01 | 0.00E-01 | 3.51E 02 | 0.00E-01 | 5.77E 05 |
| W       | 187  | 6.12E 04 | 4.26E 04 | 1.47E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.50E 06 |
| NP      | 239  | 3.65E 01 | 3.26E 00 | 1.84E 00 | 0.00E-01 | 1.50E 00 | 0.00E-01 | 9.43E 04 |

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**TABLE A.5-10**  
GRASS-COW-MEAT PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER μCI/SEC  
ADULT (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 3.25E 02 | 3.25E 02 | 3.25E 02 | 3.25E 02 | 3.25E 02 | 3.25E 02 |
| C       | 14  | 2.41E 08 | 4.83E 07 | 4.83E07  | 4.83E 07 | 4.83E 07 | 4.83E 07 | 4.83E 07 |
| NA      | 24  | 1.36E-03 | 1.36E-03 | 1.36E-03 | 1.36E-03 | 1.36E-03 | 1.36E-03 | 1.36E-03 |
|         |     |          |          |          |          |          |          |          |
| P       | 32  | 4.65E 09 | 2.89E 08 | 1.80E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 7.05E 03 | 4.21E 03 | 1.55E 03 | 9.35E 03 | 1.77E 06 |
| MN      | 54  | 0.00E-01 | 9.18E 06 | 1.75E 06 | 0.00E-01 | 2.73E 06 | 0.00E-01 | 2.81E 07 |
|         |     |          |          |          |          |          |          |          |
| MN      | 56  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| FE      | 55  | 2.93E 08 | 2.20E 08 | 4.72E 07 | 0.00E-01 | 0.00E-01 | 1.13E 08 | 1.16E 08 |
| FE      | 59  | 2.65E 08 | 6.24E 08 | 2.39E 08 | 0.00E-01 | 0.00E-01 | 1.74E 08 | 2.08E 09 |
|         |     |          |          |          |          |          |          |          |
| CO      | 58  | 0.00E-01 | 1.82E 07 | 4.09E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.70E 08 |
| CO      | 60  | 0.00E-01 | 7.52E 07 | 1.66E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.41E 09 |
| NI      | 63  | 1.89E 10 | 1.32E 09 | 6.33E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.73E 08 |
|         |     |          |          |          |          |          |          |          |
| NI      | 65  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| CU      | 64  | 0.00E-01 | 2.73E-07 | 1.28E-07 | 0.00E-01 | 6.89E-07 | 0.00E-01 | 2.33E-05 |
| ZN      | 65  | 3.56E 08 | 1.13E 09 | 5.12E 08 | 0.00E-01 | 7.57E 08 | 0.00E-01 | 7.13E 08 |
|         |     |          |          |          |          |          |          |          |
| ZN      | 69  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
|         |     |          |          |          |          |          |          |          |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 86  | 0.00E-01 | 4.87E 08 | 2.27E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.61E 07 |
| RB      | 88  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
|         |     |          |          |          |          |          |          |          |
| RB      | 89  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| SR      | 89  | 3.02E 08 | 0.00E-01 | 8.66E 06 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.84E 07 |
| SR      | 90  | 1.24E 10 | 0.00E-01 | 3.05E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.59E 08 |
|         |     |          |          |          |          |          |          |          |
| SR      | 91  | 1.43E-10 | 0.00E-01 | 5.73E-12 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.76E-10 |
| SR      | 92  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| Y       | 90  | 1.07E 02 | 0.00E-01 | 2.86E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.13E 06 |
|         |     |          |          |          |          |          |          |          |
| Y       | 91M | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| Y       | 91  | 1.13E 06 | 0.00E-01 | 3.03E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.23E 08 |
| Y       | 92  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
|         |     |          |          |          |          |          |          |          |
| Y       | 93  | 6.59E-12 | 0.00E-01 | 1.82E-13 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.09E-07 |
| ZR      | 95  | 1.87E 06 | 6.01E 05 | 4.07E 05 | 0.00E-01 | 9.43E 05 | 0.00E-01 | 1.90E 09 |
| ZR      | 97  | 2.08E-05 | 4.19E-06 | 1.92E-06 | 0.00E-01 | 6.33E-06 | 0.00E-01 | 1.30E 00 |
|         |     |          |          |          |          |          |          |          |
| NB      | 95  | 2.30E 06 | 1.28E 06 | 6.88E 05 | 0.00E-01 | 1.26E 06 | 0.00E-01 | 7.76E 09 |
| MO      | 99  | 0.00E-01 | 9.99E 04 | 1.90E 04 | 0.00E-01 | 2.26E 05 | 0.00E-01 | 2.32E 05 |
| TC      | 99M | 4.50E-21 | 1.27E-20 | 1.62E-10 | 0.00E-01 | 1.93E-19 | 6.23E-21 | 7.53E-18 |
|         |     |          |          |          |          |          |          |          |
| TC      | 101 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-10 (cont'd)**  
GRASS-COW-MEAT PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
ADULT (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| RU      | 103  | 1.05E 08 | 0.00E-01 | 4.53E 07 | 0.00E-01 | 4.01E 08 | 0.00E-01 | 1.23E 10 |
| RU      | 105  | 5.87E-28 | 0.00E-01 | 2.32E-28 | 0.00E-01 | 7.58E-27 | 0.00E-01 | 3.59E-25 |
| RU      | 106  | 2.80E 09 | 0.00E-01 | 3.54E 08 | 0.00E-01 | 5.40E 09 | 0.00E-01 | 1.81E 11 |
| AG      | 110M | 6.68E 06 | 6.18E 06 | 3.67E 06 | 0.00E-01 | 1.22E 07 | 0.00E-01 | 2.52E 09 |
| TE      | 125M | 3.59E 08 | 1.30E 08 | 4.81E 07 | 1.08E 08 | 1.46E 09 | 0.00E-01 | 1.43E 09 |
| TE      | 127M | 1.12E 09 | 3.99E 08 | 1.36E 08 | 2.85E 08 | 4.53E 09 | 0.00E-01 | 3.74E 09 |
| TE      | 127  | 2.14E-10 | 7.68E-11 | 4.63E-11 | 1.58E-10 | 8.71E-10 | 0.00E-01 | 1.69E-08 |
| TE      | 129M | 1.13E 09 | 4.23E 08 | 1.80E 08 | 3.90E 08 | 4.73E 09 | 0.00E-01 | 5.71E 09 |
| TE      | 129  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| TE      | 131M | 4.52E 02 | 2.21E 02 | 1.84E 02 | 3.50E 02 | 2.24E 03 | 0.00E-01 | 2.20E 04 |
| TE      | 131  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| TE      | 132  | 1.42E 06 | 9.19E 05 | 8.63E 05 | 1.01E 06 | 8.85E 06 | 0.00E-01 | 4.35E 07 |
| I       | 130  | 2.12E-06 | 6.26E-06 | 2.47E-06 | 5.30E-04 | 9.76E-06 | 0.00E-01 | 5.39E-06 |
| I       | 131  | 1.07E 07 | 1.54E 07 | 8.81E 06 | 5.04E 09 | 2.64E 07 | 0.00E-01 | 4.06E 06 |
| I       | 132  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| I       | 133  | 3.67E-01 | 6.38E-01 | 1.94E-01 | 9.37E 01 | 1.11E 00 | 0.00E-01 | 5.73E-01 |
| I       | 134  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| I       | 135  | 4.47E-17 | 1.17E-16 | 4.32E-17 | 7.73E-15 | 1.88E-16 | 0.00E-01 | 1.32E-16 |
| CS      | 134  | 6.58E 08 | 1.56E 09 | 1.28E 09 | 0.00E-01 | 5.06E 08 | 1.68E 08 | 2.74E 07 |
| CS      | 136  | 1.18E 07 | 4.66E 07 | 3.35E 07 | 0.00E-01 | 2.59E 07 | 3.55E 06 | 5.24E 06 |
| CS      | 137  | 8.72E 08 | 1.19E 09 | 7.81E 08 | 0.00E-01 | 4.05E 08 | 1.35E 08 | 2.31E 07 |
| CS      | 138  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 139  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 140  | 2.87E 07 | 3.61E 04 | 1.88E 06 | 0.00E-01 | 1.23E 04 | 2.07E 04 | 5.92E 07 |
| BA      | 141  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 3.76E-02 | 1.89E-02 | 5.00E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.39E 03 |
| LA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| CE      | 141  | 1.40E 04 | 9.50E 03 | 1.08E 03 | 0.00E-01 | 4.41E 03 | 0.00E-01 | 3.63E 07 |
| CE      | 143  | 2.01E-02 | 1.49E 01 | 1.65E-03 | 0.00E-01 | 6.55E-03 | 0.00E-01 | 5.56E 02 |
| CE      | 144  | 1.46E 06 | 6.09E 05 | 9.83E 04 | 0.00E-01 | 3.61E 05 | 0.00E-01 | 4.93E 08 |
| PR      | 143  | 2.10E 04 | 8.41E 03 | 1.04E 03 | 0.00E-01 | 4.86E 03 | 0.00E-01 | 9.19E 07 |
| PR      | 144  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| ND      | 147  | 7.17E 03 | 8.29E 03 | 4.96E 02 | 0.00E-01 | 4.84E 03 | 0.00E-01 | 3.98E 07 |
| W       | 187  | 2.17E-02 | 1.81E-02 | 6.33E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.93E 00 |
| NP      | 239  | 2.59E-01 | 2.55E-02 | 1.40E-02 | 0.00E-01 | 7.94E-02 | 0.00E-01 | 5.22E 03 |

ATTACHMENT A  
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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-11**  
GRASS-COW-MEAT PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
TEEN (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-ILLI  |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 1.94E 02 | 1.94E 02 | 1.94E 02 | 1.94E 02 | 1.94E 02 | 1.94E 02 |
| C       | 14  | 2.04E 08 | 4.08E 07 | 4.08E 07 | 4.08E 07 | 4.08E 07 | 4.08E 07 | 4.08E 07 |
| NA      | 24  | 1.09E-03 | 1.09E-03 | 1.09E-03 | 1.09E-03 | 1.09E-03 | 1.09E-03 | 1.09E-03 |
| P       | 32  | 3.93E 09 | 2.44E 08 | 1.52E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.30E 08 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 5.64E 03 | 3.13E 03 | 1.24E 03 | 8.05E 03 | 9.47E 05 |
| MN      | 54  | 0.00E-01 | 7.00E 06 | 1.39E 06 | 0.00E-01 | 2.09E 06 | 0.00E-01 | 1.44E 07 |
| MN      | 56  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| FE      | 55  | 2.38E 08 | 1.69E 08 | 3.93E 07 | 0.00E-01 | 0.00E-01 | 1.07E 08 | 7.30E 07 |
| FE      | 59  | 2.12E 08 | 4.95E 08 | 1.01E 08 | 0.00E-01 | 0.00E-01 | 1.56E 08 | 1.17E 09 |
| CO      | 58  | 0.00E-01 | 1.41E 07 | 3.24E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.94E 08 |
| CO      | 60  | 0.00E-01 | 5.83E 07 | 1.31E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.60E 08 |
| NI      | 63  | 1.52E 10 | 1.07E 09 | 5.15E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.71E 08 |
| NI      | 65  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| CU      | 64  | 0.00E-01 | 2.23E-07 | 1.05E-07 | 0.00E-01 | 5.64E-07 | 0.00E-01 | 1.73E-05 |
| ZN      | 65  | 2.50E 08 | 8.69E 08 | 4.05E 08 | 0.00E-01 | 5.56E 08 | 0.00E-01 | 3.68E 08 |
| ZN      | 69  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 86  | 0.00E-01 | 4.07E 08 | 1.91E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.02E 07 |
| RB      | 88  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 89  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| SR      | 89  | 2.55E 08 | 0.00E-01 | 7.29E 06 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.03E 07 |
| SR      | 90  | 8.05E 09 | 0.00E-01 | 1.99E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.26E 08 |
| SR      | 91  | 1.19E-10 | 0.00E-01 | 4.75E-12 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.41E-10 |
| SR      | 92  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| Y       | 90  | 8.98E 01 | 0.00E-01 | 2.42E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.41E 05 |
| Y       | 91M | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| Y       | 91  | 9.54E 05 | 0.00E-01 | 2.56E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.91E 08 |
| Y       | 92  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| Y       | 93  | 5.56E-12 | 0.00E-01 | 1.53E-13 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.70E-07 |
| ZR      | 95  | 1.50E 06 | 4.73E 05 | 3.26E 05 | 0.00E-01 | 6.96E 05 | 0.00E-01 | 1.09E 09 |
| ZR      | 97  | 1.73E-05 | 3.42E-06 | 1.58E-06 | 0.00E-01 | 5.19E-06 | 0.00E-01 | 9.27E-01 |
| NB      | 95  | 1.80E 06 | 9.96E 05 | 5.48E 05 | 0.00E-01 | 9.66E 05 | 0.00E-01 | 4.26E 09 |
| MO      | 99  | 0.00E-01 | 8.26E 04 | 1.58E 04 | 0.00E-01 | 1.89E 05 | 0.00E-01 | 1.48E 05 |
| TC      | 99M | 3.58E-21 | 9.97E-21 | 1.29E-19 | 0.00E-01 | 1.49E-19 | 5.54E-21 | 6.55E-18 |

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OFFSITE DOSE CALCULATION MANUAL

TABLE A.5-11 (cont'd)  
GRASS-COW-MEAT PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
TEEN (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RU      | 103  | 8.56E 07 | 0.00E-01 | 3.66E 07 | 0.00E-01 | 3.02E 08 | 0.00E-01 | 7.15E 09 |
| RU      | 105  | 4.91E-28 | 0.00E-01 | 1.91E-28 | 0.00E-01 | 6.91E-27 | 0.00E-01 | 3.96E-25 |
| RU      | 106  | 2.36E 09 | 0.00E-01 | 2.97E 08 | 0.00E-01 | 4.55E 09 | 0.00E-01 | 1.13E 11 |
| AG      | 110M | 5.06E 06 | 4.79E 06 | 2.91E 06 | 0.00E-01 | 9.13E 06 | 0.00E-01 | 1.35E 09 |
| TE      | 125M | 3.03E 08 | 1.09E 08 | 4.05E 07 | 8.47E 07 | 0.00E-01 | 0.00E-01 | 8.94E 08 |
| TE      | 127M | 9.42E 08 | 3.34E 08 | 1.12E 08 | 2.24E 08 | 3.82E 09 | 0.00E-01 | 2.35E 09 |
| TE      | 127  | 1.81E-10 | 6.43E-11 | 3.91E-11 | 1.25E-09 | 7.35E-10 | 0.00E-01 | 1.40E-08 |
| TE      | 129M | 9.50E 08 | 3.53E 08 | 1.50E 08 | 3.07E 08 | 3.97E 09 | 0.00E-01 | 3.57E 09 |
| TE      | 129  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| TE      | 131M | 3.77E 02 | 1.81E 02 | 1.51E 02 | 2.72E 02 | 1.88E 03 | 0.00E-01 | 1.45E 04 |
| TE      | 131  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| TE      | 132  | 1.16E 06 | 7.36E 05 | 6.93E 05 | 7.76E 05 | 7.06E 06 | 0.00E-01 | 2.33E 07 |
| I       | 130  | 1.71E-06 | 4.94E-06 | 1.97E-06 | 4.03E-04 | 7.61E-06 | 0.00E-01 | 3.80E-06 |
| I       | 131  | 8.93E 06 | 1.25E 07 | 6.72E 06 | 3.65E 09 | 2.15E 07 | 0.00E-01 | 2.47E 06 |
| I       | 132  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| I       | 133  | 3.07E-01 | 5.20E-01 | 1.59E-01 | 7.26E 01 | 9.12E-01 | 0.00E-01 | 3.93E-01 |
| I       | 134  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| I       | 135  | 3.64E-17 | 9.37E-17 | 3.47E-17 | 6.03E-15 | 1.48E-16 | 0.00E-01 | 1.04E-16 |
| CS      | 134  | 5.23E 08 | 1.23E 09 | 5.71E 08 | 0.00E-01 | 3.91E 08 | 1.49E 08 | 1.53E 07 |
| CS      | 136  | 9.20E 06 | 3.62E 07 | 2.43E 07 | 0.00E-01 | 1.97E 07 | 3.11E 06 | 2.91E 06 |
| CS      | 137  | 7.24E 08 | 9.63E 08 | 3.36E 08 | 0.00E-01 | 3.28E 08 | 1.27E 08 | 1.37E 07 |
| CS      | 138  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 139  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 140  | 2.38E 07 | 2.91E 04 | 1.53E 06 | 0.00E-01 | 9.88E 03 | 1.96E 04 | 3.67E 07 |
| BA      | 141  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 3.09E-02 | 1.52E-02 | 4.04E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.72E 02 |
| LA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| CE      | 141  | 1.18E 04 | 7.88E 03 | 9.05E 02 | 0.00E-01 | 3.71E 03 | 0.00E-01 | 2.25E 07 |
| CE      | 143  | 1.69E-02 | 1.23E 01 | 1.38E-03 | 0.00E-01 | 5.53E-03 | 0.00E-01 | 3.70E 02 |
| CE      | 144  | 1.23E 06 | 5.08E 05 | 6.60E 04 | 0.00E-01 | 3.04E 05 | 0.00E-01 | 3.09E 08 |
| PR      | 143  | 1.77E 04 | 7.05E 03 | 8.78E 02 | 0.00E-01 | 4.10E 03 | 0.00E-01 | 5.81E 07 |
| PR      | 144  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| ND      | 147  | 6.32E 03 | 6.87E 03 | 4.11E 02 | 0.00E-01 | 4.03E 03 | 0.00E-01 | 2.48E 07 |
| W       | 187  | 1.81E-02 | 1.48E-02 | 5.18E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.00E 00 |
| NP      | 239  | 2.26E-01 | 2.13E-02 | 1.19E-02 | 0.00E-01 | 6.70E-07 | 0.00E-01 | 3.43E 03 |

ATTACHMENT A  
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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-12**  
GRASS-COW-MEAT PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
CHILD (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 2.34E 02 | 2.34E 02 | 2.34E 02 | 2.34E 02 | 2.34E 02 | 2.34E 02 |
| C       | 14  | 3.83E 08 | 7.67E 07 | 7.67E 07 | 7.67E 07 | 7.67E 07 | 7.67E 07 | 7.67E 07 |
| NA      | 24  | 1.73E-03 | 1.73E-03 | 1.73E-03 | 1.73E-03 | 1.73E-03 | 1.73E-03 | 1.73E-03 |
| P       | 32  | 7.41E 09 | 3.47E 08 | 2.86E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.05E 08 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 8.79E 03 | 4.88E 03 | 1.33E 03 | 8.91E 03 | 4.66E 05 |
| MN      | 54  | 0.00E-01 | 8.01E 06 | 2.13E 06 | 0.00E-01 | 2.25E 06 | 0.00E-01 | 6.72E 06 |
| MN      | 56  | 0.00E-01 | 1.63E-53 | 3.67E-54 | 0.00E-01 | 1.97E-53 | 0.00E-01 | 2.36E-51 |
| FE      | 55  | 4.57E 08 | 2.42E 08 | 7.50E 07 | 0.00E-01 | 0.00E-01 | 1.37E 08 | 4.49E 07 |
| FE      | 59  | 3.76E 08 | 6.09E 08 | 3.03E 08 | 0.00E-01 | 0.00E-01 | 1.76E 08 | 6.34E 08 |
| CO      | 58  | 0.00E-01 | 1.64E 07 | 5.03E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.58E 07 |
| CO      | 60  | 0.00E-01 | 6.93E 07 | 2.04E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.84E 08 |
| NI      | 63  | 2.91E 10 | 1.56E 09 | 9.91E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.05E 08 |
| NI      | 65  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| CU      | 64  | 0.00E-01 | 3.00E-07 | 1.81E-07 | 0.00E-01 | 7.24E-07 | 0.00E-01 | 1.41E-05 |
| ZN      | 65  | 3.75E 08 | 1.00E 09 | 6.22E 08 | 0.00E-01 | 6.30E 08 | 0.00E-01 | 1.76E 08 |
| ZN      | 69  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 86  | 0.00E-01 | 5.77E 08 | 3.55E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.71E 07 |
| RB      | 88  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 89  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| SR      | 89  | 4.82E 08 | 0.00E-01 | 1.38E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.87E 07 |
| SR      | 90  | 1.04E 10 | 0.00E-01 | 2.64E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.40E 08 |
| SR      | 91  | 2.24E-10 | 0.00E-01 | 8.45E-12 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.94E-10 |
| SR      | 92  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| Y       | 90  | 1.70E 02 | 0.00E-01 | 4.55E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.84E 05 |
| Y       | 91M | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| Y       | 91  | 1.80E 06 | 0.00E-01 | 4.82E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.40E 08 |
| Y       | 92  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| Y       | 93  | 1.04E-11 | 0.00E-01 | 2.87E-13 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.56E-07 |
| ZR      | 95  | 2.66E 06 | 5.86E 05 | 5.21E 05 | 0.00E-01 | 8.38E 05 | 0.00E-01 | 6.11E 08 |
| ZR      | 97  | 3.22E-05 | 4.65E-06 | 2.74E-06 | 0.00E-01 | 6.68E-06 | 0.00E-01 | 7.05E-01 |
| NB      | 95  | 3.10E 06 | 1.21E 06 | 8.63E 05 | 0.00E-01 | 1.13E 06 | 0.00E-01 | 2.23E 09 |
| MO      | 99  | 0.00E-01 | 1.15E 05 | 2.84E 04 | 0.00E-01 | 2.45E 05 | 0.00E-01 | 9.51E 04 |
| TC      | 99M | 6.27E-21 | 1.23E-20 | 2.04E-19 | 0.00E-01 | 1.79E-19 | 6.24E-21 | 7.00E-18 |

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**TABLE A.5-12 (cont'd)**  
GRASS-COW-MEAT PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
CHILD (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RU      | 103  | 1.55E 08 | 0.00E-01 | 5.95E 07 | 0.00E-01 | 3.90E 08 | 0.00E-01 | 4.00E 09 |
| RU      | 105  | 9.16E-28 | 0.00E-01 | 3.32E-28 | 0.00E-01 | 8.05E-27 | 0.00E-01 | 5.98E-25 |
| RU      | 106  | 4.44E 09 | 0.00E-01 | 5.54E 08 | 0.00E-01 | 5.99E 09 | 0.00E-01 | 6.90E 10 |
| AG      | 110M | 8.34E 06 | 5.67E 06 | 4.53E 06 | 0.00E-01 | 1.06E 07 | 0.00E-01 | 6.74E 08 |
| TE      | 125M | 5.69E 08 | 1.54E 08 | 7.59E 07 | 1.60E 08 | 0.00E-01 | 0.00E-01 | 5.49E 08 |
| TE      | 127M | 1.77E 09 | 4.78E 08 | 2.11E 08 | 4.24E 08 | 5.06E 09 | 0.00E-01 | 1.44E 09 |
| TE      | 127  | 3.41E-10 | 9.20E-11 | 7.32E-11 | 2.36E-10 | 9.71E-10 | 0.00E-01 | 1.33E-08 |
| TE      | 129M | 1.79E 09 | 5.00E 08 | 2.78E 08 | 5.77E 08 | 5.26E 09 | 0.00E-01 | 2.18E 09 |
| TE      | 129  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| TE      | 131M | 7.01E 02 | 2.43E 02 | 2.58E 02 | 4.99E 02 | 2.35E 03 | 0.00E-01 | 9.84E 03 |
| TE      | 131  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| TE      | 132  | 2.12E 06 | 9.39E 05 | 1.13E 06 | 1.37E 06 | 8.72E 06 | 0.00E-01 | 9.46E 06 |
| I       | 130  | 3.05E-06 | 6.17E-06 | 3.18E-06 | 6.80E-04 | 9.22E-06 | 0.00E-01 | 2.89E-06 |
| I       | 131  | 1.66E 07 | 1.67E 07 | 9.47E 06 | 5.51E 09 | 2.74E 07 | 0.00E-01 | 1.48E 06 |
| I       | 132  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| I       | 133  | 5.70E-01 | 7.04E-01 | 2.66E-01 | 1.31E 02 | 1.17E 00 | 0.00E-01 | 2.84E-01 |
| I       | 134  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| I       | 135  | 6.59E-17 | 1.19E-16 | 5.61E-17 | 1.05E-14 | 1.82E-16 | 0.00E-01 | 9.04E-17 |
| CS      | 134  | 9.22E 08 | 1.51E 09 | 3.19E 08 | 0.00E-01 | 4.69E 08 | 1.68E 08 | 8.16E 06 |
| CS      | 136  | 1.59E 07 | 4.36E 07 | 2.82E 07 | 0.00E-01 | 2.32E 07 | 3.46E 06 | 1.53E 06 |
| CS      | 137  | 1.33E 09 | 1.28E 09 | 1.88E 08 | 0.00E-01 | 4.16E 08 | 1.50E 08 | 7.99E 06 |
| CS      | 138  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 139  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 140  | 4.39E 07 | 3.84E 04 | 2.56E 06 | 0.00E-01 | 1.25E 04 | 2.29E 04 | 2.22E 07 |
| BA      | 141  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 5.66E-02 | 1.98E-02 | 6.66E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.51E 02 |
| LA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| CE      | 141  | 2.22E 04 | 1.11E 04 | 1.64E 03 | 0.00E-01 | 4.86E 03 | 0.00E-01 | 1.38E 07 |
| CE      | 143  | 3.18E-02 | 1.72E 01 | 2.50E-03 | 0.00E-01 | 7.23E-03 | 0.00E-01 | 2.52E 02 |
| CE      | 144  | 2.32E 06 | 7.26E 05 | 1.24E 05 | 0.00E-01 | 4.02E 05 | 0.00E-01 | 1.89E 08 |
| PR      | 143  | 3.34E 04 | 1.00E 04 | 1.66E 03 | 0.00E-01 | 5.43E 03 | 0.00E-01 | 3.60E 07 |
| PR      | 144  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| ND      | 147  | 1.19E 04 | 9.60E 03 | 7.43E 02 | 0.00E-01 | 5.27E 03 | 0.00E-01 | 1.52E 07 |
| W       | 187  | 3.36E-02 | 1.99E-02 | 8.94E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.80E 00 |
| NP      | 239  | 4.26E-01 | 3.06E-02 | 2.15E-02 | 0.00E-01 | 8.84E-02 | 0.00E-01 | 2.26E 03 |

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**TABLE A.5-13**  
VEGETATION PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
ADULT (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 2.26E 03 | 2.26E 03 | 2.26E 03 | 2.26E 03 | 2.26E 03 | 2.26E 03 |
| C       | 14  | 2.38E 08 | 4.55E 07 | 4.55E 07 | 4.55E 07 | 4.55E 07 | 4.55E 07 | 4.55E 07 |
| NA      | 24  | 2.69E 05 | 2.69E 05 | 2.69E 05 | 2.69E 05 | 2.69E 05 | 2.69E 05 | 2.69E 05 |
| P       | 32  | 1.40E 09 | 8.73E 07 | 5.42E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.58E 08 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 4.64E 04 | 2.78E 04 | 1.02E 04 | 6.16E 04 | 1.17E 07 |
| MN      | 54  | 0.00E-01 | 3.13E 08 | 5.97E 07 | 0.00E-01 | 9.31E 07 | 0.00E-01 | 9.58E 08 |
| MN      | 56  | 0.00E-01 | 1.59E 01 | 2.82E 00 | 0.00E-01 | 2.02E 01 | 0.00E-01 | 5.08E 02 |
| FE      | 55  | 2.09E 08 | 1.45E 08 | 3.37E 07 | 0.00E-01 | 0.00E-01 | 8.06E 07 | 8.29E 07 |
| FE      | 59  | 1.26E 08 | 2.96E 08 | 1.14E 08 | 0.00E-01 | 0.00E-01 | 8.28E 07 | 9.83E 08 |
| CO      | 58  | 0.00E-01 | 3.07E 07 | 6.89E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.23E 08 |
| CO      | 60  | 0.00E-01 | 1.67E 08 | 3.69E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.14E 09 |
| NI      | 63  | 1.04E 10 | 7.28E 08 | 3.49E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.50E 08 |
| NI      | 65  | 6.93E 01 | 9.01E 00 | 4.11E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.28E 02 |
| CU      | 64  | 0.00E-01 | 9.21E 03 | 4.32E 03 | 0.00E-01 | 2.32E 04 | 0.00E-01 | 7.85E 05 |
| ZN      | 65  | 3.17E 08 | 1.01E 09 | 4.56E 08 | 0.00E-01 | 6.75E 08 | 0.00E-01 | 6.36E 08 |
| ZN      | 69  | 8.77E-06 | 1.68E-05 | 1.17E-06 | 0.00E-01 | 1.09E-05 | 0.00E-01 | 2.52E-06 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 3.11E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.48E 00 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 2.49E-11 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.96E-16 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 86  | 0.00E-01 | 2.19E 08 | 1.02E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.33E 07 |
| RB      | 88  | 0.00E-01 | 3.47E-22 | 1.84E-22 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 89  | 0.00E-01 | 1.41E-26 | 9.88E-27 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| SR      | 89  | 9.97E 09 | 0.00E-01 | 2.86E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.60E 09 |
| SR      | 90  | 6.05E 11 | 0.00E-01 | 1.48E 11 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.75E 10 |
| SR      | 91  | 3.03E 05 | 0.00E-01 | 1.22E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.44E 06 |
| SR      | 92  | 4.27E 02 | 0.00E-01 | 1.85E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.46E 03 |
| Y       | 90  | 1.33E 04 | 0.00E-01 | 3.56E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.41E 08 |
| Y       | 91M | 5.24E-09 | 0.00E-01 | 2.03E-10 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.54E-08 |
| Y       | 91  | 5.11E 06 | 0.00E-01 | 1.37E 05 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.81E 09 |
| Y       | 92  | 9.16E-01 | 0.00E-01 | 2.68E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.60E 04 |
| Y       | 93  | 1.74E 02 | 0.00E-01 | 4.81E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.52E 06 |
| ZR      | 95  | 1.18E 06 | 3.77E 05 | 2.55E 05 | 0.00E-01 | 5.92E 05 | 0.00E-01 | 1.20E 09 |
| ZR      | 97  | 3.37E 02 | 6.81E 01 | 3.11E 01 | 0.00E-01 | 1.03E 02 | 0.00E-01 | 2.11E 07 |
| NB      | 95  | 1.43E 05 | 7.93E 04 | 4.26E 04 | 0.00E-01 | 7.84E 04 | 0.00E-01 | 4.81E 08 |
| MO      | 99  | 0.00E-01 | 6.15E 06 | 1.17E 06 | 0.00E-01 | 1.39E 07 | 0.00E-01 | 1.43E 07 |
| TC      | 99M | 3.10E 00 | 8.77E 00 | 1.12E 02 | 0.00E-01 | 1.33E 02 | 4.30E 00 | 5.19E 03 |

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**TABLE A.5-13 (cont'd)**  
VEGETATION PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
ADULT (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 8.34E-31 | 1.20E-30 | 1.18E-29 | 0.00E-01 | 2.16E-29 | 6.14E-31 | 0.00E-01 |
| RU      | 103  | 4.76E 06 | 0.00E-01 | 2.05E 06 | 0.00E-01 | 1.82E 07 | 0.00E-01 | 5.56E 08 |
| RU      | 105  | 5.39E 01 | 0.00E-01 | 2.13E 01 | 0.00E-01 | 6.97E 02 | 0.00E-01 | 3.30E 04 |
| RU      | 106  | 1.93E 08 | 0.00E-01 | 2.44E 07 | 0.00E-01 | 3.72E 08 | 0.00E-01 | 1.25E 10 |
| AG      | 110M | 1.05E 07 | 9.75E 06 | 5.79E 06 | 0.00E-01 | 1.92E 07 | 0.00E-01 | 3.98E 09 |
| TE      | 125M | 9.66E 07 | 3.50E 07 | 1.29E 07 | 2.90E 07 | 3.93E 08 | 0.00E-01 | 3.86E 08 |
| TE      | 127M | 3.49E 08 | 1.25E 08 | 4.26E 07 | 8.93E 07 | 1.42E 09 | 0.00E-01 | 1.17E 09 |
| TE      | 127  | 5.66E 03 | 2.03E 03 | 1.23E 03 | 4.20E 03 | 2.31E 04 | 0.00E-01 | 4.47E 05 |
| TE      | 129M | 2.51E 08 | 9.38E 07 | 3.98E 07 | 8.63E 07 | 1.05E 09 | 0.00E-01 | 1.27E 09 |
| TE      | 129  | 7.65E-04 | 2.87E-04 | 1.86E-04 | 5.87E-04 | 3.22E-03 | 0.00E-01 | 5.77E-04 |
| TE      | 131M | 9.12E 05 | 4.46E 05 | 3.72E 05 | 7.07E 05 | 4.52E 06 | 0.00E-01 | 4.43E 07 |
| TE      | 131  | 1.51E-15 | 6.32E-16 | 4.78E-16 | 1.24E-15 | 6.63E-15 | 0.00E-01 | 2.14E-16 |
| TE      | 132  | 4.30E 06 | 2.78E 06 | 2.61E 06 | 3.07E 06 | 2.68E 07 | 0.00E-01 | 1.32E 08 |
| I       | 130  | 3.95E 05 | 1.16E 06 | 4.57E 05 | 9.81E 07 | 1.81E 06 | 0.00E-01 | 9.97E 05 |
| I       | 131  | 8.08E 07 | 1.16E 08 | 6.62E 07 | 3.79E 10 | 1.98E 08 | 0.00E-01 | 3.05E 07 |
| I       | 132  | 5.77E 01 | 1.54E 02 | 5.40E 01 | 5.40E 03 | 2.46E 02 | 0.00E-01 | 2.90E 01 |
| I       | 133  | 2.09E 06 | 3.63E 06 | 1.11E 06 | 5.33E 08 | 6.33E 06 | 0.00E-01 | 3.26E 06 |
| I       | 134  | 9.69E-05 | 2.63E-04 | 9.42E-05 | 4.56E-03 | 4.19E-04 | 0.00E-01 | 2.30E-07 |
| I       | 135  | 3.90E 04 | 1.02E 05 | 3.77E 04 | 6.74E 06 | 1.64E 05 | 0.00E-01 | 1.15E 05 |
| CS      | 134  | 4.67E 09 | 1.11E 10 | 9.08E 09 | 0.00E-01 | 3.59E 09 | 1.19E 09 | 1.94E 08 |
| CS      | 136  | 4.20E 07 | 1.66E 08 | 1.19E 08 | 0.00E-01 | 9.22E 07 | 1.26E 07 | 1.88E 07 |
| CS      | 137  | 6.36E 09 | 8.70E 09 | 5.70E 09 | 0.00E-01 | 2.95E 09 | 9.81E 08 | 1.68E 08 |
| CS      | 138  | 3.94E-11 | 7.78E-11 | 3.86E-11 | 0.00E-01 | 5.72E-11 | 5.65E-12 | 3.32E-16 |
| BA      | 139  | 2.90E-02 | 2.07E-05 | 8.50E-04 | 0.00E-01 | 1.93E-05 | 1.17E-05 | 5.15E-02 |
| BA      | 140  | 1.29E 08 | 1.61E 05 | 8.42E 06 | 0.00E-01 | 5.49E 04 | 9.25E 04 | 2.65E 08 |
| BA      | 141  | 1.28E-21 | 9.64E-25 | 4.31E-23 | 0.00E-01 | 8.96E-25 | 5.47E-25 | 6.01E-31 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 1.98E 03 | 9.99E 02 | 2.64E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.33E 07 |
| LA      | 142  | 1.42E-04 | 6.44E-05 | 1.61E-05 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.70E-01 |
| CE      | 141  | 1.97E 05 | 1.33E 05 | 1.51E 04 | 0.00E-01 | 6.19E 04 | 0.00E-01 | 5.10E 08 |
| CE      | 143  | 9.98E 02 | 7.38E 05 | 8.17E 01 | 0.00E-01 | 3.25E 02 | 0.00E-01 | 2.76E 07 |
| CE      | 144  | 3.29E 07 | 1.38E 07 | 1.77E 06 | 0.00E-01 | 8.16E 06 | 0.00E-01 | 1.11E 10 |
| PR      | 143  | 6.26E 04 | 2.51E 04 | 3.11E 03 | 0.00E-01 | 1.45E 04 | 0.00E-01 | 2.74E 08 |
| PR      | 144  | 3.13E-26 | 1.30E-26 | 1.59E-27 | 0.00E-01 | 7.32E-27 | 0.00E-01 | 0.00E-01 |
| ND      | 147  | 3.36E 04 | 3.89E 04 | 2.32E 03 | 0.00E-01 | 2.27E 04 | 0.00E-01 | 1.87E 08 |
| W       | 187  | 3.82E 04 | 3.20E 04 | 1.12E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.05E 07 |
| NP      | 239  | 1.43E 03 | 1.40E 02 | 7.74E 01 | 0.00E-01 | 4.38E 02 | 0.00E-01 | 2.88E 07 |

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**TABLE A.5-14**  
VEGETATION PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
TEEN (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 2.59E 03 | 2.59E 03 | 2.59E 03 | 2.59E 03 | 2.59E 03 | 2.59E 03 |
| C       | 14  | 3.69E 08 | 7.38E 07 | 7.38E 07 | 7.38E 07 | 7.38E 07 | 7.38E 07 | 7.38E 07 |
| NA      | 24  | 2.39E 05 | 2.39E 05 | 2.39E 05 | 2.39E 05 | 2.39E 05 | 2.39E 05 | 2.39E 05 |
| P       | 32  | 1.61E 09 | 9.96E 07 | 6.23E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.35E 08 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 6.17E 04 | 3.43E 04 | 1.35E 04 | 8.81E 04 | 1.04E 07 |
| MN      | 54  | 0.00E-01 | 4.54E 08 | 9.01E 07 | 0.00E-01 | 1.36E 08 | 0.00E-01 | 9.32E 08 |
| MN      | 56  | 0.00E-01 | 1.44E 01 | 2.55E 00 | 0.00E-01 | 1.82E 01 | 0.00E-01 | 9.45E 02 |
| FE      | 55  | 3.25E 08 | 2.31E 08 | 5.38E 07 | 0.00E-01 | 0.00E-01 | 1.46E 08 | 9.98E 07 |
| FE      | 59  | 1.79E 08 | 4.18E 08 | 1.62E 08 | 0.00E-01 | 0.00E-01 | 1.32E 08 | 9.90E 08 |
| CO      | 58  | 0.00E-01 | 4.36E 07 | 1.01E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.01E 08 |
| CO      | 60  | 0.00E-01 | 2.49E 08 | 5.60E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.24E 09 |
| NI      | 63  | 1.61E 10 | 1.13E 09 | 5.44E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.81E 08 |
| NI      | 65  | 6.45E 01 | 8.24E 00 | 3.76E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.47E 02 |
| CU      | 64  | 0.00E-01 | 8.34E 03 | 3.92E 03 | 0.00E-01 | 2.11E 04 | 0.00E-01 | 6.47E 05 |
| ZN      | 65  | 4.24E 08 | 1.47E 09 | 6.86E 08 | 0.00E-01 | 9.42E 08 | 0.00E-01 | 6.23E 08 |
| ZN      | 69  | 8.21E-06 | 1.56E 05 | 1.10E-06 | 0.00E-01 | 1.02E-05 | 0.00E-01 | 2.88E-05 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 2.92E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.08E-16 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 2.27E-11 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.14E-28 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 86  | 0.00E-01 | 2.74E 08 | 1.29E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.05E 07 |
| RB      | 88  | 0.00E-01 | 3.21E-22 | 1.71E-22 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.75E-29 |
| RB      | 89  | 0.00E-01 | 1.26E-26 | 8.94E-27 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.94E-35 |
| SR      | 89  | 1.51E 10 | 0.00E-01 | 4.34E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.80E 09 |
| SR      | 90  | 7.51E 11 | 0.00E-01 | 1.85E 11 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.11E 10 |
| SR      | 91  | 2.83E 05 | 0.00E-01 | 1.13E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.28E 06 |
| SR      | 92  | 3.98E 02 | 0.00E-01 | 1.70E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.01E 04 |
| Y       | 90  | 1.24E 04 | 0.00E-01 | 3.34E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.02E 08 |
| Y       | 91M | 4.88E-09 | 0.00E-01 | 1.87E-10 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.30E-07 |
| Y       | 91  | 7.84E 06 | 0.00E-01 | 2.10E 05 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.21E 09 |
| Y       | 92  | 8.61E-01 | 0.00E-01 | 2.49E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.36E 04 |
| Y       | 93  | 1.63E 02 | 0.00E-01 | 4.47E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.99E 06 |
| ZR      | 95  | 1.72E 06 | 5.44E 05 | 3.74E 05 | 0.00E-01 | 7.99E 05 | 0.00E-01 | 1.25E 09 |
| ZR      | 97  | 3.12E 02 | 6.18E 01 | 2.85E 01 | 0.00E-01 | 9.37E 01 | 0.00E-01 | 1.67E 07 |
| NB      | 95  | 1.93E 05 | 1.07E 05 | 5.88E 04 | 0.00E-01 | 1.04E 05 | 0.00E-01 | 4.57E 08 |
| MO      | 99  | 0.00E-01 | 5.65E 06 | 1.08E 06 | 0.00E-01 | 1.29E 07 | 0.00E-01 | 1.01E 07 |
| TC      | 99M | 2.74E 00 | 7.64E 00 | 9.90E 01 | 0.00E-01 | 1.14E 02 | 4.24E 00 | 5.02E 03 |

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**TABLE A.5-14 (cont'd)**  
VEGETATION PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
TEEN (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 7.76E-31 | 1.10E-30 | 1.08E-29 | 0.00E-01 | 2.00E-29 | 6.72E-31 | 0.00E-01 |
| RU      | 103  | 6.81E 06 | 0.00E-01 | 2.91E 06 | 0.00E-01 | 2.40E 07 | 0.00E-01 | 5.69E 08 |
| RU      | 105  | 5.01E 01 | 0.00E-01 | 1.94E 01 | 0.00E-01 | 6.32E 02 | 0.00E-01 | 4.04E 04 |
| RU      | 106  | 3.09E 08 | 0.00E-01 | 3.90E 07 | 0.00E-01 | 5.97E 08 | 0.00E-01 | 1.48E 10 |
| AG      | 110M | 1.52E 07 | 1.43E 07 | 8.72E 06 | 0.00E-01 | 2.74E 07 | 0.00E-01 | 4.03E 09 |
| TE      | 125M | 1.48E 08 | 5.34E 07 | 1.98E 07 | 4.14E 07 | 0.00E-01 | 0.00E-01 | 4.39E 08 |
| TE      | 127M | 5.52E 08 | 1.96E 08 | 6.56E 07 | 1.31E 08 | 2.24E 09 | 0.00E-01 | 1.37E 09 |
| TE      | 127  | 5.34E 03 | 1.89E 03 | 1.15E 03 | 3.68E 03 | 2.16E 04 | 0.00E-01 | 4.12E 05 |
| TE      | 129M | 3.62E 08 | 1.34E 08 | 5.73E 07 | 1.17E 08 | 1.51E 09 | 0.00E-01 | 1.36E 09 |
| TE      | 129  | 7.16E-04 | 2.67E-04 | 1.74E-04 | 5.12E-04 | 3.01E-03 | 0.00E-01 | 3.92E-03 |
| TE      | 131M | 8.44E 05 | 4.05E 05 | 3.38E 05 | 6.09E 05 | 4.22E 06 | 0.00E-01 | 3.25E 07 |
| TE      | 131  | 1.41E-14 | 5.80E-16 | 4.40E-16 | 1.08E-15 | 6.15E-15 | 0.00E-01 | 1.15E-16 |
| TE      | 132  | 3.91E 06 | 2.48E 06 | 2.33E 06 | 2.61E 06 | 2.37E 07 | 0.00E-01 | 7.84E 07 |
| I       | 130  | 3.51E 05 | 1.02E 06 | 4.05E 05 | 8.28E 07 | 1.56E 06 | 0.00E-01 | 7.80E 05 |
| I       | 131  | 7.69E 07 | 1.08E 08 | 5.78E 07 | 3.14E 10 | 1.85E 08 | 0.00E-01 | 2.13E 07 |
| I       | 132  | 5.20E 01 | 1.36E 02 | 4.89E 01 | 4.59E 03 | 2.14E 02 | 0.00E-01 | 5.93E 01 |
| I       | 133  | 1.94E 06 | 3.29E 06 | 1.00E 06 | 4.59E 08 | 5.77E 06 | 0.00E-01 | 2.49E 06 |
| I       | 134  | 8.76E-05 | 2.32E-04 | 8.34E-05 | 3.87E-03 | 3.66E-04 | 0.00E-01 | 3.06E-06 |
| I       | 135  | 3.52E 04 | 9.07E 04 | 3.36E 04 | 5.84E 06 | 1.43E 05 | 0.00E-01 | 1.01E 05 |
| CS      | 134  | 7.10E 09 | 1.67E 10 | 7.75E 09 | 0.00E-01 | 5.31E 09 | 2.03E 09 | 2.08E 08 |
| CS      | 136  | 4.28E 07 | 1.68E 08 | 1.13E 08 | 0.00E-01 | 9.16E 07 | 1.44E 07 | 1.35E 07 |
| CS      | 137  | 1.01E 10 | 1.35E 10 | 4.69E 09 | 0.00E-01 | 4.59E 09 | 1.78E 09 | 1.92E 08 |
| CS      | 138  | 3.64E-11 | 6.98E-11 | 3.49E-11 | 0.00E-01 | 5.15E-11 | 6.00E-12 | 3.17E-14 |
| BA      | 139  | 2.73E-02 | 1.92E-05 | 7.96E-04 | 0.00E-01 | 1.81E-05 | 1.32E-05 | 2.44E-01 |
| BA      | 140  | 1.38E 08 | 1.69E 05 | 8.91E 06 | 0.00E-01 | 5.74E 04 | 1.14E 05 | 2.13E 08 |
| BA      | 141  | 1.19E-21 | 8.90E-25 | 3.98E-23 | 0.00E-01 | 8.27E-25 | 6.10E-25 | 2.54E-27 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 1.81E 03 | 8.89E 02 | 2.37E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.11E 07 |
| LA      | 142  | 1.30E-04 | 5.78E-05 | 1.44E-05 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.76E 00 |
| CE      | 141  | 2.83E 05 | 1.89E 05 | 2.17E 04 | 0.00E-01 | 8.90E 04 | 0.00E-01 | 5.41E 08 |
| CE      | 143  | 9.33E 02 | 6.79E 05 | 7.58E 01 | 0.00E-01 | 3.04E 02 | 0.00E-01 | 2.04E 07 |
| CE      | 144  | 5.27E 07 | 2.18E 07 | 2.83E 06 | 0.00E-01 | 1.30E 07 | 0.00E-01 | 1.33E 10 |
| PR      | 143  | 7.01E 04 | 2.80E 04 | 3.49E 03 | 0.00E-01 | 1.63E 04 | 0.00E-01 | 2.31E 08 |
| PR      | 144  | 2.93E-26 | 1.20E-26 | 1.49E-27 | 0.00E-01 | 6.88E-27 | 0.00E-01 | 3.23E-29 |
| ND      | 147  | 3.66E 04 | 3.98E 04 | 2.38E 03 | 0.00E-01 | 2.34E 04 | 0.00E-01 | 1.44E 08 |
| W       | 187  | 3.56E 04 | 2.90E 04 | 1.02E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.84E 06 |
| NP      | 239  | 1.39E 02 | 1.31E 02 | 7.26E 01 | 0.00E-01 | 4.10E 02 | 0.00E-01 | 2.10E 07 |

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**TABLE A.5-15**  
VEGETATION PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
CHILD (RI FACTORS)

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 4.01E 03 | 4.01E 03 | 4.01E 03 | 4.01E 03 | 4.01E 03 | 4.01E 03 |
| C       | 14  | 8.89E 08 | 1.78E 08 | 1.78E 08 | 1.78E 08 | 1.78E 08 | 1.78E 08 | 1.78E 08 |
| NA      | 24  | 3.73E 05 | 3.73E 05 | 3.73E 05 | 3.73E 05 | 3.73E 05 | 3.73E 05 | 3.73E 05 |
| P       | 32  | 3.37E 09 | 1.58E 08 | 1.30E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.30E 07 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 1.17E 05 | 6.50E 04 | 1.78E 04 | 1.19E 05 | 6.21E 06 |
| MN      | 54  | 0.00E-01 | 6.65E 08 | 1.77E 08 | 0.00E-01 | 1.86E 08 | 0.00E-01 | 5.58E 08 |
| MN      | 56  | 0.00E-01 | 1.88E 01 | 4.24E 00 | 0.00E-01 | 2.27E 01 | 0.00E-01 | 2.72E 03 |
| FE      | 55  | 8.00E 08 | 4.24E 08 | 1.31E 08 | 0.00E-01 | 0.00E-01 | 2.40E 08 | 7.86E 07 |
| FE      | 59  | 3.97E 08 | 6.43E 08 | 3.20E 08 | 0.00E-01 | 0.00E-01 | 1.86E 08 | 6.69E 08 |
| CO      | 58  | 0.00E-01 | 6.44E 07 | 1.97E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.76E 08 |
| CO      | 60  | 0.00E-01 | 3.78E 08 | 1.12E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.10E 09 |
| NI      | 63  | 3.95E 10 | 2.11E 09 | 1.34E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.42E 08 |
| NI      | 65  | 1.18E 02 | 1.11E 01 | 6.51E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.37E 03 |
| CU      | 64  | 0.00E-01 | 1.10E 04 | 6.65E 03 | 0.00E-01 | 2.66E 04 | 0.00E-01 | 5.16E 05 |
| ZN      | 65  | 8.12E 08 | 2.16E 09 | 1.35E 09 | 0.00E-01 | 1.36E 09 | 0.00E-01 | 3.80E 08 |
| ZN      | 69  | 1.51E-05 | 2.19E-05 | 2.02E-06 | 0.00E-01 | 1.33E-05 | 0.00E-01 | 1.38E-03 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 5.38E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.14E-17 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 3.85E-11 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.94E-28 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 86  | 0.00E-01 | 4.52E 08 | 2.78E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.91E 07 |
| RB      | 88  | 0.00E-01 | 4.43E-22 | 3.08E-22 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.17E-23 |
| RB      | 89  | 0.00E-01 | 1.67E-26 | 1.48E-26 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.45E-28 |
| SR      | 89  | 3.60E 10 | 0.00E-01 | 1.03E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.39E 09 |
| SR      | 90  | 1.24E 12 | 0.00E-01 | 3.15E 11 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.67E 10 |
| SR      | 91  | 5.21E 05 | 0.00E-01 | 1.97E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.15E 06 |
| SR      | 92  | 7.29E 02 | 0.00E-01 | 2.92E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.38E 04 |
| Y       | 90  | 2.30E 04 | 0.00E-01 | 6.17E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.56E 07 |
| Y       | 91M | 8.95E-09 | 0.00E-01 | 3.26E-10 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.75E-05 |
| Y       | 91  | 1.86E 07 | 0.00E-01 | 4.99E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.48E 09 |
| Y       | 92  | 1.59E 00 | 0.00E-01 | 4.54E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.58E 04 |
| Y       | 93  | 3.01E 02 | 0.00E-01 | 8.26E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.48E 06 |
| ZR      | 95  | 3.86E 06 | 8.49E 05 | 7.56E 05 | 0.00E-01 | 1.22E 06 | 0.00E-01 | 8.85E 08 |
| ZR      | 97  | 5.70E 02 | 8.24E 01 | 4.86E 01 | 0.00E-01 | 1.18E 02 | 0.00E-01 | 1.25E 07 |
| NB      | 95  | 4.11E 05 | 1.60E 05 | 1.14E 05 | 0.00E-01 | 1.50E 05 | 0.00E-01 | 2.96E 08 |
| MO      | 99  | 0.00E-01 | 7.71E 06 | 1.91E 06 | 0.00E-01 | 1.65E 07 | 0.00E-01 | 6.38E 06 |
| TC      | 99M | 4.71E 00 | 9.24E 00 | 1.51E 02 | 0.00E-01 | 1.34E 02 | 4.69E 00 | 5.26E 03 |

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**TABLE A.5-15 (cont'd)**  
VEGETATION PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
CHILD (RI FACTORS)

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 1.43E-30 | 1.49E-30 | 1.89E-29 | 0.00E-01 | 2.55E-29 | 7.90E-31 | 4.75E-30 |
| RU      | 103  | 1.53E 07 | 0.00E-01 | 5.88E 06 | 0.00E-01 | 3.85E 07 | 0.00E-01 | 3.96E 08 |
| RU      | 105  | 9.17E 01 | 0.00E-01 | 3.33E 01 | 0.00E-01 | 8.06E 02 | 0.00E-01 | 5.99E 04 |
| RU      | 106  | 7.45E 08 | 0.00E-01 | 9.30E 07 | 0.00E-01 | 1.01E 09 | 0.00E-01 | 1.16E 10 |
| AG      | 110M | 3.21E 07 | 2.17E 07 | 1.73E 07 | 0.00E-01 | 4.04E 07 | 0.00E-01 | 2.58E 09 |
| TE      | 125M | 3.51E 08 | 9.50E 07 | 4.67E 07 | 9.84E 07 | 0.00E-01 | 0.00E-01 | 3.38E 08 |
| TE      | 127M | 1.32E 09 | 3.56E 08 | 1.57E 08 | 3.16E 08 | 3.77E 09 | 0.00E-01 | 1.07E 09 |
| TE      | 127  | 9.85E 03 | 2.66E 03 | 2.11E 03 | 6.82E 03 | 2.80E 04 | 0.00E-01 | 3.85E 05 |
| TE      | 129M | 8.41E 08 | 2.35E 08 | 1.30E 08 | 2.71E 08 | 2.47E 09 | 0.00E-01 | 1.03E 09 |
| TE      | 129  | 1.33E-03 | 3.70E-04 | 3.15E-04 | 9.46E-04 | 3.88E-03 | 0.00E-01 | 8.25E-02 |
| TE      | 131M | 1.54E 06 | 5.33E 05 | 5.68E 05 | 1.10E 06 | 5.16E 06 | 0.00E-01 | 2.16E 07 |
| TE      | 131  | 2.59E-15 | 7.90E-16 | 7.71E-16 | 1.98E-15 | 7.84E-15 | 0.00E-01 | 1.36E-14 |
| TE      | 132  | 7.00E 06 | 3.10E 06 | 3.74E 06 | 4.51E 06 | 2.88E 07 | 0.00E-01 | 3.12E 07 |
| I       | 130  | 6.16E 05 | 1.24E 06 | 6.41E 05 | 1.37E 08 | 1.86E 06 | 0.00E-01 | 5.82E 05 |
| I       | 131  | 1.43E 08 | 1.44E 08 | 8.17E 07 | 4.76E 10 | 2.36E 08 | 0.00E-01 | 1.28E 07 |
| I       | 132  | 9.23E 01 | 1.70E 02 | 7.80E 01 | 7.87E 03 | 2.60E 02 | 0.00E-01 | 2.00E 02 |
| I       | 133  | 3.53E 06 | 4.37E 06 | 1.65E 06 | 8.12E 08 | 7.28E 06 | 0.00E-01 | 1.76E 06 |
| I       | 134  | 1.56E-04 | 2.89E-04 | 1.33E-04 | 6.65E-04 | 4.42E-04 | 0.00E-01 | 1.92E-04 |
| I       | 135  | 6.26E 04 | 1.13E 05 | 5.33E 04 | 9.98E 06 | 1.73E 05 | 0.00E-01 | 8.59E 04 |
| CS      | 134  | 1.60E 10 | 2.63E 10 | 5.55E 09 | 0.00E-01 | 8.15E 09 | 2.93E 09 | 1.42E 08 |
| CS      | 136  | 8.04E 07 | 2.21E 08 | 1.43E 08 | 0.00E-01 | 1.18E 08 | 1.76E 07 | 7.77E 06 |
| CS      | 137  | 2.39E 10 | 2.29E 10 | 3.38E 09 | 0.00E-01 | 7.46E 09 | 2.68E 09 | 1.43E 08 |
| CS      | 138  | 6.61E-11 | 9.20E-11 | 5.83E-11 | 0.00E-01 | 6.47E-11 | 6.96E-12 | 4.24E-11 |
| BA      | 139  | 5.04E-02 | 2.69E-05 | 1.46E-03 | 0.00E-01 | 2.35E-05 | 1.58E-05 | 2.91E 00 |
| BA      | 140  | 2.77E 08 | 2.43E 05 | 1.62E 07 | 0.00E-01 | 7.90E 04 | 1.45E 05 | 1.40E 08 |
| BA      | 141  | 2.20E-21 | 1.23E-24 | 7.16E-23 | 0.00E-01 | 1.07E-24 | 7.24E-24 | 1.25E-21 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 3.25E 03 | 1.14E 03 | 3.83E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.17E 07 |
| LA      | 142  | 2.36E-04 | 7.51E-05 | 2.35E-05 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.49E 01 |
| CE      | 141  | 6.56E 05 | 3.27E 05 | 4.86E 04 | 0.00E-01 | 1.43E 05 | 0.00E-01 | 4.08E 08 |
| CE      | 143  | 1.72E 03 | 9.31E 05 | 1.35E 02 | 0.00E-01 | 3.91E 02 | 0.00E-01 | 1.36E 07 |
| CE      | 144  | 1.27E 08 | 3.98E 07 | 6.78E 06 | 0.00E-01 | 2.21E 07 | 0.00E-01 | 1.04E 10 |
| PR      | 143  | 1.46E 05 | 4.38E 04 | 7.23E 03 | 0.00E-01 | 2.37E 04 | 0.00E-01 | 1.57E 08 |
| PR      | 144  | 5.44E-26 | 1.68E-26 | 2.74E-27 | 0.00E-01 | 8.90E-27 | 0.00E-01 | 3.62E-23 |
| ND      | 147  | 7.24E 04 | 5.86E 04 | 4.54E 03 | 0.00E-01 | 3.22E 04 | 0.00E-01 | 9.29E 07 |
| W       | 187  | 6.47E 04 | 3.83E 04 | 1.72E 04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.38E 07 |
| NP      | 239  | 2.56E 03 | 1.84E 02 | 1.29E 02 | 0.00E-01 | 5.31E 02 | 0.00E-01 | 1.36E 07 |

|                 |                                 |                 |
|-----------------|---------------------------------|-----------------|
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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-16**  
GROUND PLANE PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
(RI FACTOR)

|       |          |         |          |        |          |
|-------|----------|---------|----------|--------|----------|
| H-3   | 0.00E 00 | Y-91M   | 1.00E 05 | CS-134 | 6.86E 09 |
| C-14  | 0.00E 00 | Y-91    | 1.07E 06 | CS-136 | 1.49E 08 |
| NA-24 | 1.19E 07 | Y-92    | 1.80E 05 | CS-137 | 1.03E 10 |
| P-32  | 0.00E 00 | Y-93    | 1.85E 05 | CS-138 | 3.59E 05 |
| CR-51 | 4.66E 06 | ZR-95   | 2.45E 08 | BA-139 | 1.06E 05 |
| MN-54 | 1.39E 09 | ZR-97   | 2.96E 06 | BA-140 | 2.05E 07 |
| MN-56 | 9.03E 05 | NB-95   | 1.37E 08 | BA-141 | 4.18E 04 |
| FE-55 | 0.00E 00 | MO-99   | 3.99E 06 | BA-142 | 4.49E 04 |
| FE-59 | 2.73E 08 | TC-99M  | 1.84E 05 | LA-140 | 1.92E 07 |
|       |          | TC-101  | 2.04E 04 |        |          |
| CO-58 | 3.79E 08 | RU-103  | 1.08E 08 | LA-142 | 7.37E 05 |
| CO-60 | 2.15E 10 | RU-105  | 6.36E 05 | CE-141 | 1.37E 07 |
| NI-63 | 0.00E 00 | RU-106  | 4.21E 08 | CE-143 | 2.31E 06 |
| NI-65 | 3.02E 05 | AG-110M | 3.44E 09 | CE-144 | 6.96E 07 |
| CU-64 | 6.07E 05 | TE-125M | 1.55E 06 | PR-143 | 0.00E 00 |
| ZN-65 | 7.46E 08 | TE-127M | 9.17E 04 | PR-144 | 1.83E 03 |
| ZN-69 | 0.00E 00 | TE-127  | 2.98E 03 | ND-147 | 8.46E 06 |
| BR-83 | 4.87E 03 | TE-129M | 1.98E 07 | W-187  | 2.36E 06 |
| BR-84 | 2.03E 05 | TE-129  | 2.62E 04 | NP-239 | 1.71E 06 |
| BR-85 | 0.00E 00 | TE-131M | 8.03E 06 |        |          |
| RB-86 | 8.99E 06 | TE-131  | 2.92E 04 |        |          |
| RB-88 | 3.31E 04 | TE-132  | 4.23E 06 |        |          |
| RB-89 | 1.21E 05 | I-130   | 5.51E 06 |        |          |
| SR-89 | 2.16E 04 | I-131   | 1.72E 07 |        |          |
| SR-90 | 0.00E 00 | I-132   | 1.25E 06 |        |          |
| SR-91 | 2.14E 06 | I-133   | 2.45E 06 |        |          |
| SR-92 | 7.77E 05 | I-134   | 4.47E 05 |        |          |
| Y-90  | 4.49E 03 | I-135   | 2.53E 06 |        |          |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-17**  
GRASS-GOAT-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
ADULT

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 1.56E 03 | 1.56E 03 | 1.56E 03 | 1.56E 03 | 1.56E 03 | 1.56E 03 |
| C       | 14  | 2.63E 08 | 5.27E 07 | 5.27E 07 | 5.27E 07 | 5.27E 07 | 5.27E 07 | 5.27E 07 |
| NA      | 24  | 2.93E 05 | 2.93E 05 | 2.93E 05 | 2.93E 05 | 2.93E 05 | 2.93E 05 | 2.93E 05 |
| P       | 32  | 2.05E 10 | 1.27E 09 | 7.93E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.31E 09 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 3.43E 03 | 2.05E 03 | 7.55E 02 | 4.55E 03 | 8.62E 05 |
| MN      | 54  | 0.00E-01 | 1.01E 06 | 1.93E 05 | 0.00E-01 | 3.00E 05 | 0.00E-01 | 3.09E 06 |
| MN      | 56  | 0.00E-01 | 4.99E-03 | 8.85E-04 | 0.00E-01 | 6.34E-03 | 0.00E-01 | 1.59E-01 |
| FE      | 55  | 3.26E 05 | 2.25E 05 | 5.26E 04 | 0.00E-01 | 0.00E-01 | 1.26E 05 | 1.29E 05 |
| FE      | 59  | 3.86E 05 | 9.07E 05 | 3.48E 05 | 0.00E-01 | 0.00E-01 | 2.54E 05 | 3.02E 06 |
| CO      | 58  | 0.00E-01 | 5.66E 05 | 1.27E 06 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.15E 07 |
| CO      | 60  | 0.00E-01 | 1.97E 06 | 4.34E 06 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.70E 07 |
| NI      | 63  | 8.07E 08 | 5.65E 07 | 2.71E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.17E 07 |
| NI      | 65  | 5.56E-02 | 7.22E-03 | 3.30E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.83E-01 |
| CU      | 64  | 0.00E-01 | 2.66E 03 | 1.25E 03 | 0.00E-01 | 6.70E 03 | 0.00E-01 | 2.27E 05 |
| ZN      | 65  | 1.65E 08 | 5.24E 08 | 2.37E 08 | 0.00E-01 | 3.50E 08 | 0.00E-01 | 3.30E 08 |
| ZN      | 69  | 6.27E-13 | 1.20E-12 | 8.34E-14 | 0.00E-01 | 7.79E-13 | 0.00E-01 | 1.80E-13 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 86  | 0.00E-01 | 3.11E 08 | 1.45E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.14E 07 |
| RB      | 88  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 89  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| SR      | 89  | 3.05E 09 | 0.00E-01 | 8.75E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.89E 08 |
| SR      | 90  | 9.83E 10 | 0.00E-01 | 2.41E 10 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.84E 09 |
| SR      | 91  | 6.02E 04 | 0.00E-01 | 2.43E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.87E 05 |
| SR      | 92  | 1.03E 00 | 0.00E-01 | 4.45E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.04E 01 |
| Y       | 90  | 8.49E 00 | 0.00E-01 | 2.28E-00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 9.00E 04 |
| Y       | 91M | 7.24E-21 | 0.00E-01 | 2.80E-22 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.13E-20 |
| Y       | 91  | 1.03E 03 | 0.00E-01 | 2.76E 01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.67E 05 |
| Y       | 92  | 6.71E-06 | 0.00E-01 | 1.96E-07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.18E-01 |
| Y       | 93  | 2.80E-02 | 0.00E-01 | 7.73E-04 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 8.87E 02 |
| ZR      | 95  | 1.13E 02 | 3.63E 01 | 2.46E 01 | 0.00E-01 | 5.70E 01 | 0.00E-01 | 1.15E 05 |
| ZR      | 97  | 5.20E-02 | 1.05E-01 | 4.80E-03 | 0.00E-01 | 1.58E-01 | 0.00E-01 | 3.25E 03 |
| NB      | 95  | 9.91E 03 | 5.51E 03 | 2.96E 03 | 0.00E-01 | 5.45E 03 | 0.00E-01 | 3.35E 07 |
| MO      | 99  | 0.00E-01 | 2.97E 06 | 5.65E 05 | 0.00E-01 | 6.73E 06 | 0.00E-01 | 6.89E 06 |
| TC      | 99M | 3.99E-01 | 1.13E 00 | 1.44E 01 | 0.00E-01 | 1.71E 01 | 5.53E-01 | 6.67E 02 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-17 (cont'd)**  
GRASS-GOAT-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
ADULT

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RU      | 103  | 1.22E 02 | 0.00E-01 | 5.26E 01 | 0.00E-01 | 4.66E 02 | 0.00E-01 | 1.43E 04 |
| RU      | 105  | 1.03E-04 | 0.00E-01 | 4.07E-05 | 0.00E-01 | 1.33E-03 | 0.00E-01 | 6.30E-02 |
| RU      | 106  | 2.45E 03 | 0.00E-01 | 3.10E 02 | 0.00E-01 | 4.73E 03 | 0.00E-01 | 1.58E 05 |
| AG      | 110M | 6.99E 06 | 6.46E 06 | 3.84E 06 | 0.00E-01 | 1.27E 07 | 0.00E-01 | 2.64E 09 |
| TE      | 125M | 1.95E 06 | 7.08E 05 | 2.62E 05 | 5.88E 05 | 7.95E 06 | 0.00E-01 | 7.81E 06 |
| TE      | 127M | 5.49E 06 | 1.96E 06 | 6.70E 05 | 1.40E 06 | 2.23E 07 | 0.00E-01 | 1.84E 07 |
| TE      | 127  | 7.84E 01 | 2.82E 01 | 1.70E 01 | 5.81E 01 | 3.19E 02 | 0.00E-01 | 6.19E 03 |
| TE      | 129M | 7.22E 06 | 2.69E 06 | 1.14E 06 | 2.48E 06 | 3.02E 07 | 0.00E-01 | 3.64E 07 |
| TE      | 129  | 3.41E-11 | 1.28E-11 | 8.31E-12 | 2.62E-11 | 1.43E-10 | 0.00E-01 | 2.57E-11 |
| TE      | 131M | 4.33E 04 | 2.12E 04 | 1.77E 04 | 3.36E 04 | 2.15E 05 | 0.00E-01 | 2.10E 06 |
| TE      | 131  | 4.40E-34 | 1.84E-34 | 1.39E-34 | 3.62E-34 | 1.93E-33 | 0.00E-01 | 6.23E-35 |
| TE      | 132  | 2.88E 05 | 1.86E 05 | 1.75E 05 | 2.06E 05 | 1.80E 06 | 0.00E-01 | 8.82E 06 |
| I       | 130  | 5.04E 05 | 1.49E 06 | 5.87E 05 | 1.26E 08 | 2.32E 06 | 0.00E-01 | 1.28E 06 |
| I       | 131  | 3.55E 08 | 5.08E 08 | 2.91E 08 | 1.67E 11 | 8.71E 08 | 0.00E-01 | 1.34E 08 |
| I       | 132  | 1.98E-00 | 5.29E-00 | 1.85E-00 | 1.85E 01 | 8.43E-00 | 0.00E-01 | 9.94E-01 |
| I       | 133  | 4.65E 06 | 8.08E 06 | 2.46E 06 | 1.19E 09 | 1.41E 07 | 0.00E-01 | 7.26E 06 |
| I       | 134  | 2.44E-12 | 6.63E-12 | 2.37E-12 | 1.15E-10 | 1.05E-11 | 0.00E-01 | 5.78E-15 |
| I       | 135  | 1.54E 04 | 4.04E 04 | 1.49E 04 | 2.66E 06 | 6.48E 04 | 0.00E-01 | 4.56E 04 |
| CS      | 134  | 1.70E 10 | 4.04E 10 | 3.30E 10 | 0.00E-01 | 1.31E 10 | 4.34E 09 | 7.06E 08 |
| CS      | 136  | 7.83E 08 | 3.09E 09 | 2.23E 09 | 0.00E-01 | 1.72E 09 | 2.36E 08 | 3.51E 08 |
| CS      | 137  | 2.21E 10 | 3.03E 10 | 1.98E 10 | 0.00E-01 | 1.03E 10 | 3.42E 09 | 5.86E 08 |
| CS      | 138  | 2.75E-23 | 5.43E-23 | 2.69E-23 | 0.00E-01 | 3.99E-23 | 3.94E-24 | 2.32E-28 |
| BA      | 139  | 5.48E-09 | 3.90E-12 | 1.60E-10 | 0.00E-01 | 3.65E-12 | 2.21E-12 | 9.71E-09 |
| BA      | 140  | 3.23E 06 | 4.05E 03 | 2.11E 05 | 0.00E-01 | 1.38E 03 | 2.32E 03 | 6.64E 06 |
| BA      | 141  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 5.43E-01 | 2.73E-01 | 7.23E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.01E 04 |
| LA      | 142  | 1.13E-12 | 5.12E-13 | 1.28E-13 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.74E-09 |
| CE      | 141  | 5.81E 02 | 3.93E 02 | 4.46E 01 | 0.00E-01 | 1.83E 02 | 0.00E-01 | 1.50E 06 |
| CE      | 143  | 4.99E 00 | 3.69E 03 | 4.08E-00 | 0.00E-01 | 1.62E 00 | 0.00E-01 | 1.38E 05 |
| CE      | 144  | 4.29E 04 | 1.79E 04 | 2.30E 03 | 0.00E-01 | 1.06E 04 | 0.00E-01 | 1.45E 07 |
| PR      | 143  | 1.90E 01 | 7.60E 00 | 9.39E-00 | 0.00E-01 | 4.39E 00 | 0.00E-01 | 8.30E 04 |
| PR      | 144  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| ND      | 147  | 1.14E 01 | 1.31E 01 | 7.85E-01 | 0.00E-01 | 7.67E 00 | 0.00E-01 | 6.30E 04 |
| W       | 187  | 7.87E 02 | 6.58E 02 | 2.30E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.16E 05 |
| NP      | 239  | 4.41E-01 | 4.33E-02 | 2.39E-02 | 0.00E-01 | 1.35E-01 | 0.00E-01 | 8.89E 03 |

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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-18**  
GRASS-GOAT-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
TEEN

[illegible]

ATTACHMENT A  
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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-18 (cont'd)**  
GRASS-GOAT-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
TEEN

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| RU      | 103  | 2.17E 02 | 0.00E-01 | 9.28E 01 | 0.00E-01 | 7.66E 02 | 0.00E-01 | 1.81E 04 |
| RU      | 105  | 1.88E-04 | 0.00E-01 | 7.30E-05 | 0.00E-01 | 2.37E-03 | 0.00E-01 | 1.52E-01 |
| RU      | 106  | 4.50E 03 | 0.00E-01 | 5.67E 02 | 0.00E-01 | 8.68E 03 | 0.00E-01 | 2.16E 05 |
| AG      | 110M | 1.16E 07 | 1.09E 07 | 6.65E 06 | 0.00E-01 | 2.08E 07 | 0.00E-01 | 3.07E 09 |
| TE      | 125M | 3.60E 06 | 1.30E 06 | 4.82E 05 | 1.01E 06 | 0.00E-01 | 0.00E-01 | 1.06E 07 |
| TE      | 127M | 1.01E 07 | 3.59E 06 | 1.20E 06 | 2.41E 06 | 4.10E 07 | 0.00E-01 | 2.52E 07 |
| TE      | 127  | 1.45E 02 | 5.15E 01 | 3.13E 01 | 1.00E 02 | 5.89E 02 | 0.00E-01 | 1.12E 04 |
| TE      | 129M | 1.32E 07 | 4.90E 06 | 2.09E 06 | 4.26E 06 | 5.53E 07 | 0.00E-01 | 4.96E 07 |
| TE      | 129  | 6.28E-11 | 2.34E-11 | 1.53E-11 | 4.48E-11 | 2.63E-10 | 0.00E-01 | 3.43E-10 |
| TE      | 131M | 7.89E 04 | 3.78E 04 | 3.16E 04 | 5.69E 04 | 3.94E 05 | 0.00E-01 | 3.04E 06 |
| TE      | 131  | 8.04E-34 | 3.31E-34 | 2.51E-34 | 6.19E-34 | 3.51E-33 | 0.00E-01 | 6.60E-35 |
| TE      | 132  | 5.15E 05 | 3.26E 05 | 3.07E 05 | 3.44E 05 | 3.13E 06 | 0.00E-01 | 1.03E 07 |
| I       | 130  | 8.87E 05 | 2.57E 06 | 1.02E 06 | 2.09E 08 | 3.95E 06 | 0.00E-01 | 1.97E 06 |
| I       | 131  | 6.45E 08 | 9.03E 08 | 4.85E 08 | 2.63E 11 | 1.55E 09 | 0.00E-01 | 1.79E 08 |
| I       | 132  | 3.51E-01 | 9.18E-01 | 3.29E-01 | 3.09E 01 | 1.45E 00 | 0.00E-01 | 4.00E-01 |
| I       | 133  | 8.49E 06 | 1.44E 07 | 4.39E 06 | 2.01E 09 | 2.52E 07 | 0.00E-01 | 1.09E 07 |
| I       | 134  | 4.34E-12 | 1.15E-11 | 4.13E-12 | 1.92E-10 | 1.81E-11 | 0.00E-01 | 1.51E-13 |
| I       | 135  | 2.74E 04 | 7.05E 04 | 2.61E 04 | 4.54E 06 | 1.11E 05 | 0.00E-01 | 7.82E 04 |
| CS      | 134  | 2.94E 10 | 6.93E 10 | 3.22E 10 | 0.00E-01 | 2.20E 10 | 8.41E 09 | 8.62E 08 |
| CS      | 136  | 1.33E 09 | 5.25E 09 | 3.52E 09 | 0.00E-01 | 2.86E 09 | 4.50E 08 | 4.22E 08 |
| CS      | 137  | 4.02E 10 | 5.34E 10 | 1.86E 10 | 0.00E-01 | 1.82E 10 | 7.06E 09 | 7.60E 08 |
| CS      | 138  | 4.99E-23 | 9.58E-23 | 4.79E-23 | 0.00E-01 | 7.07E-23 | 8.23E-24 | 4.34E-26 |
| BA      | 139  | 1.01E-08 | 7.13E-12 | 2.95E-10 | 0.00E-01 | 6.72E-12 | 4.91E-12 | 9.04E-08 |
| BA      | 140  | 5.82E 06 | 7.14E 03 | 3.75E 05 | 0.00E-01 | 2.42E 03 | 4.08E 03 | 8.98E 06 |
| BA      | 141  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 9.75E-01 | 4.79E-01 | 1.27E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.75E 04 |
| LA      | 142  | 2.03E-12 | 9.03E 13 | 2.25E-13 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.75E-08 |
| CE      | 141  | 1.07E 03 | 7.12E 02 | 8.18E 01 | 0.00E-01 | 3.35E 02 | 0.00E-01 | 2.04E 06 |
| CE      | 143  | 9.17E 00 | 6.67E 03 | 7.45E-00 | 0.00E-01 | 2.99E 00 | 0.00E-01 | 2.01E 05 |
| CE      | 144  | 7.90E 04 | 3.27E 04 | 4.24E 03 | 0.00E-01 | 1.95E 04 | 0.00E-01 | 1.99E 07 |
| PR      | 143  | 3.48E 01 | 1.39E 00 | 1.73E 00 | 0.00E-01 | 8.08E 00 | 0.00E-01 | 1.15E 05 |
| PR      | 144  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| ND      | 147  | 2.19E 01 | 2.38E 01 | 1.42E 00 | 0.00E-01 | 1.40E 01 | 0.00E-01 | 8.57E 04 |
| W       | 187  | 1.44E 03 | 1.17E 03 | 4.11E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.18E 05 |
| NP      | 239  | 8.41E-01 | 7.93E-02 | 4.41E-02 | 0.00E-01 | 2.49E-01 | 0.00E-01 | 1.28E 04 |

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OFFSITE DOSE CALCULATION MANUAL

TABLE A.5-19  
GRASS-GOAT-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER μCi/SEC  
CHILD

[illegible]

ATTACHMENT A  
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OFFSITE DOSE CALCULATION MANUAL

**TABLE A.5-19 (cont'd)**  
GRASS-GOAT-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
CHILD

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| RU      | 103  | 5.14E 02 | 0.00E-01 | 1.97E 02 | 0.00E-01 | 1.29E 03 | 0.00E-01 | 1.33E 04 |
| RU      | 105  | 4.59E-04 | 0.00E-01 | 1.67E-04 | 0.00E-01 | 4.04E-03 | 0.00E-01 | 3.00E-01 |
| RU      | 106  | 1.11E 04 | 0.00E-01 | 1.38E 03 | 0.00E-01 | 1.50E 04 | 0.00E-01 | 1.72E 05 |
| AG      | 110M | 2.51E 07 | 1.69E 07 | 1.35E 07 | 0.00E-01 | 3.15E 07 | 0.00E-01 | 2.01E 09 |
| TE      | 125M | 8.85E 06 | 2.40E 06 | 1.18E 06 | 2.48E 06 | 0.00E-01 | 0.00E-01 | 8.54E 06 |
| TE      | 127M | 2.50E 07 | 6.72E 06 | 2.96E 06 | 5.97E 06 | 7.12E 07 | 0.00E-01 | 2.02E 07 |
| TE      | 127  | 3.57E 02 | 9.64E 01 | 7.67E 01 | 2.47E 02 | 1.02E 03 | 0.00E-01 | 1.40E 04 |
| TE      | 129M | 3.26E 07 | 9.09E 06 | 5.05E 06 | 1.05E 07 | 9.56E 07 | 0.00E-01 | 3.97E 07 |
| TE      | 129  | 1.55E-10 | 4.32E-11 | 3.68E-11 | 1.11E-10 | 4.53E-10 | 0.00E-01 | 9.64E-09 |
| TE      | 131M | 1.92E 05 | 6.64E 04 | 7.07E 04 | 1.37E 05 | 6.43E 05 | 0.00E-01 | 2.69E 06 |
| TE      | 131  | 1.97E-33 | 6.01E-34 | 5.87E-34 | 1.51E-33 | 5.97E-33 | 0.00E-01 | 1.04E-32 |
| TE      | 132  | 1.23E 06 | 5.44E 05 | 6.58E 05 | 7.93E 05 | 5.05E 06 | 0.00E-01 | 5.48E 06 |
| I       | 130  | 2.07E 06 | 4.19E 06 | 2.16E 06 | 4.62E 08 | 6.27E 06 | 0.00E-01 | 1.96E 06 |
| I       | 131  | 1.56E 09 | 1.57E 09 | 8.94E 08 | 5.20E 11 | 2.58E 09 | 0.00E-01 | 1.40E 08 |
| I       | 132  | 8.30E-01 | 1.52E 00 | 7.01E-01 | 7.07E 01 | 2.33E 00 | 0.00E-01 | 1.79E 00 |
| I       | 133  | 2.06E 07 | 2.55E 07 | 9.65E 06 | 4.74E 09 | 4.25E 07 | 0.00E-01 | 1.03E 07 |
| I       | 134  | 1.03E-11 | 1.91E-11 | 8.77E-12 | 4.39E-10 | 2.92E-11 | 0.00E-01 | 1.26E-11 |
| I       | 135  | 6.49E 04 | 1.17E 05 | 5.52E 04 | 1.03E 07 | 1.79E 05 | 0.00E-01 | 8.90E 04 |
| CS      | 134  | 6.79E 10 | 1.11E 11 | 2.35E 10 | 0.00E-01 | 3.45E 10 | 1.24E 10 | 6.01E 08 |
| CS      | 136  | 3.01E 09 | 8.27E 09 | 5.35E 09 | 0.00E-01 | 4.40E 09 | 6.57E 08 | 2.91E 08 |
| CS      | 137  | 9.67E 10 | 9.26E 10 | 1.37E 10 | 0.00E-01 | 3.02E 10 | 1.09E 10 | 5.80E 08 |
| CS      | 138  | 1.21E-22 | 1.68E-22 | 1.07E-22 | 0.00E-01 | 1.18E-22 | 1.27E-23 | 7.74E-23 |
| BA      | 139  | 2.49E-08 | 1.33E-11 | 7.21E-10 | 0.00E-01 | 1.16E-11 | 7.82E-12 | 1.44E-06 |
| BA      | 140  | 1.41E 07 | 1.23E 04 | 8.21E 05 | 0.00E-01 | 4.01E 03 | 7.34E 03 | 7.12E 06 |
| BA      | 141  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 2.33E 00 | 8.16E-00 | 2.75E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.27E 04 |
| LA      | 142  | 4.91E-12 | 1.56E-12 | 4.90E-13 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.10E-07 |
| CE      | 141  | 2.63E 03 | 1.31E 03 | 1.94E 02 | 0.00E-01 | 5.74E 02 | 0.00E-01 | 1.63E 06 |
| CE      | 143  | 2.25E 01 | 1.22E 04 | 1.77E 00 | 0.00E-01 | 5.12E 00 | 0.00E-01 | 1.79E 05 |
| CE      | 144  | 1.95E 05 | 6.11E 04 | 1.04E 04 | 0.00E-01 | 3.38E 04 | 0.00E-01 | 1.59E 07 |
| PR      | 143  | 8.62E 01 | 2.59E 01 | 4.28E 00 | 0.00E-01 | 1.40E 01 | 0.00E-01 | 9.30E 04 |
| PR      | 144  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| ND      | 147  | 5.36E 01 | 4.34E 01 | 3.36E 00 | 0.00E-01 | 2.38E 01 | 0.00E-01 | 6.88E 04 |
| W       | 187  | 3.49E 03 | 2.07E 03 | 9.28E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.90E 05 |
| NP      | 239  | 2.07E 00 | 1.49E-01 | 1.04E-01 | 0.00E-01 | 4.30E-01 | 0.00E-01 | 1.10E 04 |

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**TABLE A.5-20**  
GRASS-GOAT-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
INFANT

| NUCLIDE |     | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|-----|----------|----------|----------|----------|----------|----------|----------|
| H       | 3   | 0.00E-01 | 4.86E 03 | 4.86E 03 | 4.86E 03 | 4.86E 03 | 4.86E 03 | 4.86E 03 |
| C       | 14  | 2.34E 09 | 5.00E 08 | 5.00E 08 | 5.00E 08 | 5.00E 08 | 5.00E 08 | 5.00E 08 |
| NA      | 24  | 1.85E 06 | 1.85E 06 | 1.85E 06 | 1.85E 06 | 1.85E 06 | 1.85E 06 | 1.85E 06 |
| P       | 32  | 1.92E 11 | 1.13E 10 | 7.45E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.60E 09 |
| CR      | 51  | 0.00E-01 | 0.00E-01 | 1.94E 04 | 1.26E 04 | 2.76E 03 | 2.46E 04 | 5.64E 05 |
| MN      | 54  | 0.00E-01 | 4.68E 06 | 1.06E 06 | 0.00E-01 | 1.04E 06 | 0.00E-01 | 1.72E 06 |
| MN      | 56  | 0.00E-01 | 3.78E-03 | 6.51E-04 | 0.00E-01 | 3.25E-03 | 0.00E-01 | 3.43E-01 |
| FE      | 55  | 1.76E 06 | 1.13E 06 | 3.03E 06 | 0.00E-01 | 0.00E-01 | 5.54E 05 | 1.44E 05 |
| FE      | 59  | 2.92E 06 | 5.09E 06 | 2.01E 06 | 0.00E-01 | 0.00E-01 | 1.51E 06 | 2.43E 06 |
| CO      | 58  | 0.00E-01 | 2.91E 06 | 7.26E 06 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 7.25E 06 |
| CO      | 60  | 0.00E-01 | 1.06E 07 | 2.50E 07 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.52E 07 |
| NI      | 63  | 4.19E 09 | 2.59E 08 | 1.45E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.29E 07 |
| NI      | 65  | 5.27E-01 | 5.96E-02 | 2.71E-02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 4.54E 00 |
| CU      | 64  | 0.00E-01 | 2.07E 04 | 9.58E 03 | 0.00E-01 | 3.50E 04 | 0.00E-01 | 4.25E 05 |
| ZN      | 65  | 6.66E 08 | 2.28E 09 | 1.05E 09 | 0.00E-01 | 1.11E 09 | 0.00E-01 | 1.93E 09 |
| ZN      | 69  | 6.04E-12 | 1.09E-11 | 8.10E-13 | 0.00E-01 | 4.52E-12 | 0.00E-01 | 8.87E-10 |
| BR      | 83  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 84  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BR      | 85  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 86  | 0.00E-01 | 2.67E 09 | 1.32E 09 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.83E 07 |
| RB      | 88  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RB      | 89  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| SR      | 89  | 2.64E 10 | 0.00E-01 | 7.58E 08 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 5.43E 08 |
| SR      | 90  | 2.55E 11 | 0.00E-01 | 6.50E 10 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.19E 09 |
| SR      | 91  | 5.65E 05 | 0.00E-01 | 2.05E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.69E 05 |
| SR      | 92  | 9.78E 00 | 0.00E-01 | 3.63E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.05E 02 |
| Y       | 90  | 8.16E 01 | 0.00E-01 | 2.19E 00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.13E 05 |
| Y       | 91M | 6.87E-20 | 0.00E-01 | 2.34E-21 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.29E-16 |
| Y       | 91  | 8.79E 03 | 0.00E-01 | 2.34E 02 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.30E 05 |
| Y       | 92  | 6.47E-05 | 0.00E-01 | 1.82E-06 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 1.23E 00 |
| Y       | 93  | 2.70E-01 | 0.00E-01 | 7.36E-03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.13E 03 |
| ZR      | 95  | 8.17E 02 | 1.99E 02 | 1.41E 02 | 0.00E-01 | 2.14E 02 | 0.00E-01 | 9.91E 04 |
| ZR      | 97  | 4.88E-01 | 8.37E-02 | 3.82E-02 | 0.00E-01 | 8.44E-02 | 0.00E-01 | 5.34E 03 |
| NB      | 95  | 7.12E 04 | 2.93E 04 | 1.70E 04 | 0.00E-01 | 2.10E 04 | 0.00E-01 | 2.48E 07 |
| MO      | 99  | 0.00E-01 | 2.50E 07 | 4.87E 06 | 0.00E-01 | 3.73E 07 | 0.00E-01 | 8.22E 06 |
| TC      | 99M | 3.30E 00 | 6.81E 00 | 8.77E 01 | 0.00E-01 | 7.33E 01 | 3.56E 00 | 1.98E 03 |

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**TABLE A.5-20 (cont'd)**  
GRASS-GOAT-MILK PATHWAY FACTOR  
M<sup>2</sup> MREM/YR PER  $\mu$ CI/SEC  
INFANT

| NUCLIDE |      | BONE     | LIVER    | T BODY   | THYROID  | KIDNEY   | LUNG     | GI-LLI   |
|---------|------|----------|----------|----------|----------|----------|----------|----------|
| TC      | 101  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| RU      | 103  | 1.04E 03 | 0.00E-01 | 3.48E 02 | 0.00E-01 | 2.16E 03 | 0.00E-01 | 1.26E 04 |
| RU      | 105  | 9.68E-04 | 0.00E-01 | 3.26E-04 | 0.00E-01 | 7.12E-03 | 0.00E-01 | 3.85E-01 |
| RU      | 106  | 2.28E 04 | 0.00E-01 | 2.85E 03 | 0.00E-01 | 2.70E 04 | 0.00E-01 | 1.73E 05 |
| AG      | 110M | 4.63E 07 | 3.38E 07 | 2.24E 07 | 0.00E-01 | 4.83E 07 | 0.00E-01 | 1.75E 09 |
| TE      | 125M | 1.81E 07 | 6.05E 06 | 2.45E 06 | 6.09E 06 | 0.00E-01 | 0.00E-01 | 8.62E 06 |
| TE      | 127M | 5.05E 07 | 1.68E 07 | 6.12E 06 | 1.46E 07 | 1.24E 08 | 0.00E-01 | 2.04E 07 |
| TE      | 127  | 7.59E 02 | 2.54E 02 | 1.63E 02 | 6.18E 02 | 1.85E 03 | 0.00E-01 | 1.59E 04 |
| TE      | 129M | 6.69E 07 | 2.29E 07 | 1.03E 07 | 2.57E 07 | 1.67E 08 | 0.00E-01 | 3.99E 07 |
| TE      | 129  | 3.28E-10 | 1.13E-10 | 7.66E-11 | 2.75E-10 | 8.17E-10 | 0.00E-01 | 2.62E-08 |
| TE      | 131M | 4.05E 05 | 1.63E 05 | 1.35E 05 | 3.31E 05 | 1.12E 06 | 0.00E-01 | 2.75E 06 |
| TE      | 131  | 4.18E-33 | 1.54E-33 | 1.17E-33 | 3.73E-33 | 1.07E-32 | 0.00E-01 | 1.69E-31 |
| TE      | 132  | 2.53E 06 | 1.25E 06 | 1.17E 06 | 1.85E 06 | 7.84E 06 | 0.00E-01 | 4.64E 06 |
| I       | 130  | 4.26E 06 | 9.38E 06 | 3.76E 06 | 1.05E 09 | 1.03E 07 | 0.00E-01 | 2.01E 06 |
| I       | 131  | 3.26E 09 | 3.85E 09 | 1.69E 09 | 1.26E 12 | 4.49E 09 | 0.00E-01 | 1.37E 08 |
| I       | 132  | 1.72E 00 | 3.49E 00 | 1.24E 00 | 1.64E 02 | 3.90E 00 | 0.00E-01 | 2.83E 00 |
| I       | 133  | 4.35E 07 | 6.34E 07 | 1.86E 07 | 1.15E 10 | 7.45E 07 | 0.00E-01 | 1.07E 07 |
| I       | 134  | 2.13E-11 | 4.36E-11 | 1.55E-11 | 1.02E-09 | 4.88E-11 | 0.00E-01 | 4.51E-11 |
| I       | 135  | 1.35E 05 | 2.68E 05 | 9.79E 04 | 2.41E 07 | 2.99E 05 | 0.00E-01 | 9.71E 04 |
| CS      | 134  | 1.09E 11 | 2.04E 11 | 2.06E 10 | 0.00E-01 | 5.25E 10 | 1.86E 10 | 5.54E 08 |
| CS      | 136  | 5.88E 09 | 1.73E 10 | 6.45E 09 | 0.00E-01 | 6.89E 09 | 1.41E 09 | 2.63E 08 |
| CS      | 137  | 1.54E 11 | 1.81E 11 | 1.28E 10 | 0.00E-01 | 4.85E 10 | 1.96E 10 | 5.65E 08 |
| CS      | 138  | 2.55E-22 | 4.15E-22 | 2.01E-22 | 0.00E-01 | 2.07E-22 | 3.23E-23 | 6.63E-22 |
| BA      | 139  | 5.30E-08 | 3.51E-11 | 1.53E-09 | 0.00E-01 | 2.11E-11 | 2.13E-11 | 3.35E-06 |
| BA      | 140  | 2.89E 07 | 2.89E 04 | 1.49E 06 | 0.00E-01 | 6.87E 03 | 1.78E 04 | 7.11E 06 |
| BA      | 141  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| BA      | 142  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| LA      | 140  | 4.88E 00 | 1.92E 00 | 4.94E-00 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 2.26E 04 |
| LA      | 142  | 1.03E-11 | 3.78E-12 | 9.06E-13 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 6.43E-07 |
| CE      | 141  | 5.20E 03 | 3.17E 03 | 3.74E 02 | 0.00E-01 | 9.79E 02 | 0.00E-01 | 1.64E 06 |
| CE      | 143  | 4.76E 01 | 3.16E 04 | 3.61E 00 | 0.00E-01 | 9.21E 00 | 0.00E-01 | 1.84E 05 |
| CE      | 144  | 2.79E 05 | 1.14E 05 | 1.56E 04 | 0.00E-01 | 4.62E 04 | 0.00E-01 | 1.60E 07 |
| PR      | 143  | 1.78E 02 | 6.67E 01 | 8.84E 00 | 0.00E-01 | 2.48E 01 | 0.00E-01 | 9.41E 04 |
| PR      | 144  | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 0.00E-01 |
| ND      | 147  | 1.06E 02 | 1.09E 02 | 6.69E 00 | 0.00E-01 | 4.21E 01 | 0.00E-01 | 6.92E 04 |
| W       | 187  | 7.35E 03 | 5.11E 03 | 1.77E 03 | 0.00E-01 | 0.00E-01 | 0.00E-01 | 3.00E 05 |
| NP      | 239  | 4.38E 00 | 3.91E-01 | 2.21E-01 | 0.00E-01 | 7.80E-01 | 0.00E-01 | 1.13E 04 |

|                 |                                 |                 |
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APPENDIX B  
Meteorological Model

|                 |                                 |                 |
|-----------------|---------------------------------|-----------------|
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**APPENDIX B**

The X/Qs and D/Qs are calculated using the computer code XOQDOQ which implements the guidance of Reg. Guide 1.111.

The constant mean wind direction model, as defined in equation 3 of Reg. Guide 1.111, is used to calculate X/Q values.

$$(X/Q)_D = \frac{2.032 \sum_{ij} n_{ij} \exp[-h_e^2/2 \sigma_{zj}^2(x)]}{N \times \bar{U}_i \sum_{zj} (x)}$$

Where:  $h_e$  = effective release height (m). (All releases from Wolf Creek Generating Station are considered as ground releases therefore  $h_e = 0$ .)

$n_{ij}$  = hours of valid data for weather conditions in given direction, windspeed class I, and atmospheric stability class j.

$N$  = total hours of valid data

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$\bar{U}_i$  = midpoint of windspeed class (m/s)

$x$  = distance downwind (m)

$\sigma_{zj}(x)$  = vertical plume spread without volumetric correction at distance  $x$  and stability class j. See Figure B.1.

$\Sigma_{zj}(x)$  = vertical plume spread with volumetric correction for release within buildings wake cavity, at distance  $x$  and stability class j.

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For ground level releases  $\Sigma_{zj}(x)$  is the lesser of

$$(\sigma_{zj}^2(x) + 0.5 D_z^2 / \pi)^{1/2} \text{ or } \sqrt{3} \sigma_{zj}(x)$$

|                 |                                 |                 |
|-----------------|---------------------------------|-----------------|
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**APPENDIX B (cont'd.)**

Where:  $D_z$  = maximum adjacent building height either up- or down-wind from the release point

$2.032 = (2/\pi)^{1/2}$  divided by width, in radians, of a 22.5 sector

$(X/Q)_D$  = Average effluent concentration,  $X$ , normalized to source strength,  $Q$ , at distance  $x$  in sector  $D$ .

For WCGS the above Meteorological Model will simplify to the following equation for  $X/Q$ :

$$(X/Q)_D = \frac{2.032 \sum_{ij} n_{ij}}{N \bar{U}_i x \sum_{ij} (x)}$$

The calculation of the relative disposition per unit area,  $D/Q$ , is performed using the deposition rate graphs found in Reg. Guide 1.111. For a 22.5 sector, since the effluent concentration is assumed uniform across the sector, the relative deposition per unit area is assumed uniform across the sector.

The calculation of  $D/Q$  is determined from relative deposition by the following relationship:

$$D/Q = \frac{\sum_{ij} D_{ij}(x) \cdot DEPL_{ij}(x)}{(2\pi/16)x}$$

Where:  $D_{ij}(x)$  = Relative deposition rate for windspeed class  $i$  and stability class  $j$  at downwind distance  $x$  (1/m). See Figure B.3.

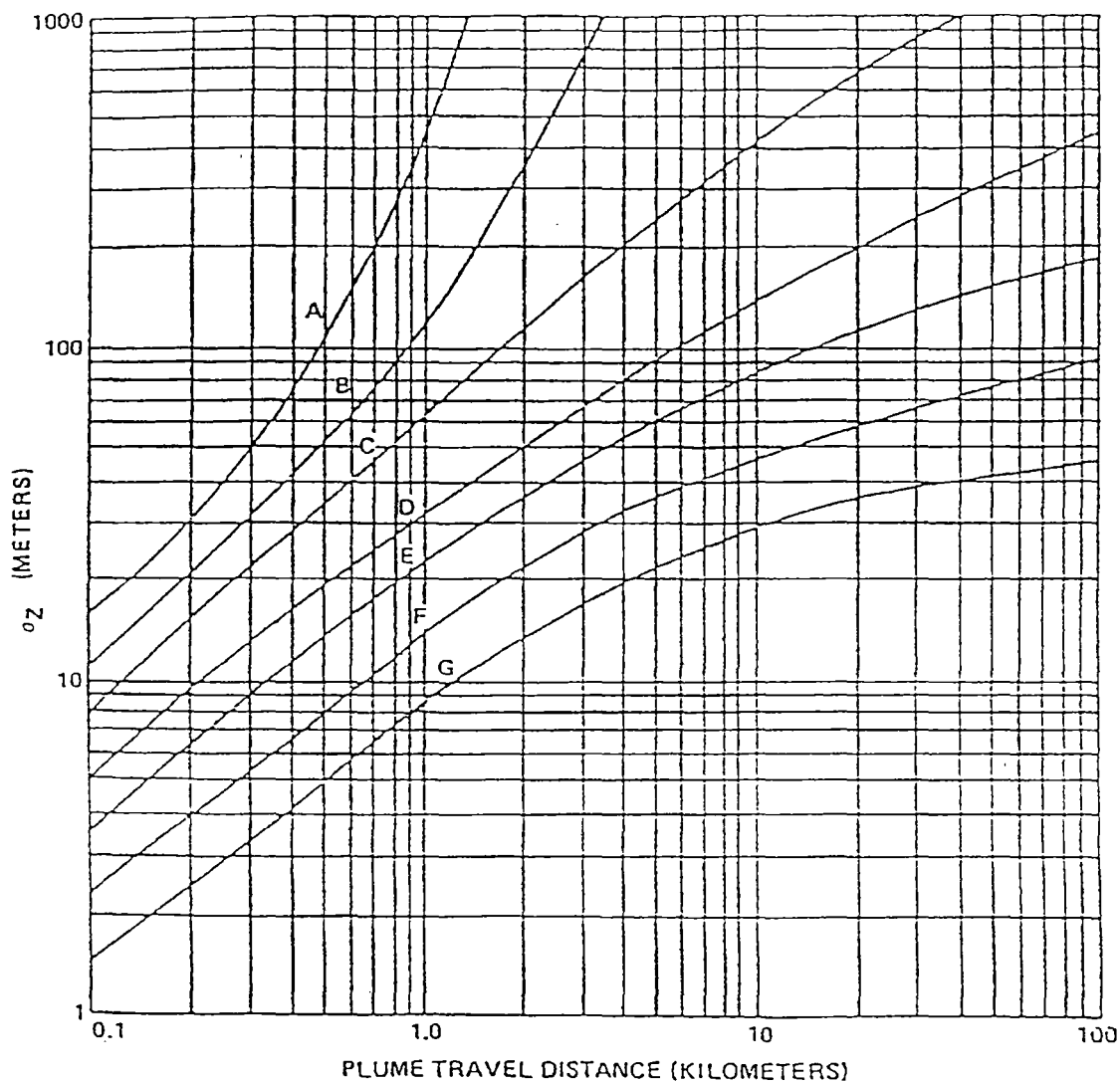
$(2\pi/16)x$  = length of arc across sector at downwind distance  $x$  (m).

$D/Q$  = relative deposition per unit area (m)

$DEPL_{ij}(x)$  = Reduction factor due to plume depletion at distance  $x$  for windspeed  $i$  and stability class  $j$ .

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Figure B.1

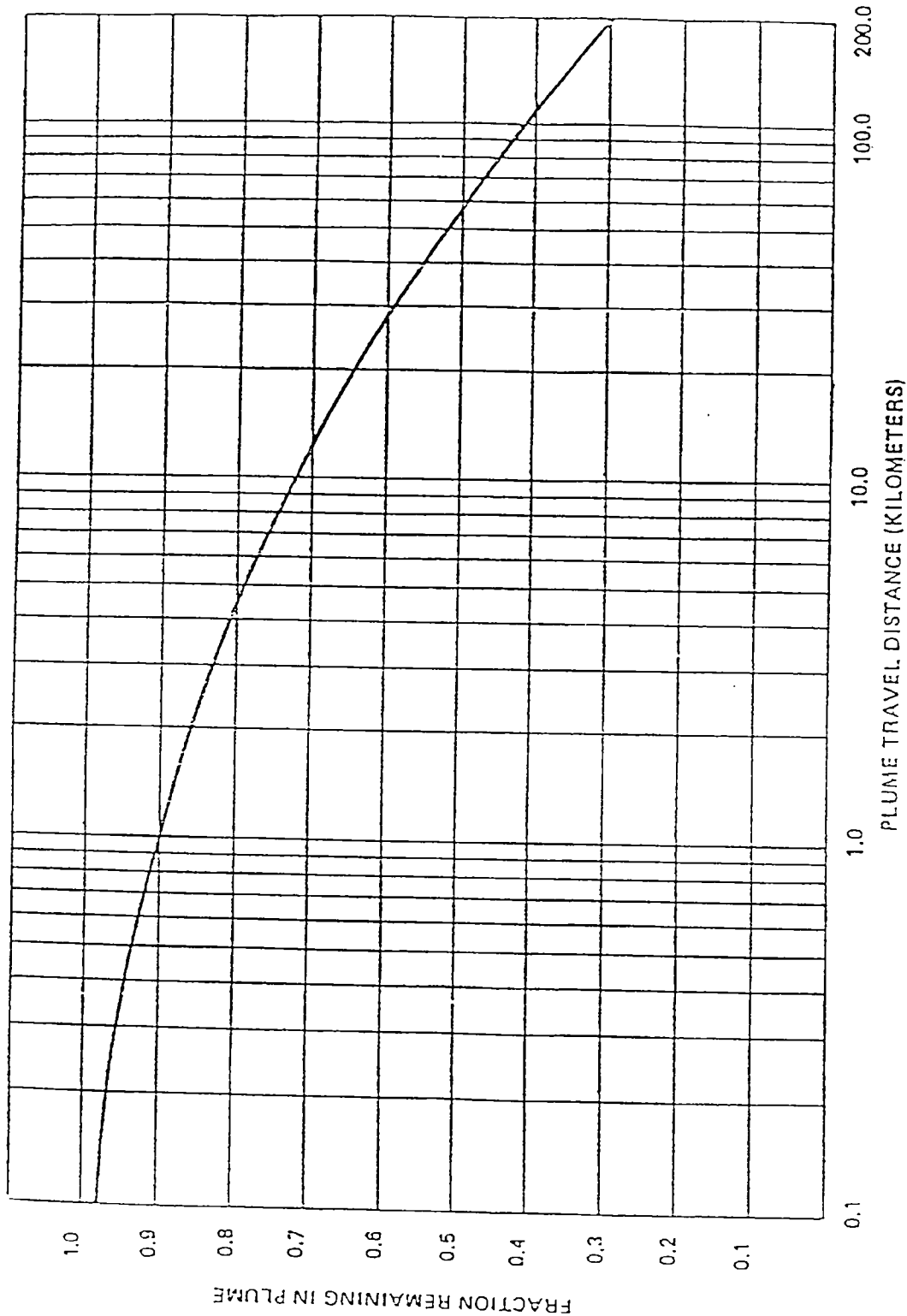


Vertical Standard Deviation of Material in a Plume (Letters denote Pasquill Stability Class)

NOTE: THESE ARE STANDARD RELATIONSHIPS AND MAY HAVE TO BE MODIFIED FOR CERTAIN TYPES OF TERRAIN AND/OR CLIMATIC CONDITIONS (E.G. VALLEY DESERT OVER WATER).

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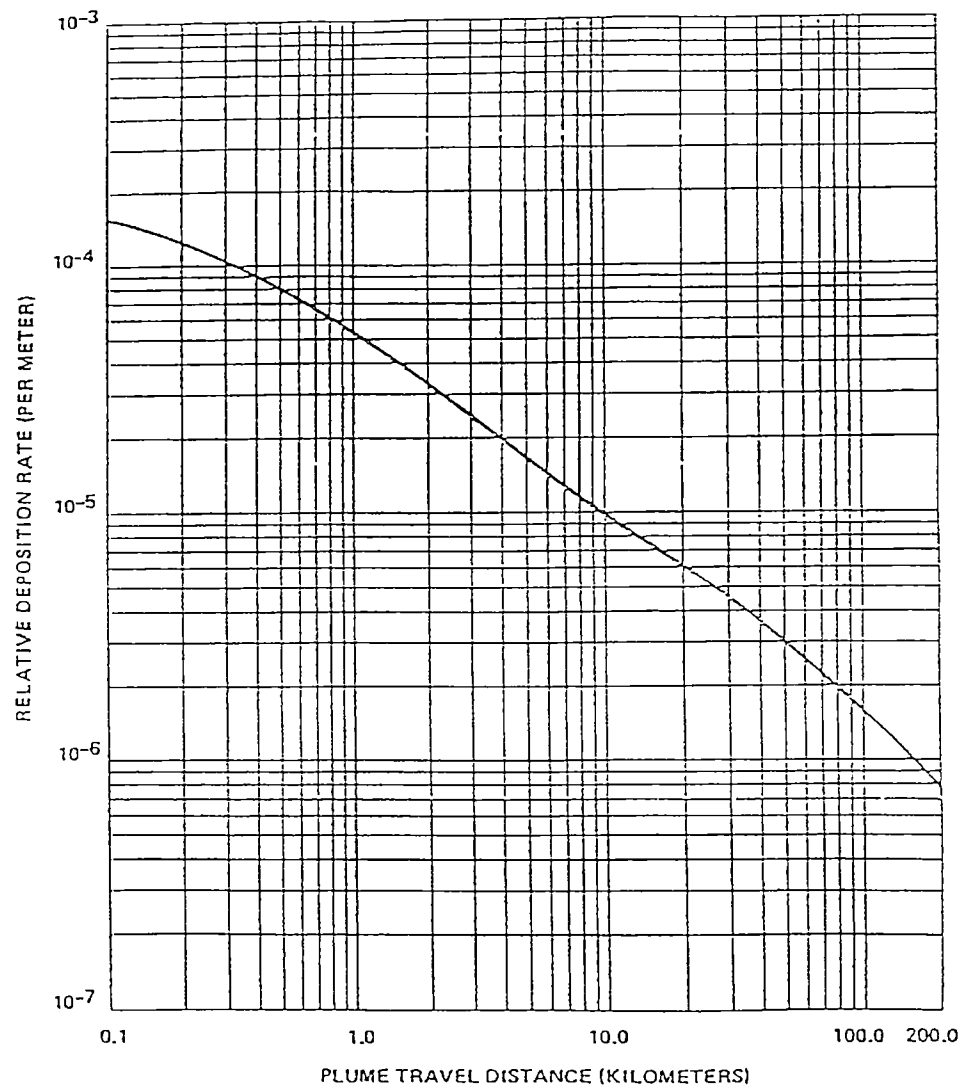
Figure B.2



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Figure B.3



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- END -