

3. To comply with this specification, the effluent radiation monitor has a setpoint corresponding to an offsite total body dose rate at or below the limit (see Part 2 Section 2.6). In addition, compliance is assessed by calculating offsite total body dose rate based on periodic samples obtained per station procedures.

#### 4.2.1.2 Noble Gas: Skin Dose Rate

1. ODCM Part 1 limits the skin dose rate due to noble gases in gaseous effluents released from a site to areas at and beyond the site boundary to less than or equal to a dose rate of 3000 mrem/yr at all times. (See TRM 3.11.f)
2. The skin dose rate due to noble gases released in gaseous effluents is calculated by the following expression:

$$\dot{D}_{SK} = \sum_i \left\{ L_i \left[ (\chi/Q)_s Q_{is} + (\chi/Q)_v Q_{iv} + (\chi/Q)_g Q_{ig} \right] + (1.11) M_i \left[ (\chi/Q)_s^* Q_{is} + (\chi/Q)_v^* Q_{iv} + (\chi/Q)_g^* Q_{ig} \right] \right\} \quad (4-2)$$

The summation is over noble gas radionuclides  $i$ .

$\dot{D}_{SK}$  Skin Dose Rate [mrem/yr]

Dose rate to skin due to beta and gamma radiation from noble gas radionuclides released in gaseous effluents.

$L_i$  Skin Dose Conversion Factor [(mrem/yr)/(μCi/m<sup>3</sup>)]

Skin dose factor due to gamma emissions for noble gas radionuclide  $i$ .  $L$  values are taken from Table 4-28

$M_i$  Gamma Air Dose Conversion Factor [(mrad/yr)/(μCi/m<sup>3</sup>)]

3. Gamma air dose rate factor per unit of radioactivity release rate for radionuclide  $i$ . See Table 4-28 for Gamma Air Dose conversion factors (From Table B-1 of Regulatory Guide 1.109).
4. Since Byron does not have an elevated release point, the  $Q_{is}$  term is not used.

5. To comply with this specification, gaseous effluent radiation monitors have setpoints corresponding to an offsite skin dose rate at or below the limit (see Part 2 Section 2.6). In addition, compliance is assessed by calculating offsite skin dose rate based on periodic samples obtained per station procedures.

#### 4.2.1.3 Non-Noble Gas Radionuclides: Organ Dose Rate

1. ODCM Part 1 limits the dose rate to any organ, due to radioactive materials in gaseous effluents released from a site to areas at and beyond the site boundary, to less than or equal to a dose rate of 1500 mrem/yr (See TRM 3.11.f)
2. Typically the child is considered to be the limiting receptor in calculating dose rate to organs due to inhalation of non-noble gas radionuclides in gaseous effluents.
3. The dose rate to any child organ due to inhalation is calculated by the following expression:

$$\dot{D}_{(Child)i(Inhal)j}^{NNG} = \sum_i R_{(Child)i(Inhal)j} \{ (\chi/Q)_s Q_{is} + (\chi/Q)_v Q_{iv} + (\chi/Q)_g Q_{ig} \} \quad (4-3)$$

The summation is over non-noble gas radionuclides  $i$ .

$$\dot{D}_{(Child)i(Inhal)j}^{NNG} \quad \text{Inhalation Dose Rate} \quad [\text{mrem/yr}]$$

Dose rate to the child age group from radionuclide  $i$ , via the inhalation pathway to organ  $j$  due to non-noble gas radionuclides.

$$R_{(Child)i(Inhal)j} \quad \text{Inhalation Dose Factor} \quad [(\text{mrem/yr})/(\mu\text{Ci}/\text{m}^3)]$$

Inhalation dose factor for child age group for radionuclide  $i$ , and organ  $j$ . Inhalation dose factors for non-noble gas radionuclides (child) are shown in Table 4-11



4. Since Byron does not have an elevated release point, the  $Q_{is}$  term is not used.
  5. ODCM Part 1 requires the dose rate due to non-noble gas radioactive materials in airborne effluents be determined to be within the above limit in accordance with a sampling and analysis program specified in TRM Table T3.11.f-1.
  6. The child organ dose rate due to inhalation is calculated in each sector at the location of the highest offsite  $\chi/Q$  (see Table 4-1). The result for the sector with the highest organ inhalation dose rate is compared to the limit.
- 4.2.2. Time Averaged Dose from Noble Gas
- 4.2.2.1 Gamma Air Dose
1. ODCM and TRM limits the gamma air dose due to noble gas effluents released from each reactor unit to areas at and beyond the unrestricted area boundary to the following:

A. Less than or equal to 5 mrad per calendar quarter.

B. Less than or equal to 10 mrad per calendar year.

The gamma air dose due to noble gases released in gaseous effluents is calculated by the following expression:

$$D_{\gamma} = (3.17E-8) \sum_i M_i \left\{ (\chi/Q)_s^{\gamma} A_{is} + (\chi/Q)_v^{\gamma} A_{iv} + (\chi/Q)_g^{\gamma} A_{ig} \right\} \quad (4-4)$$

The summation is over noble gas radionuclides  $i$ .

$D_{\gamma}$           Gamma Air Dose [mrad]

Dose to air due to gamma radiation from noble gas radionuclides released in gaseous effluents.

**3.17E-8**      Conversion Constant (seconds to years) ..... [yr/sec]

**$M_i$**           Gamma Air Dose Conversion Factor [(mrad/yr)/( $\mu\text{Ci}/\text{m}^3$ )]

Gamma air dose rate factor per unit of radioactivity release rate for radionuclide *i*. See Table 4-28 for Gamma Air Dose conversion factors (From Table B-1 of Regulatory Guide 1.109).

$(\chi/Q)_s^i, (\chi/Q)_v^i, (\chi/Q)_g^i$  Gamma- $\chi/Q$  Factor [sec/m<sup>3</sup>]

Radioactivity concentration based on finite cloud methodology at a specific location per unit of radioactivity release rate from a stack, vent or ground level release, respectively. See Table 4-3 for Gamma- $\chi/Q$  Factors.

$A_{is}, A_{iv}, A_{ig}$  Cumulative Radionuclide Release [ $\mu$ Ci]

Measured cumulative release of radionuclide *i* over the time period of interest from a stack, vent, or ground level release point, respectively.

Since Byron does not have an elevated release point, the  $A_{is}$  term is not used.

2. TRM 3.11.g requires determination of cumulative and projected gamma air dose contributions due to noble gases for the current calendar quarter and the current calendar year at least once per 31 days.
3. Gamma air dose is calculated for the sector with the highest offsite  $(\chi/Q)^i$  and is compared with the Part 1 limits on gamma air dose.
4. For a release attributable to a processing or effluent system shared by more than one reactor unit, the dose due to an individual unit is obtained by proportioning the effluents among the units sharing the system.

#### 4.2.2.2 Beta Air Dose

1. TRM Chapter 3.11 limits beta air dose due to noble gases in gaseous effluents released from each reactor unit to areas at and beyond the unrestricted area boundary to the following:
  - A. Less than or equal to 10 mrad per calendar quarter.
  - B. Less than or equal to 20 mrad per calendar year.

2. The beta air dose due to noble gases released in gaseous effluents is calculated by the following expression:

$$D_{\beta} = (3.17E - 8) \sum_i \{ N_i [(\chi/Q)_s A_{is} + (\chi/Q)_v A_{iv} + (\chi/Q)_g A_{ig}] \} \quad (4-5)$$

The summation is over noble gas radionuclides  $i$ .

$D_{\beta}$  Beta Dose [mrad]

Dose to air due to beta radiation from noble gas radionuclides released in gaseous effluents.

**3.17E-8** Conversion Constant (seconds to years) [yr/sec]

$N_i$  Beta Air Dose Conversion Factor [(mrad/yr)/( $\mu$ Ci/m<sup>3</sup>)]

Beta air dose rate per unit of radioactivity concentration for radionuclide  $i$ . See Table 4-28 for Beta Air Dose conversion factors (From Table B-1 of Regulatory Guide 1.109).

$(\chi/Q)_s$  Relative Concentration Factor [sec/m<sup>3</sup>]

$(\chi/Q)_v$  Radioactivity concentration based on semi-infinite cloud methodology at a specified location per unit of radioactivity release rate for a stack, vent, or ground level release, respectively. See Table 4-1.

$A_{is}, A_{iv}, A_{ig}$  Cumulative Radionuclide Release [ $\mu$ Ci]

Measured cumulative release of radionuclide  $i$  over the time period of interest from a stack, vent, or ground level release point, respectively.

Since Byron does not have an elevated release point, the  $A_{is}$  term is not used.

3. TRM 3.11.g requires determination of cumulative and projected beta air dose contributions due to noble gases for the current calendar quarter and the current calendar year at least once per 31 days.
4. Beta air dose is calculated for the sector with the highest offsite ( $\chi/Q$ ) and is compared with the ODCM Part 1 limit on beta air dose.
5. For a release attributable to a processing or effluent system shared by more than one reactor unit, the dose due to an individual unit is obtained by proportioning the effluents among the units sharing the system.

#### 4.2.2.3 Whole Body Dose

1. The total body dose, to any receiver is due, in part, to gamma radiation emitted from radioactivity in airborne effluents. This component is added to others to demonstrate compliance to the requirements of 40CFR190 and 10CFR20.
2. The total body dose component due to gamma radiation from noble gases released in gaseous effluents is calculated by the following expression:

$$D_{TB} = (3.17E-8) \sum_i K_i \left\{ (\chi/Q)_s A_{is} + (\chi/Q)_v A_{iv} + (\chi/Q)_g A_{ig} \right\} \quad (4-6)$$

The summation is over noble gas radionuclides  $i$ .

$D_{TB}$  Total Body Dose [mrem]

Dose to the total body due to gamma radiation from noble gas radionuclides released in gaseous effluents.

$3.17E-8$  Conversion Constant (seconds to years) [yr/sec]

$K_i$  Gamma Total Body Dose Conversion Factor [(mrem/yr)/( $\mu\text{Ci}/\text{m}^3$ )]

Gamma total body dose factor due to gamma emissions for noble gas radionuclide  $i$  released from a stack, vent or ground level release point, respectively. See Table 4-28 for Gamma total body dose conversion factors. (From Table B-1 of Regulatory Guide 1.109)

$A_{is}, A_{iv}, A_{ig}$  Cumulative Radionuclide Release [ $\mu\text{Ci}$ ]

Measured cumulative release of radionuclide  $i$  over the time period of interest from a stack, vent, or ground level release point, respectively.

3. The total body dose is also calculated for the 40CFR190 and 10CFR20 compliance assessments. In some cases, the total body dose may be required in 10CFR50 Appendix I assessments (See Part 2 Table 1-1).

#### 4.2.2.4 Skin Dose

1. There is no regulatory requirement to evaluate skin dose. However, this component is evaluated for reference as there is skin dose design objective contained in 10CFR50 Appendix I. Note that in the unlikely event that beta air dose guideline is exceeded, then the skin dose will require evaluation.
2. The part of skin dose due to noble gases released in gaseous effluents is calculated by the following expression:

$$D_{SK} = (3.17E - 8) \sum_i \left\{ L_i \left[ (\chi/Q)_s A_{is} + (\chi/Q)_v A_{iv} + (\chi/Q)_g A_{ig} \right] + (1.11) M_i \left[ (\chi/Q)_s^y A_{is} + (\chi/Q)_v^y A_{iv} + (\chi/Q)_g^y A_{ig} \right] \right\} \quad (4-7)$$

The summation is over noble gas radionuclides  $i$ .

$D_{SK}$  Skin Dose [mrem]

Dose to the skin due to beta and gamma radiation from noble gas radionuclides released in gaseous effluents.

$L_i$  Beta Skin Dose Conversion Factor [(mrem/yr)/( $\mu$ Ci/m<sup>3</sup>)]

Beta skin dose rate per unit of radioactivity concentration for radionuclide  $i$ . Taken from Table 4-28.

1.11 Conversion Constant (rads in air to rem in tissue) [mrem/mrad]

All other terms have been previously defined.

The skin dose is calculated for reference only.

**4.2.3. Time Averaged Dose from Non-Noble Gas Radionuclides**

1. TRM 3.11 provides the following limits, based on 10CFR50 Appendix I, on the dose to a member of the public from specified non-noble gas radionuclides in gaseous effluents released from each reactor unit to areas at and beyond the unrestricted area boundary:
  - A. Less than or equal to 7.5 mrem to any organ during any calendar quarter
  - B. Less than or equal to 15 mrem to any organ during any calendar year
2. The individual dose components are also required as part of the 40CFR190 assessments and combined as part of the 10CFR20 assessment (Part 2 Table 1-1). The dose due to radionuclides deposited on the ground is considered to be a component of the deep dose equivalent for 10CFR20 compliance and an organ (and total body) dose component for 10CFR50 Appendix I and 40CFR190 compliance.
3. The dose is calculated for releases in the time period under consideration.

4. Specifically, the dose is calculated as follows:

$$D_{aj}^{NNG} = (3.17E-8) \sum_p \sum_i [W_s R_{a|pj} A_{is} + W_v R_{a|pj} A_{iv} + W_g R_{a|pj} A_{ig}] \quad (4-8)$$

The summation is over pathways  $p$  and non-noble gas radionuclides  $i$ .

$D_{aj}^{NNG}$  Dose Due to Non-Noble Gas Radionuclides [mrem]

Dose due to non-noble gases (radioiodines, tritium and particulates) to age group  $a$ , and to organ  $j$ .

$3.17E-8$  Conversion Constant (seconds to years) [yr/sec]

$W_s, W_v, W_g$  Relative Concentration Factor

Radioactive concentration at a specific location per unit of radioactivity release rate or concentration for stack, vent or ground level release, respectively.

$W_s, W_v$ , or  $W_g = (\chi/Q)_s, (\chi/Q)_v$  or  $(\chi/Q)_g$  for immersion, inhalation and all tritium pathways.

$W_s, W_v$ , or  $W_g = (D/Q)_s, (D/Q)_v$  or  $(D/Q)_g$  for ground plain and all ingestion pathways.

$(\chi/Q)_s, (\chi/Q)_v, (\chi/Q)_g$  Relative Concentration Factor [sec/m<sup>3</sup>]

Radioactivity concentration based on semi-infinite cloud model at a specified location per unit of radioactivity release rate for a stack, vent, or ground level release, respectively. See Table 4-1 through Table 4-6.

$(D/Q)_s, (D/Q)_v, (D/Q)_g$  Relative Deposition Factor [1/m<sup>2</sup>]

Radioactivity concentration at a specified location per unit of radioactivity release concentration for a stack, vent, or ground level release, respectively. See Table 4-1 through Table 4-6.

**$R_{aipj}$**  Site-Specific Dose Factor  $[(m^2 \text{ mrem/yr})/(\mu\text{Ci/sec})]$   
or  $[(\text{mrem/yr})/(\mu\text{Ci}/m^3)]$

Site-specific dose factor for age group **a**, nuclide **i**, pathway **p** and organ **j**. Pathways included are ground plane exposure, inhalation, vegetation ingestion, milk ingestion and meat ingestion. Values of  $R_{aipj}$  are provided in Table 4-7 and Table 4-9 through Table 4-26.

**$A_{is}$ ,  $A_{iv}$ ,  $A_{ig}$**  Cumulative Radionuclide Release  $[\mu\text{Ci}]$

Measured cumulative release of radionuclide **i** over the time period of interest from a stack, vent, or ground level release point, respectively.

Since Byron does not have an elevated release point, the stack terms for  **$A_{is}$** ,  **$W_s$** ,  **$(\chi/Q)_s$** , and  **$(D/Q)_s$**  are not used.

5. TRM 3.11.h requires cumulative and projected dose contributions for the current calendar quarter and the current calendar year for the specified non-noble gas radionuclides in airborne effluents to be determined at least once per 31 days.
6. To comply with this specification, Byron Station obtains and analyzes samples in accordance with the radioactive gaseous waste or gaseous effluent sampling and analysis program (TRM 3.11.f-1). In accordance with NUREG 0133 (Reference 14), dose due to non-noble gases is assessed at the location in the unrestricted area where the combination of existing pathways and receptor age groups indicates the maximum potential exposure. The inhalation and ground plane exposure pathways are considered to exist at all locations. The food ingestion pathways at a specific location are considered based on their existence as determined by land use census. The values used for  $(\chi/Q)$  and  $(D/Q)$  are shown in Table 4-1 through Table 4-6 and correspond to the applicable pathway location.
7. For a release attributable to a processing or effluent system shared by more than one reactor, the dose due to an individual unit is obtained by proportioning the effluents among the units sharing the system.
8. The dose evaluated is also included as part of the 10CFR20 and 40CFR190 assessment (See Part 2 Section 5).



## 4.2.3.1 Ground Plane

1. The site-specific dose factor for ground deposition of radioactivity is considered to be a total body dose component and is calculated by the following expression:

$$R_{ai(GP)}[D/Q] = K' K'' (0.7) DFG_i \left[ \frac{1 - e^{-\lambda_i t_b}}{\lambda_i} \right] \quad (4-9)$$

$R_{ai(GP)}[D/Q]$  Ground Plane Deposition Dose Factor [(m<sup>2</sup> mrem/yr)/(μCi/sec)]

Site-specific ground plane dose factor for age group **a**, nuclide **i** and organ **j**. The ground plane dose is calculated using (D/Q).

**K'** Conversion Constant (1E6 pCi per μCi) [pCi/μCi]

**K''** Conversion Constant (8760 hr/yr) [hr/yr]

**0.7** Shielding Factor; a factor that accounts for dimensionless shielding due to occupancy of structures.

**DFG<sub>i</sub>** Ground Plane Dose Conversion Factor [(mrem/hr)/(pCi/m<sup>2</sup>)]

Dose rate to the total body per unit of surface radioactivity concentration due to standing on ground uniformly contaminated with radionuclide **i**. Ground Plane Dose Conversion Factors are shown in Table 4-8.

Note that ground plane dose conversion factors are only given for the total body and no age group. Doses to other organs are assumed to be equal to the total body dose. All age groups are assumed to receive the same dose.

**λ<sub>i</sub>** Radiological Decay Constant [hr<sup>-1</sup>]

Radiological decay constant for radionuclide **i**.

**t<sub>b</sub>** Time Period of Ground Deposition [hr]

Time period during which the radioactivity on the ground is assumed to have been deposited (see Part 2 Table 1-3).

2. The ground plane exposure pathway is considered to exist at all locations.

#### 4.2.3.2 Inhalation

1. The site-specific dose factor for inhalation is calculated by the following expression:

$$R_{ai(inhal)}[\chi/Q] = K'BR_aDFA_{aij} \quad (4-10)$$

$R_{ai(inhal)}[\chi/Q]$  Inhalation Pathway Dose Factor [(mrem/yr)/( $\mu\text{Ci}/\text{m}^3$ )]

Site-specific inhalation dose factor for age group **a**, nuclide **i** and organ **j**. The inhalation dose is calculated using  $(\chi/Q)$ .

**K'** Conversion Constant (1E6 pCi per  $\mu\text{Ci}$ ) [ $\text{pCi}/\mu\text{Ci}$ ]

**BR<sub>a</sub>** Individual Air Inhalation Rate [ $\text{m}^3/\text{yr}$ ]

The air intake rate for individuals in age group **a**. See Table E-5 of Regulatory Guide 1.109.

**DFA<sub>aij</sub>** Inhalation Dose Conversion Factor [mrem/pCi]

Dose commitment to an individual in age group **a** to organ **j** per unit of activity of radionuclide **i** inhaled. Taken from Tables E-7 through E-10 of Regulatory Guide 1.109. The values for H-3 and Sr-90 are taken from NUREG 4013 (Reference 107).

2. The inhalation exposure pathway is considered to exist at all locations.

#### 4.2.3.3 Ingestion: Vegetation

1. Food ingestion pathway doses are calculated at locations indicated by the land use census survey. If no real pathway exists within 5 miles of the station, the cow-milk pathway is assumed to be located at 5 miles. Food pathway calculations are not made for sectors in which the offsite regions near the station are over bodies of water.

2. The dose factor for consumption of vegetables is calculated by the following expression:

$$R_{ai(\text{veg})}[D/Q] = K' \left[ \frac{(r)}{Y_v(\lambda_i + \lambda_w)} \right] (DFL_{aij}) [U_a^L f_L e^{-\lambda_i t_L} + U_a^S f_g e^{-\lambda_i t_h}] \quad (4-11)$$

$R_{ai(\text{veg})}[D/Q]$  Vegetation Ingestion Pathway Dose Factor  
 $[(m^2 \text{ mrem/yr})/(\mu\text{Ci/sec})]$

Site-specific vegetation ingestion dose factor for age group **a**, nuclide **i** and organ **j**. With the exception of H-3 and C-14 the vegetation dose is calculated using (D/Q).

$K'$  Conversion Constant (1E6 pCi per  $\mu\text{Ci}$ ) [ $\text{pCi}/\mu\text{Ci}$ ]

$r$  Vegetation Retention Factor [dimensionless]

$Y_v$  Agricultural Productivity Yield [ $\text{kg}/\text{m}^2$ ]

$\lambda_i$  Radiological Decay Constant [ $1/\text{sec}$ ]

Radiological decay constant for radionuclide **i**

$\lambda_w$  Weathering Decay Constant [ $1/\text{sec}$ ]

Removal constant for physical loss of activity by weathering. See ODCM Part 2 Table 1-3.

$DFL_{aij}$  Ingestion Dose Conversion Factor [ $\text{mrem}/\text{pCi}$ ]

Ingestion dose conversion factor for age group **a**, nuclide **i** and organ **j**. Converts pCi ingested to mrem. Taken from Tables E-11 through E-14 of Regulatory Guide 1.109. The values for H-3 and Sr-90 are taken from NUREG 4013 (Reference 107).

$U_a^L$  Consumption Rate for Fresh Leafy Vegetation [ $\text{kg}/\text{yr}$ ]

Consumption rate for fresh leafy vegetation for age group **a**.

$U_a^S$  Consumption Rate for Stored Vegetation [ $\text{kg}/\text{yr}$ ]

Consumption rate for stored vegetation for age group **a**.

**$f_L$**  Local Leafy Vegetation Fraction [dimensionless]

Fraction of the annual intake of fresh leafy vegetation that is grown locally.

**$f_g$**  Local Stored Vegetation Fraction [dimensionless]

Fraction of the annual intake of stored vegetation that is grown locally.

**$t_L$**  Environmental Transport Time - Fresh Vegetation [sec]

Average time between harvest of leafy vegetation and its consumption.

**$t_h$**  Environmental Transport Time - Stored Vegetation [sec]

Average time between harvest of stored vegetation and its consumption.

3. The tritium dose from the vegetation pathway must be considered separately as the transport mechanism is based on airborne concentration rather than ground deposition. The dose factor for the tritium vegetation pathway is:

$$R_{a(H-3)(veg)j}[\chi/Q] = K' K''' (U_a^L f_L + U_a^S f_g) DFL_{a(H-3)j} [0.75(0.5/H)] \quad (4-12)$$

**$R_{a(H-3)(veg)j}[\chi/Q]$**  Tritium Vegetation Ingestion Pathway Dose

Factor[(mrem/yr)/(μCi/m<sup>3</sup>)]

Site-specific tritium vegetation ingestion dose factor for age group *a* and organ *j*.  
The tritium vegetation dose is calculated using  $[\chi/Q]$

**$K'''$**  Conversion Constant (1E3 gm per Kg) [gm/Kg]

**$H$**  Absolute Atmospheric Humidity [gm/m<sup>3</sup>]

**0.75** Water Fraction [dimensionless]

The fraction of total vegetation that is water.

**0.5** Specific Activity Ratio [dimensionless]

4. The Carbon-14 dose from the vegetation pathway must be considered separately as the transport mechanism is based on airborne concentration rather than ground deposition. The dose factor for the Carbon-14 vegetation pathway is:

$$R_i^v [\chi / Q] = K' K'' (U_a^L f_L + U_a^S f_g) (DFL_i)_a p \left[ \frac{0.11}{0.16} \right] \quad (4-12a)$$

$K'$  a constant of unit conversion,  $1 \text{ E } 6 \text{ pCi/uCi}$

$U_a^L$  gm/kg

Leafy veg consumption rate adult (kg/yr)

$U_a^S$  Fraction of annual intake of fresh, leafy vegetation grown locally

Stored veg consumption rate adult (kg/yr)

$f_g$  Fraction of annual intake of stored vegetation grown locally

$(DFL_i)_a$  Ingestion Dose Factors

$p$  The fractional equilibrium ratio (4400 hrs/8760 hrs). The ratio of the total annual release time (for C-14) atmospheric releases to the total annual time during which photosynthesis occurs (taken to be 4400 hrs), under the condition that the value of  $p$  should never exceed unity. For continuous C-14 releases,  $p$  is taken to be unity.

0.11 The fraction of total plant mass that is natural carbon (dimensionless)

0.16 The concentration of natural carbon in the atmosphere ( $\text{gm/m}^3$ )

## 4.2.3.4 Ingestion Milk

1. The dose factor for consumption of milk is calculated by the following expressions:

$$R_{ai(\text{Milk})}[D/Q] = K' \frac{Q_F(U_{am})}{\lambda_i + \lambda_w} F_m(r)(DFL_{aij}) \left[ \frac{f_p f_s}{Y_p} + \frac{(1 - f_p f_s)e^{-\lambda_i t_h}}{Y_s} \right] e^{-\lambda_i t_r} \quad (4-13)$$

$R_{ai(\text{Milk})}[D/Q]$  Milk Ingestion Pathway Dose Factor  
 $[(m^2 \text{ mrem/yr})/(\mu\text{Ci/sec})]$

Site-specific milk ingestion dose factor for age group **a**, nuclide **i** and organ **j**.  
 With the exception of H-3 and C-14 the milk dose factor is calculated using (D/Q).

**K'** Conversion Constant (1E6 pCi per  $\mu\text{Ci}$ ) [ $\text{pCi}/\mu\text{Ci}$ ]

**Q<sub>F</sub>** Feed Consumption [ $\text{Kg/da}$ ]

Amount of feed consumed by milk animal each day. See ODCM Part 2 Table 1-3.

**U<sub>am</sub>** Milk Consumption Rate [ $\text{l/yr}$ ]

Milk consumption rate for age group **a**.

**F<sub>m</sub>** Stable Element Transfer Coefficient for Milk [ $\text{da/l}$ ]

Fraction of animal's daily intake of a particular chemical element that appears in each liter of milk ( $\text{pCi/l}$  in milk per  $\text{pCi/da}$  ingested by animal). See ODCM Part 2 Table 1-4.

**f<sub>p</sub>** Pasture Time Fraction [dimensionless]

Fraction of year that animal is on pasture.

**f<sub>s</sub>** Pasture Grass Fraction [dimensionless]

Fraction of animal feed that is pasture grass while animal is on pasture.

**Y<sub>P</sub>** Agricultural Productivity Yield - Pasture Grass [ $\text{kg/m}^2$ ]

The agricultural productivity by unit area of pasture feed grass.

**$Y_s$**  Agricultural Productivity Yield - Stored Feed [kg/m<sup>2</sup>]

The agricultural productivity by unit area of stored feed.

**$t_h$**  Environmental Transport Time - Stored Feed [sec]

Average time between harvest to consumption of stored feed by milk animal.

**$t_f$**  Environmental Transport Time - Pasture to Consumption [sec]

Average time from pasture, to milk animal, to milk, to consumption.

All other terms have been previously defined.

The tritium dose from the milk pathway must be considered separately as the transport mechanism is based on airborne concentration rather than ground deposition. The dose factor for the tritium milk pathway is:

$$R_{a(H-3)(Milk)_j} [\chi/Q] = K' K'' F_m Q_F U_{am} DFL_{a(H-3)_j} [0.75(0.5/H)] \quad (4-14)$$

$R_{a(H-3)(milk)_j} [\chi/Q]$  Tritium Milk Ingestion Pathway Dose Factor

[(mrem/yr)/(μCi/m<sup>3</sup>)]

Site-specific tritium milk ingestion dose factor for age group **a** and organ **j**.

The tritium milk dose is calculated using  $[\chi/Q]$

**$K''$**  Conversion Constant (1E3 gm per Kg) [gm/Kg]

**H** Absolute Atmospheric Humidity [gm/m<sup>3</sup>]

**0.75** Water Fraction [dimensionless]

The fraction of total feed that is water.

**0.5** Specific Activity Ratio [dimensionless]

2. The Carbon-14 dose from the milk pathway must be considered separately as the transport mechanism is based on airborne concentration rather than ground deposition. The dose factor for the Carbon-14 milk pathway is:

$$R_i^C [D/Q] = K' K'' p F_m Q_F U_{ap} (DFL_i)_a [0.11 / 0.16] \quad (4-14a)$$

$K'$  a unit of conversion, 1.0E6 pCi/uCi

$K''$  gm/kg

$p$  The fractional equilibrium ratio (4400 hrs/8760 hrs). The ratio of the total annual release time (for C-14) atmospheric releases to the total annual time during which photosynthesis occurs (taken to be 4400 hrs), under the condition that the value of  $p$  should never exceed unity. For continuous C-14 releases,  $p$  is taken to be unity.

$F_m$  Stable Element Transfer Data

$Q_F$  Milk cow feed consumption rate (kg/day wet)

$U_{ap}$  Cow milk consumption rate adult (l/yr)

$(DFL_i)_a$  Ingestion Dose Factors

0.11 The fraction of total plant mass that is natural carbon (dimensionless)

0.16 The concentration of natural carbon in the atmosphere (gm/m<sup>3</sup>)

#### 4.2.3.5 Ingestion: Meat

1. The dose factor for consumption of meat is calculated by the following expression:

$$R_{ai(Meat)_j} [D/Q] = K' \frac{Q_F (U_{af})}{\lambda_i + \lambda_w} F_r(r) (DFL_{aij}) \left[ \frac{f_p f_s}{Y_p} + \frac{(1 - f_p f_s) e^{-\lambda_i t_h}}{Y_s} \right] e^{-\lambda_i t_r} \quad (4-15)$$

$R_{ai(Meat)_j} [D/Q]$  Meat Ingestion Pathway Dose Factor  
[(m<sup>2</sup> mrem/yr)/(μCi/sec)]



Site-specific meat ingestion dose factor for age group *a*, nuclide *i* and organ *j*.  
With the exception of H-3 and C-14 the meat dose factor is calculated using (D/Q).

**U<sub>af</sub>** Meat Consumption Rate [kg/yr]

Meat consumption rate for age group *a*.

**F<sub>f</sub>** Stable Element Transfer Coefficient for Meat [da/Kg]

Fraction of animal's daily intake of a particular chemical element that appears in each Kg of meat (pCi/Kg in meat per pCi/da ingested by animal). See ODCM Part 2 Table 1-4.

**t<sub>h</sub>** Environmental Transport Time - Stored Feed [sec]

Average time between harvest to consumption of stored feed by meat animal.

**t<sub>f</sub>** Environmental Transport Time - Pasture to Consumption [sec]

Average time from pasture, to meat animal, to meat, to consumption.

All other terms have been previously defined.

The tritium dose from the meat pathway must be considered separately as the transport mechanism is based on airborne concentration rather than ground deposition. The dose factor for the tritium meat pathway is:

$$R_{a(H-3)(Meat)j} [\chi/Q] = K K'' F_f Q_F U_{af} (DFI)_{a(H-3)j} [0.75(0.5/H)] \quad (4-16)$$

$$R_{a(H-3)(Meat)j} [\chi/Q] \text{ Tritium Meat Ingestion Pathway Dose Factor (mrem/yr)/(\mu\text{Ci/m}^3)]$$

Site-specific tritium meat ingestion dose factor for age group *a* and organ *j*.

The tritium meat dose is calculated using  $\chi/Q$ .

**K''** Conversion Constant (1E3 gm per Kg) [gm/Kg]

**H** Absolute Atmospheric Humidity [gm/m<sup>3</sup>]

**0.75** Water Fraction [dimensionless]

The fraction of total feed that is water.

**0.5** Specific Activity Ratio [dimensionless]

All other terms have been previously defined.

2. The Carbon-14 dose from the meat pathway must be considered separately as the transport mechanism is based on airborne concentration rather than ground deposition. The dose factor for the Carbon-14 meat pathway is:

$$R_i^M [\chi / Q] = K' K''' p F_f Q_F U_{ap} (DFL_i)_a [0.11/0.16] \quad (4-16a)$$

$K'$	a unit of conversion, 1.0E6 pCi/uCi
$K'''$	Conversion Constant (1E3 gm per kg)[gm/kg]
$p$	The fractional equilibrium ratio (4400 hrs/8760 hrs). The ratio of the total annual release time (for C-14) atmospheric releases to the total annual time during which photosynthesis occurs (taken to be 4400 hrs), under the condition that the value of $p$ should never exceed unity. For continuous C-14 releases, $p$ is taken to be unity.
$F_f$	Days/kg for each stable element
$Q_F$	Milk cow feed consumption rate (kg/day wet)
$U_{ap}$	Meat consumption rate adult (kg/yr)
$(DFL_i)_a$	Ingestion Dose Factors
0.11	the fraction of total plant mass that is natural carbon (dimensionless)
0.16	the concentration of natural carbon in the atmosphere (gm/m <sup>3</sup> )

**Table 4-1**  
**X/Q and D/Q Maxima at or Beyond the Unrestricted Area Boundary**

Downwind Direction	Mixed Mode(Vent) Release				Ground Level Release		
	Radius (meters)	X/Q (sec/m <sup>3</sup> )	Radius (meters)	D/Q (1/m <sup>2</sup> )	Radius (meters)	X/Q (sec/m <sup>3</sup> )	D/Q (1/m <sup>2</sup> )
N	1875.	1.988E-07	1875.	1.983E-09	1875.	8.676E-07	4.671E-09
NNE	1829.	1.677E-07	1829.	1.927E-09	1829.	7.531E-07	4.271E-09
NE	1585.	1.530E-07	1585.	1.821E-09	1585.	7.876E-07	4.388E-09
ENE	1234.	1.353E-07	1234.	1.764E-09	1234.	8.808E-07	5.036E-09
E	1227.	1.688E-07	1227.	2.335E-09	1227.	1.143E-06	6.226E-09
ESE	991.	2.519E-07	991.	3.540E-09	991.	1.692E-06	9.896E-09
SE	1006.	3.020E-07	1006.	3.578E-09	1006.	2.480E-06	1.118E-08
SSE	800.	4.497E-07	800.	3.761E-09	800.	4.152E-06	1.420E-08
S	945.	2.249E-07	945.	2.792E-09	945.	1.946E-06	9.364E-09
SSW	975.	1.476E-07	975.	1.970E-09	975.	1.305E-06	6.672E-09
SW	1067.	1.148E-07	1067.	1.786E-09	1067.	9.279E-07	5.316E-09
WSW	1212.	1.199E-07	1212.	1.903E-09	1212.	7.646E-07	5.002E-09
W	1189.	1.758E-07	1189.	1.870E-09	1189.	9.348E-07	5.330E-09
WNW	1227.	1.205E-07	1227.	1.292E-09	1227.	6.543E-07	3.745E-09
NW	1128.	1.686E-07	1128.	1.719E-09	1128.	8.807E-07	4.984E-09
NNW	1044.	3.047E-07	1044.	3.223E-09	1044.	1.432E-06	8.871E-09

Byron Site Meteorological Data 1/78 - 12/87

Note: Based on "Irrigation from the Rock River" letter from G.P. Lahti (Sargent and Lundy) to J.C. Golden (NSEP), June 4, 1990 and the formulas in Reg. Guide 1.109.

$\chi/Q$  is used for beta skin, and inhalation dose pathways. See Sections 4.2.1, 4.2.2 and 4.2.3.

D/Q is used for produce and leafy vegetable pathways. See Section 4.2.3.

The ground level release data are provided for reference purposes only. Routine dose calculations are performed using mixed mode data.

Radius is the approximate distance from the midpoint between gaseous effluent release points to the location of the highest  $\chi/Q$  or D/Q at or beyond the unrestricted area boundary (UAB).

**Table 4-2**  
**X/Q and D/Q Maxima at or Beyond the Restricted Area Boundary**

Downwind Direction	Mixed Mode(Vent) Release				Ground Level Release		
	Radius (meters)	X/Q (sec/m <sup>3</sup> )	Radius (meters)	D/Q (1/m <sup>2</sup> )	Radius (meters)	X/Q (sec/m <sup>3</sup> )	D/Q (1/m <sup>2</sup> )
N	777.	6.357E-07	777.	7.004E-09	777.	3.290E-06	2.036E-08
NNE	538.	8.778E-07	538.	1.046E-08	538.	5.086E-06	3.193E-08
NE	528.	6.803E-07	528.	7.792E-09	528.	4.371E-06	2.646E-08
ENE	474.	5.341E-07	474.	5.947E-09	474.	4.014E-06	2.346E-08
E	468.	6.698E-07	468.	7.930E-09	468.	5.359E-06	2.930E-08
ESE	480.	7.377E-07	480.	8.963E-09	480.	5.434E-06	3.144E-08
SE	427.	1.126E-06	427.	1.063E-08	427.	1.024E-05	4.352E-08
SSE	410.	1.349E-06	410.	8.744E-09	410.	1.305E-05	4.044E-08
S	295.	1.441E-06	295.	1.171E-08	295.	1.391E-05	5.707E-08
SSW	299.	9.382E-07	299.	8.293E-09	299.	9.376E-06	4.197E-08
SW	451.	3.949E-07	451.	5.065E-09	451.	3.666E-06	2.095E-08
WSW	386.	6.098E-07	386.	7.425E-09	386.	4.699E-06	3.088E-08
W	379.	1.041E-06	379.	8.116E-09	379.	6.009E-06	3.275E-08
WNW	385.	7.454E-07	385.	6.081E-09	385.	4.382E-06	2.370E-08
NW	445.	7.394E-07	445.	6.117E-09	445.	4.068E-06	2.198E-08
NNW	658.	6.123E-07	658.	6.177E-09	658.	2.980E-06	1.874E-08

**Byron Site Meteorological Data 1/78 - 12/87**

Note: Based on "Irrigation from the Rock River" letter from G.P. Lahti (Sargent and Lundy) to J.C. Golden (NSEP), June 4, 1990 and the formulas in Reg. Guide 1.109.

The ground level release data are provided for reference purposes only. Routine dose calculations are performed using mixed mode data.

Radius is the approximate distance from the midpoint between gaseous effluent release points to the location of the highest X/Q or D/Q at or beyond the restricted area boundary (RAB).

**Table 4-3**  
**Maximum Offsite Gamma- $\chi$ /Q**

<b>Downwind Direction</b>	<b>Radius (meters)</b>	<b>Ground Gamma-<math>\chi</math>/Q (sec/m**3)</b>	<b>Vent Gamma-<math>\chi</math>/Q (sec/m**3)</b>
N	1875	4.80E-07	1.46E-07
NNE	1829	4.16E-07	1.36E-07
NE	1585	4.34E-07	1.31E-07
ENE	1234	4.83E-07	1.27E-07
E	1227	6.10E-07	1.50E-07
ESE	991	8.73E-07	2.13E-07
SE	1006	1.24E-06	2.45E-07
SSE	800	1.83E-06	3.02E-07
S	945	9.68E-07	1.85E-07
SSW	975	6.69E-07	1.34E-07
SW	1067	4.84E-07	1.08E-07
WSW	1212	4.19E-07	1.11E-07
W	1189	5.07E-07	1.39E-07
WNW	1227	3.54E-07	9.70E-08
NW	1128	4.61E-07	1.29E-07
NNW	1044	7.43E-07	2.15E-07

**Table 4-4**  
 **$\chi/Q$  and  $D/Q$  at the Nearest Resident Locations within 5 miles**

Location Description	Direction	Distance		Ground Level Release		Mixed Mode (Vent) Release	
		Miles	meters	$\chi/Q$ sec/m <sup>3</sup>	$D/Q$ m <sup>-2</sup>	$\chi/Q$ sec/m <sup>3</sup>	$D/Q$ m <sup>-2</sup>
NEAREST RESIDENCE	N	2.67	4300	3.70E-07	9.80E-10	6.30E-08	3.80E-10
NEAREST RESIDENCE	NNE	0.99	1600	1.50E-06	5.30E-09	8.30E-08	1.70E-09
NEAREST RESIDENCE	NE	1.18	1900	1.00E-06	3.40E-09	6.60E-08	1.10E-09
NEAREST RESIDENCE	ENE	1.30	2100	8.20E-07	2.20E-09	4.60E-08	7.30E-10
NEAREST RESIDENCE	E	1.30	2100	1.20E-06	2.80E-09	5.90E-08	9.40E-10
NEAREST RESIDENCE	ESE	1.43	2300	9.10E-07	2.10E-09	5.10E-08	7.10E-10
NEAREST RESIDENCE	SE	0.75	1200	3.60E-06	7.40E-09	6.90E-08	2.00E-09
NEAREST RESIDENCE	SSE	0.62	1000	3.80E-06	8.10E-09	5.40E-08	1.60E-09
NEAREST RESIDENCE	S	0.50	800	3.40E-06	1.20E-08	8.40E-08	2.40E-09
NEAREST RESIDENCE	SSW	0.62	1000	1.70E-06	6.80E-09	6.40E-08	1.90E-09
NEAREST RESIDENCE	SW	0.75	1200	7.80E-07	3.10E-09	3.50E-08	8.80E-10
NEAREST RESIDENCE	WSW	1.68	2700	3.30E-07	1.40E-09	5.40E-08	6.50E-10
NEAREST RESIDENCE	W	1.68	2700	5.50E-07	1.40E-09	5.20E-08	4.10E-10
NEAREST RESIDENCE	WNW	0.75	1200	1.70E-06	5.20E-09	4.60E-08	1.00E-09
NEAREST RESIDENCE	NW	0.99	1600	1.10E-06	3.30E-09	4.30E-08	7.30E-10
NEAREST RESIDENCE	NNW	1.30	2100	8.50E-07	2.90E-09	6.20E-08	7.90E-10

**Table 4-5**  
 **$\chi/Q$  and D/Q at the Nearest Cow Milk Locations within 5 miles**

Location Description	Direction	Distance		Ground Level Release		Mixed Mode (Vent) Release	
		miles	meters	$\chi/Q$ sec/m <sup>3</sup>	D/Q m <sup>-2</sup>	$\chi/Q$ sec/m <sup>3</sup>	D/Q m <sup>-2</sup>
COW MILK	N	4.97	8000	1.50E-07	3.20E-10	4.20E-08	1.40E-10
COW MILK	NNE	4.97	8000	1.30E-07	3.10E-10	3.90E-08	1.60E-10
COW MILK	NE	1.86	3000	5.00E-07	1.50E-09	6.70E-08	6.20E-10
COW MILK	ENE	4.97	8000	1.10E-07	2.00E-10	2.90E-08	1.10E-10
COW MILK	E	4.97	8000	1.60E-07	2.70E-10	3.90E-08	1.40E-10
COW MILK	ESE	4.97	8000	1.40E-07	2.30E-10	3.50E-08	1.20E-10
COW MILK	SE	4.97	8000	2.00E-07	2.70E-10	3.80E-08	1.40E-10
COW MILK	SSE	4.97	8000	1.50E-07	2.20E-10	3.10E-08	1.20E-10
COW MILK	S	4.78	7700	9.10E-08	2.40E-10	2.90E-08	1.50E-10
COW MILK	SSW	4.97	8000	6.10E-08	1.80E-10	2.20E-08	1.20E-10
COW MILK	SW	4.97	8000	3.90E-08	1.10E-10	1.50E-08	7.10E-11
COW MILK	WSW	4.97	8000	6.30E-08	2.10E-10	2.50E-08	1.30E-10
COW MILK	W	2.49	4000	3.00E-07	7.20E-10	4.90E-08	2.60E-10
COW MILK	WNW	3.29	5300	1.70E-07	4.00E-10	3.40E-08	1.50E-10
COW MILK	NW	2.98	4800	2.10E-07	4.90E-10	3.70E-08	1.80E-10
COW MILK	NNW	4.97	8000	1.10E-07	2.70E-10	3.50E-08	1.20E-10

**Table 4-6**  
 **$\chi/Q$  and D/Q at the Nearest Cow Meat Locations within 5 miles**

Location Description	Direction	Distance		Ground Level Release		Mixed Mode (Vent) Release	
		miles	meters	$\chi/Q$ sec/m <sup>3</sup>	D/Q m <sup>-2</sup>	$\chi/Q$ sec/m <sup>3</sup>	D/Q m <sup>-2</sup>
COW MEAT	N	2.98	4800	3.10E-07	8.10E-10	6.00E-08	3.20E-10
COW MEAT	NNE	1.49	2400	7.70E-07	2.60E-09	7.60E-08	9.90E-10
COW MEAT	NE	3.42	5500	2.00E-07	5.30E-10	5.20E-08	2.70E-10
COW MEAT	ENE	2.30	3700	3.40E-07	8.10E-10	4.30E-08	3.50E-10
COW MEAT	E	2.24	3600	5.00E-07	1.10E-09	5.80E-08	4.70E-10
COW MEAT	ESE	1.49	2400	8.50E-07	2.00E-09	5.10E-08	6.80E-10
COW MEAT	SE	1.68	2700	9.80E-07	1.80E-09	5.90E-08	6.90E-10
COW MEAT	SSE	3.17	5100	2.90E-07	4.90E-10	4.10E-08	2.40E-10
COW MEAT	S	0.56	900	2.80E-06	9.90E-09	7.70E-08	2.10E-09
COW MEAT	SSW	2.17	3500	2.10E-07	8.00E-10	4.00E-08	4.30E-10
COW MEAT	SW	3.17	5100	7.60E-08	2.50E-10	2.10E-08	1.50E-10
COW MEAT	WSW	1.68	2700	3.30E-07	1.40E-09	5.40E-08	6.50E-10
COW MEAT	W	1.68	2700	5.50E-07	1.40E-09	5.20E-08	4.10E-10
COW MEAT	WNW	3.29	5300	1.70E-07	4.00E-10	3.40E-08	1.50E-10
COW MEAT	NW	3.79	6100	1.50E-07	3.20E-10	3.30E-08	1.30E-10
COW MEAT	NNW	1.37	2200	7.90E-07	2.70E-09	6.20E-08	7.50E-10



[illegible]

**Table 4-7 (Continued)**  
**Ground Plane Dose Factors (same for all age groups)**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	1.56E+06	1.56E+06	1.56E+06	1.56E+06	1.56E+06	1.56E+06	1.56E+06
Te-127M	9.16E+04	9.16E+04	9.16E+04	9.16E+04	9.16E+04	9.16E+04	9.16E+04
Te-127	2.99E+03	2.99E+03	2.99E+03	2.99E+03	2.99E+03	2.99E+03	2.99E+03
Te-129M	1.98E+07	1.98E+07	1.98E+07	1.98E+07	1.98E+07	1.98E+07	1.98E+07
Te-129	2.62E+04	2.62E+04	2.62E+04	2.62E+04	2.62E+04	2.62E+04	2.62E+04
Te-131M	8.02E+06	8.02E+06	8.02E+06	8.02E+06	8.02E+06	8.02E+06	8.02E+06
Te-131	2.92E+04	2.92E+04	2.92E+04	2.92E+04	2.92E+04	2.92E+04	2.92E+04
Te-132	4.22E+06	4.22E+06	4.22E+06	4.22E+06	4.22E+06	4.22E+06	4.22E+06
I-130	5.50E+06	5.50E+06	5.50E+06	5.50E+06	5.50E+06	5.50E+06	5.50E+06
I-131	1.72E+07	1.72E+07	1.72E+07	1.72E+07	1.72E+07	1.72E+07	1.72E+07
I-132	1.25E+06	1.25E+06	1.25E+06	1.25E+06	1.25E+06	1.25E+06	1.25E+06
I-133	2.45E+06	2.45E+06	2.45E+06	2.45E+06	2.45E+06	2.45E+06	2.45E+06
I-134	4.46E+05	4.46E+05	4.46E+05	4.46E+05	4.46E+05	4.46E+05	4.46E+05
I-135	2.53E+06	2.53E+06	2.53E+06	2.53E+06	2.53E+06	2.53E+06	2.53E+06
Cs-134	6.94E+09	6.94E+09	6.94E+09	6.94E+09	6.94E+09	6.94E+09	6.94E+09
Cs-136	1.50E+08	1.50E+08	1.50E+08	1.50E+08	1.50E+08	1.50E+08	1.50E+08
Cs-137	1.76E+10	1.76E+10	1.76E+10	1.76E+10	1.76E+10	1.76E+10	1.76E+10
Cs-138	3.59E+05	3.59E+05	3.59E+05	3.59E+05	3.59E+05	3.59E+05	3.59E+05
Ba-139	1.06E+05	1.06E+05	1.06E+05	1.06E+05	1.06E+05	1.06E+05	1.06E+05
Ba-140	2.05E+07	2.05E+07	2.05E+07	2.05E+07	2.05E+07	2.05E+07	2.05E+07
Ba-141	4.17E+04	4.17E+04	4.17E+04	4.17E+04	4.17E+04	4.17E+04	4.17E+04
Ba-142	4.44E+04	4.44E+04	4.44E+04	4.44E+04	4.44E+04	4.44E+04	4.44E+04
La-140	1.92E+07	1.92E+07	1.92E+07	1.92E+07	1.92E+07	1.92E+07	1.92E+07
La-142	7.60E+05	7.60E+05	7.60E+05	7.60E+05	7.60E+05	7.60E+05	7.60E+05
Ce-141	1.37E+07	1.37E+07	1.37E+07	1.37E+07	1.37E+07	1.37E+07	1.37E+07
Ce-143	2.31E+06	2.31E+06	2.31E+06	2.31E+06	2.31E+06	2.31E+06	2.31E+06
Ce-144	6.96E+07	6.96E+07	6.96E+07	6.96E+07	6.96E+07	6.96E+07	6.96E+07
Pr-143	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pr-144	1.84E+03	1.84E+03	1.84E+03	1.84E+03	1.84E+03	1.84E+03	1.84E+03
Nd-147	8.48E+06	8.48E+06	8.48E+06	8.48E+06	8.48E+06	8.48E+06	8.48E+06
W-187	2.35E+06	2.35E+06	2.35E+06	2.35E+06	2.35E+06	2.35E+06	2.35E+06
Np-239	1.71E+06	1.71E+06	1.71E+06	1.71E+06	1.71E+06	1.71E+06	1.71E+06

**Notes:**

- 1) Units are m<sup>2</sup> mrem/yr per  $\mu$ Ci/sec.
- 2) All age groups are assumed to receive the same dose.

**Table 4-8**  
**External Dose Factors for Standing on Contaminated Ground**  
**DFG<sub>ij</sub> (mrem/hr per pCi/ m<sup>2</sup>)**

<u>Element</u>	<u>Whole Body</u> <u>Dose Factor</u>	<u>Reference</u>	<u>Element</u>	<u>Whole Body</u> <u>Dose Factor</u>	<u>Reference</u>
H-3	0.00E+00	6	Be-7	5.95E-10	99
C-14	0.00E+00	6	F-18	1.19E-08	99
Na-22	2.42E-08	99	Na-24	2.50E-08	6
Mg-27	1.14E-08	99	Mg-28	1.48E-08	99
Al-26	2.95E-08	99	Al-28	2.00E-08	99
P-32	0.00E+00	6	Cl-38	1.70E-08	99
Ar-41	1.39E-08	99	K-40	2.22E-09	99
K-42	4.64E-09	99	K-43	1.19E-08	99
Ca-47	1.14E-08	99	Sc-44	2.50E-08	99
Sc-46m	1.21E-09	99	Sc-46	2.24E-08	99
Sc-47	1.46E-09	99	Ti-44	1.95E-09	99
V-48	3.21E-08	99	Cr-51	2.20E-10	6
Mn-52m	2.79E-08	99	Mn-52	3.80E-08	99
Mn-54	5.80E-09	6	Mn-56	1.10E-08	6
Fe-52	9.12E-09	99	Fe-55	0.00E+00	6
Fe-59	8.00E-09	6	Co-57	1.65E-09	99
Co-58	7.00E-09	6	Co-60	1.70E-08	6
Ni-63	0.00E+00	6	Ni-65	3.70E-09	6
Cu-64	1.50E-09	6	Cu-67	1.52E-09	99
Cu-68	8.60E-09 <sup>1</sup>	--	Zn-65	4.00E-09	6
Zn-69m	5.06E-09	99	Zn-69	0.00E+00	6
Ga-66	2.70E-08	99	Ga-67	1.89E-09	99
Ga-68	1.24E-08	99	Ga-72	3.00E-08	99
Ge-77	1.34E-08	99	As-72	2.23E-08	99
As-73	1.16E-10	99	As-74	9.41E-09	99
As-76	6.46E-09	99	As-77	1.79E-10	99
Se-73	1.38E-08	99	Se-75	4.98E-09	99
Br-77	3.84E-09	99	Br-80	2.01E-09	99
Br-82	3.00E-08	99	Br-83	6.40E-11	6
Br-84	1.20E-08	6	Br-85	0.00E+00	6
Kr-79	3.07E-09	99	Kr-81	1.59E-10	99
Kr-83m	1.42E-11	99	Kr-85m	2.24E-09	99
Kr-85	1.35E-10	99	Kr-87	1.03E-08	99
Kr-88	2.07E-08	99	Kr-90	1.56E-08	99
Rb-84	1.07E-08	99	Rb-86	6.30E-10	6
Rb-87	0.00E+00	99	Rb-88	3.50E-09	6
Rb-89	1.50E-08	6	Sr-85	6.16E-09	99
Sr-87m	3.92E-09	99	Sr-89	5.60E-13	6
Sr-90	1.84E-11	99	Sr-91	7.10E-09	6
Sr-92	9.00E-09	6	Y-86	4.00E-08	99
Y-87	5.53E-09	99	Y-88	2.88E-08	99
Y-90	2.20E-12	6	Y-91m	3.80E-09	6
Y-91	2.40E-11	6	Y-92	1.60E-09	6
Y-93	5.70E-10	6	Zr-95	5.00E-09	6
Zr-97	5.50E-09	6	Nb-94	1.84E-08	99
Nb-95	5.10E-09	6	Nb-97m	8.57E-09	99
Nb-97	8.48E-09	99	Mo-99	1.90E-09	6
Tc-99m	9.60E-10	6	Tc-101	2.70E-09	6
Tc-104	1.83E-08 <sup>1</sup>	--	Ru-97	2.99E-09	99
Ru-103	3.60E-09	6	Ru-105	4.50E-09	6
Ru-106	1.50E-09	6	Pc-109	3.80E-10	99
Cd-109	1.12E-10	99	In-111	5.11E-09	99
In-115m	2.01E-09	99	In-116	0.00E+00 <sup>2</sup>	--
Sn-113	1.15E-09	99	Sn-117m	1.96E-08	99
Sn-119m	7.05E-11	99	Sb-117	0.00E+00 <sup>2</sup>	--
Sb-122	2.71E-09 <sup>1</sup>	--	Sb-124	1.16E-08 <sup>1</sup>	--
Sb-125	4.56E-09	99	Sb-126	7.13E-10	99
Ag-108m	1.92E-08	99	Ag-108	1.14E-09	99
Ag-110m	1.80E-08	6	Ag-111	6.75E-10	99
Te-121m	2.65E-09	99	Te-121	6.75E-09	99
Te-123m	1.88E-09	99	Te-125m	3.50E-11	6

**Table 4-8 (cont.)**  
**External Dose Factors for Standing on Contaminated Ground**  
**DFG<sub>ij</sub> (mrem/hr per pCi/ m<sup>2</sup>)**

<u>Element</u>	<u>Whole Body Dose Factor</u>	<u>Reference</u>	<u>Element</u>	<u>Whole Body Dose Factor</u>	<u>Reference</u>
Te-125	0.00E+00 <sup>2</sup>	--	Te-127m	1.10E-12	6
Te-127	1.00E-11	6	Te-129m	7.70E-10	6
Te-129	7.10E-10	6	Te-131m	8.40E-09	6
Te-131	2.20E-09	6	Te-132	1.70E-08	6
Te-134	1.05E-08	99	I-123	2.12E-09	99
I-124	1.23E-08	99	I-125	2.89E-10	99
I-130	1.40E-08	6	I-131	2.80E-09	6
I-132	1.70E-09	6	I-133	3.70E-09	6
I-134	1.60E-08	6	I-135	1.20E-08	6
Xe-127	3.44E-09	99	Xe-129m	5.57E-10	99
Xe-131m	2.13E-10	99	Xe-133m	4.81E-10	99
Xe-133	5.91E-10	99	Xe-135m	5.23E-09	99
Xe-135	3.36E-09	99	Xe-137	4.26E-09	99
Xe-138	1.30E-08	99	Cs-129	3.39E-09	99
Cs-132	8.40E-09	99	Cs-134	1.20E-08	6
Cs-136	1.50E-08	6	Cs-137	7.17E-09 <sup>4</sup>	99
Cs-138	2.10E-08	6	Cs-139	5.15E-09	99
Ba-131	5.74E-09	99	Ba-133m	8.10E-10	99
Ba-133	4.85E-09	99	Ba-135m	7.26E-10	99
Ba-137m	7.17E-09	99	Ba-137	0.00E+00 <sup>2</sup>	--
Ba-139	2.40E-09	6	Ba-La-140	1.71E-08 <sup>5</sup>	6
Ba-141	4.30E-09	6	Ba-142	7.90E-09	6
La-142	1.50E-08	6	Ce-139	2.04E-09	99
Ce-141	5.50E-10	6	Ce-143	2.20E-09	6
Ce-Pr-144	5.20E-10 <sup>7</sup>	6	Pr-142	1.84E-09	99
Pr-143	0.00E+00	6	Nd-147	1.00E-09	6
Nd-149	5.32E-09	99	Pm-145	3.38E-10	99
Pm-148m	2.35E-08	99	Pm-148	7.22E-09	99
Pm-149	5.32E-10	99	Sm-153	8.95E-10	99
Eu-152	1.30E-08	99	Eu-154	1.41E-08	99
Eu-155	8.27E-10	99	Gc-153	1.46E-09	99
Dy-157	4.39E-09	99	Er-169	6.12E-14	99
Er-171	5.11E-09	99	Tm-170	3.41E-10	99
Yb-169	4.12E-09	99	Yb-175	4.94E-10	99
Lu-177	4.60E-10	99	Hf-181	6.67E-09	99
Ta-182	1.42E-08	99	Ta-183	2.93E-09 <sup>1</sup>	--
W-187	3.10E-09	6	Re-188	1.89E-09	99
Os-191	9.83E-10	99	Ir-194	2.31E-09	99
Pt-195m	9.79E-10	99	Pt-197	3.57E-10	99
Au-195m	2.54E-09	99	Au-195	1.14E-09	99
Au-198	5.19E-09	99	Au-199	1.18E-09	99
Hg-197	9.33E-10	99	Hg-203	2.89E-09	99
Tl-201	1.24E-09	99	Tl-206	0.00E+00 <sup>2</sup>	--
Tl-208	3.58E-08	99	Pb-203	3.88E-09	99
Pb-210	3.57E-11	99	Pb-212	1.91E-09	99
Pb-214	3.18E-09	99	Bi-206	3.74E-08	99
Bi-207	1.77E-08	99	Bi-214	1.71E-08	99
Ra-226	8.78E-11	99	Th-232	8.14E-12	99
U-238	7.98E-12	99	Np-239	9.50E-10	6
Am-241	3.48E-10	99			

<sup>1</sup> Value derived by comparing the percentage and MeV of the nuclide's gammas and then comparing to Cesium-137, as a value was not available in the literature.

<sup>2</sup> 0.0 due to low yield and short half-life. A value was not available in the literature.

<sup>4</sup> Cs-137 value is from daughter product Ba-137m (7.17E-09) because ground plane dose from Cs-137 is due to gamma radiation emitted by Ba-137m. This value is from reference 99.

**Table 4-8 (cont.)**  
**External Dose Factors for Standing on Contaminated Ground**  
**DFG<sub>ij</sub> (mrem/hr per pCi/ m<sup>2</sup>)**

<sup>6</sup> Value is the sum of Ba-140 (2.10E-9) and La-140 (1.50E-8) from reference 6. In Reference 6, see Table E-6.

<sup>7</sup> Value is the sum of Ce-144 (3.20E-10) and Pr-144 (2.00E-10) from reference 6.

Note: Dose assessments for 10CFR20 and 40CFR190 compliance are made for an adult only.

Dose assessments for 10CFR50 Appendix are made using dose factors of Regulatory Guide 1.109 (Reference 6) for all age groups.

**Table 4-9**  
**Adult Inhalation Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	7.18E+02	7.18E+02	7.18E+02	7.18E+02	7.18E+02	7.18E+02
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
Cr-51	0.00E+00	0.00E+00	1.00E+02	5.95E+01	2.28E+01	1.44E+04	3.32E+03
Mn-54	0.00E+00	3.96E+04	6.30E+03	0.00E+00	9.84E+03	1.40E+06	7.74E+04
Mn-56	0.00E+00	1.24E+00	1.83E-01	0.00E+00	1.30E+00	9.44E+03	2.02E+04
Fe-55	2.46E+04	1.70E+04	3.94E+03	0.00E+00	0.00E+00	7.21E+04	6.03E+03
Fe-59	1.18E+04	2.78E+04	1.06E+04	0.00E+00	0.00E+00	1.02E+06	1.88E+05
Co-58	0.00E+00	1.58E+03	2.07E+03	0.00E+00	0.00E+00	9.28E+05	1.06E+05
Co-60	0.00E+00	1.15E+04	1.48E+04	0.00E+00	0.00E+00	5.97E+06	2.85E+05
Ni-63	4.32E+05	3.14E+04	1.45E+04	0.00E+00	0.00E+00	1.78E+05	1.34E+04
Ni-65	1.54E+00	2.10E-01	9.12E-02	0.00E+00	0.00E+00	5.60E+03	1.23E+04
Cu-64	0.00E+00	1.46E+00	6.15E-01	0.00E+00	4.62E+00	6.78E+03	4.90E+04
Zn-65	3.24E+04	1.03E+05	4.66E+04	0.00E+00	6.90E+04	8.64E+05	5.34E+04
Zn-69	3.38E-02	6.51E-02	4.52E-03	0.00E+00	4.22E-02	9.20E+02	1.63E+01
Br-83	0.00E+00	0.00E+00	2.41E+02	0.00E+00	0.00E+00	0.00E+00	2.32E+02
Br-84	0.00E+00	0.00E+00	3.13E+02	0.00E+00	0.00E+00	0.00E+00	1.64E-03
Br-85	0.00E+00	0.00E+00	1.28E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.35E+05	5.90E+04	0.00E+00	0.00E+00	0.00E+00	1.66E+04
Rb-88	0.00E+00	3.87E+02	1.93E+02	0.00E+00	0.00E+00	0.00E+00	3.34E-09
Rb-89	0.00E+00	2.56E+02	1.70E+02	0.00E+00	0.00E+00	0.00E+00	9.28E-12
Sr-89	3.04E+05	0.00E+00	8.72E+03	0.00E+00	0.00E+00	1.40E+06	3.50E+05
Sr-90	2.87E+07	0.00E+00	5.77E+05	0.00E+00	0.00E+00	9.60E+06	7.22E+05
Sr-91	6.19E+01	0.00E+00	2.50E+00	0.00E+00	0.00E+00	3.65E+04	1.91E+05
Sr-92	6.74E+00	0.00E+00	2.91E-01	0.00E+00	0.00E+00	1.65E+04	4.30E+04
Y-90	2.09E+03	0.00E+00	5.61E+01	0.00E+00	0.00E+00	1.70E+05	5.06E+05
Y-91M	2.61E-01	0.00E+00	1.02E-02	0.00E+00	0.00E+00	1.92E+03	1.33E+00
Y-91	4.62E+05	0.00E+00	1.24E+04	0.00E+00	0.00E+00	1.70E+06	3.85E+05
Y-92	1.03E+01	0.00E+00	3.02E-01	0.00E+00	0.00E+00	1.57E+04	7.35E+04
Y-93	9.44E+01	0.00E+00	2.61E+00	0.00E+00	0.00E+00	4.85E+04	4.22E+05
Zr-95	1.07E+05	3.44E+04	2.33E+04	0.00E+00	5.42E+04	1.77E+06	1.50E+05
Zr-97	9.68E+01	1.96E+01	9.04E+00	0.00E+00	2.97E+01	7.87E+04	5.23E+05
Nb-95	1.41E+04	7.82E+03	4.21E+03	0.00E+00	7.74E+03	5.05E+05	1.04E+05
Mo-99	0.00E+00	1.21E+02	2.30E+01	0.00E+00	2.91E+02	9.12E+04	2.48E+05
Tc- 99M	1.03E-03	2.91E-03	3.70E-02	0.00E+00	4.42E-02	7.64E+02	4.16E+03
Tc-101	4.18E-05	6.02E-05	5.90E-04	0.00E+00	1.08E-03	3.99E+02	1.09E-11
Ru-103	1.53E+03	0.00E+00	6.58E+02	0.00E+00	5.83E+03	5.05E+05	1.10E+05
Ru-105	7.90E-01	0.00E+00	3.11E-01	0.00E+00	1.02E+00	1.10E+04	4.82E+04
Ru-106	6.91E+04	0.00E+00	8.72E+03	0.00E+00	1.34E+05	9.36E+06	9.12E+05
Ag-110M	1.08E+04	1.00E+04	5.94E+03	0.00E+00	1.97E+04	4.63E+06	3.02E+05



**Table 4-9 (Continued)**  
**Adult Inhalation Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
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-03	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+00	7.69E+03
I-131	2.52E+04	3.58E+04	2.05E+04	1.19E+07	6.13E+04	0.00E+00	6.28E+03
I-132	1.16E+03	3.26E+03	1.16E+03	1.14E+05	5.18E+03	0.00E+00	4.06E+02
I-133	8.64E+03	1.48E+04	4.52E+03	2.15E+06	2.58E+04	0.00E+00	8.88E+03
I-134	6.44E+02	1.73E+03	6.15E+02	2.98E+04	2.75E+03	0.00E+00	1.01E+00
I-135	2.68E+03	6.98E+03	2.57E+03	4.48E+05	1.11E+04	0.00E+00	5.25E+03
Cs-134	3.73E+05	8.48E+05	7.28E+05	0.00E+00	2.87E+05	9.76E+04	1.04E+04
Cs-136	3.90E+04	1.46E+05	1.10E+05	0.00E+00	8.56E+04	1.20E+04	1.17E+04
Cs-137	4.78E+05	6.21E+05	4.28E+05	0.00E+00	2.22E+05	7.52E+04	8.40E+03
Cs-138	3.31E+02	6.21E+02	3.24E+02	0.00E+00	4.80E+02	4.86E+01	1.86E-03
Ba-139	9.36E-01	6.66E-04	2.74E-02	0.00E+00	6.22E-04	3.76E+03	8.96E+02
Ba-140	3.90E+04	4.90E+01	2.57E+03	0.00E+00	1.67E+01	1.27E+06	2.18E+05
Ba-141	1.00E-01	7.53E-05	3.36E-03	0.00E+00	7.00E-05	1.94E+03	1.16E-07
Ba-142	2.63E-02	2.70E-05	1.66E-03	0.00E+00	2.29E-05	1.19E+03	1.57E-16
La-140	3.44E+02	1.74E+02	4.58E+01	0.00E+00	0.00E+00	1.36E+05	4.58E+05
La-142	6.83E-01	3.10E-01	7.72E-02	0.00E+00	0.00E+00	6.33E+03	2.11E+03
Ce-141	1.99E+04	1.35E+04	1.53E+03	0.00E+00	6.26E+03	3.62E+05	1.20E+05
Ce-143	1.86E+02	1.38E+02	1.53E+01	0.00E+00	6.08E+01	7.98E+04	2.26E+05
Ce-144	3.43E+06	1.43E+06	1.84E+05	0.00E+00	8.48E+05	7.78E+06	8.16E+05
Pr-143	9.36E+03	3.75E+03	4.64E+02	0.00E+00	2.16E+03	2.81E+05	2.00E+05
Pr-144	3.01E-02	1.25E-02	1.53E-03	0.00E+00	7.05E-03	1.02E+03	2.15E-08
Nd-147	5.27E+03	6.10E+03	3.65E+02	0.00E+00	3.56E+03	2.21E+05	1.73E+05
W-187	8.48E+00	7.08E+00	2.48E+00	0.00E+00	0.00E+00	2.90E+04	1.55E+05
Np-239	2.30E+02	2.03E+02	1.24E+01	0.00E+00	7.00E+01	3.76E+04	1.19E+05

Notes:

- 1) Units are mrem/yr per  $\mu\text{Ci}/\text{m}^3$ .

**Table 4-10**  
**Teen Inhalation Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	7.25E+02	7.25E+02	7.25E+02	7.25E+02	7.25E+02	7.25E+02
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
Cr-51	0.00E+00	0.00E+00	1.35E+02	7.50E+01	3.07E+01	2.10E+04	3.00E+03
Mn-54	0.00E+00	5.11E+04	8.40E+03	0.00E+00	1.27E+04	1.98E+06	6.68E+04
Mn-56	0.00E+00	1.70E+00	2.52E-01	0.00E+00	1.79E+00	1.52E+04	5.74E+04
Fe-55	3.34E+04	2.38E+04	5.54E+03	0.00E+00	0.00E+00	1.24E+05	6.39E+03
Fe-59	1.59E+04	3.70E+04	1.43E+04	0.00E+00	0.00E+00	1.53E+06	1.78E+05
Co-58	0.00E+00	2.07E+03	2.78E+03	0.00E+00	0.00E+00	1.34E+06	9.52E+04
Co-60	0.00E+00	1.51E+04	1.98E+04	0.00E+00	0.00E+00	8.72E+06	2.59E+05
Ni-63	5.80E+05	4.34E+04	1.98E+04	0.00E+00	0.00E+00	3.07E+05	1.42E+04
Ni-65	2.18E+00	2.93E-01	1.27E-01	0.00E+00	0.00E+00	9.36E+03	3.67E+04
Cu-64	0.00E+00	2.03E+00	8.48E-01	0.00E+00	6.41E+00	1.11E+04	6.14E+04
Zn-65	3.86E+04	1.34E+05	6.24E+04	0.00E+00	8.64E+04	1.24E+06	4.66E+04
Zn-69	4.83E-02	9.20E-02	6.46E-03	0.00E+00	6.02E-02	1.58E+03	2.85E+02
Br-83	0.00E+00	0.00E+00	3.44E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	4.33E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	1.83E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.90E+05	8.40E+04	0.00E+00	0.00E+00	0.00E+00	1.77E+04
Rb-88	0.00E+00	5.46E+02	2.72E+02	0.00E+00	0.00E+00	0.00E+00	2.92E-05
Rb-89	0.00E+00	3.52E+02	2.33E+02	0.00E+00	0.00E+00	0.00E+00	3.38E-07
Sr-89	4.34E+05	0.00E+00	1.25E+04	0.00E+00	0.00E+00	2.42E+06	3.71E+05
Sr-90	3.31E+07	0.00E+00	6.66E+05	0.00E+00	0.00E+00	1.65E+07	7.65E+05
Sr-91	8.80E+01	0.00E+00	3.51E+00	0.00E+00	0.00E+00	6.07E+04	2.59E+05
Sr-92	9.52E+00	0.00E+00	4.06E-01	0.00E+00	0.00E+00	2.74E+04	1.19E+05
Y-90	2.98E+03	0.00E+00	8.00E+01	0.00E+00	0.00E+00	2.93E+05	5.59E+05
Y-91M	3.70E-01	0.00E+00	1.42E-02	0.00E+00	0.00E+00	3.20E+03	3.02E+01
Y-91	6.61E+05	0.00E+00	1.77E+04	0.00E+00	0.00E+00	2.94E+06	4.09E+05
Y-92	1.47E+01	0.00E+00	4.29E-01	0.00E+00	0.00E+00	2.68E+04	1.65E+05
Y-93	1.35E+02	0.00E+00	3.72E+00	0.00E+00	0.00E+00	8.32E+04	5.79E+05
Zr-95	1.46E+05	4.58E+04	3.15E+04	0.00E+00	6.74E+04	2.69E+06	1.49E+05
Zr-97	1.38E+02	2.72E+01	1.26E+01	0.00E+00	4.12E+01	1.30E+05	6.30E+05
Nb-95	1.86E+04	1.03E+04	5.66E+03	0.00E+00	1.00E+04	7.51E+05	9.68E+04
Mo-99	0.00E+00	1.69E+02	3.22E+01	0.00E+00	4.11E+02	1.54E+05	2.69E+05
Tc- 99M	1.38E-03	3.86E-03	4.99E-02	0.00E+00	5.76E-02	1.15E+03	6.13E+03
Tc-101	5.92E-05	8.40E-05	8.24E-04	0.00E+00	1.52E-03	6.67E+02	8.72E-07
Ru-103	2.10E+03	0.00E+00	8.96E+02	0.00E+00	7.43E+03	7.83E+05	1.09E+05
Ru-105	1.12E+00	0.00E+00	4.34E-01	0.00E+00	1.41E+00	1.82E+04	9.04E+04
Ru-106	9.84E+04	0.00E+00	1.24E+04	0.00E+00	1.90E+05	1.61E+07	9.60E+05
Ag-110M	1.38E+04	1.31E+04	7.99E+03	0.00E+00	2.50E+04	6.75E+06	2.73E+05



**Table 4-10 (Continued)**  
**Teen Inhalation Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
Te-125M	4.88E+03	2.24E+03	6.67E+02	1.40E+03	0.00E+00	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+04
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	4.02E+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+00	9.12E+03
I-131	3.54E+04	4.91E+04	2.64E+04	1.46E+07	8.40E+04	0.00E+00	6.49E+03
I-132	1.59E+03	4.38E+03	1.58E+03	1.51E+05	6.92E+03	0.00E+00	1.27E+03
I-133	1.22E+04	2.05E+04	6.22E+03	2.92E+06	3.59E+04	0.00E+00	1.03E+04
I-134	8.88E+02	2.32E+03	8.40E+02	3.95E+04	3.66E+03	0.00E+00	2.04E+01
I-135	3.70E+03	9.44E+03	3.49E+03	6.21E+05	1.49E+04	0.00E+00	6.95E+03
Cs-134	5.02E+05	1.13E+06	5.49E+05	0.00E+00	3.75E+05	1.46E+05	9.76E+03
Cs-136	5.15E+04	1.94E+05	1.37E+05	0.00E+00	1.10E+05	1.78E+04	1.09E+04
Cs-137	6.70E+05	8.48E+05	3.11E+05	0.00E+00	3.04E+05	1.21E+05	8.48E+03
Cs-138	4.66E+02	8.56E+02	4.46E+02	0.00E+00	6.62E+02	7.87E+01	2.70E-01
Ba-139	1.34E+00	9.44E-04	3.90E-02	0.00E+00	8.88E-04	6.46E+03	6.45E+03
Ba-140	5.47E+04	6.70E+01	3.52E+03	0.00E+00	2.28E+01	2.03E+06	2.29E+05
Ba-141	1.42E-01	1.06E-04	4.74E-03	0.00E+00	9.84E-05	3.29E+03	7.46E-04
Ba-142	3.70E-02	3.70E-05	2.27E-03	0.00E+00	3.14E-05	1.91E+03	4.79E-10
La-140	4.79E+02	2.36E+02	6.26E+01	0.00E+00	0.00E+00	2.14E+05	4.87E+05
La-142	9.60E-01	4.25E-01	1.06E-01	0.00E+00	0.00E+00	1.02E+04	1.20E+04
Ce-141	2.84E+04	1.90E+04	2.17E+03	0.00E+00	8.88E+03	6.14E+05	1.26E+05
Ce-143	2.66E+02	1.94E+02	2.16E+01	0.00E+00	8.64E+01	1.30E+05	2.55E+05
Ce-144	4.89E+06	2.02E+06	2.62E+05	0.00E+00	1.21E+06	1.34E+07	8.64E+05
Pr-143	1.34E+04	5.31E+03	6.62E+02	0.00E+00	3.09E+03	4.83E+05	2.14E+05
Pr-144	4.30E-02	1.76E-02	2.18E-03	0.00E+00	1.01E-02	1.75E+03	2.35E-04
Nd-147	7.86E+03	8.56E+03	5.13E+02	0.00E+00	5.02E+03	3.72E+05	1.82E+05
W-187	1.20E+01	9.76E+00	3.43E+00	0.00E+00	0.00E+00	4.74E+04	1.77E+05
Np-239	3.38E+02	2.88E+02	1.77E+01	0.00E+00	1.00E+02	6.49E+04	1.32E+05

Notes:

- 1) Units are mrem/yr per  $\mu\text{Ci}/\text{m}^3$ .

**Table 4-11**  
**Child Inhalation Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	6.40E+02	6.40E+02	6.40E+02	6.40E+02	6.40E+02	6.40E+02
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
Cr-51	0.00E+00	0.00E+00	1.54E+02	8.55E+01	2.43E+01	1.70E+04	1.08E+03
Mn-54	0.00E+00	4.29E+04	9.51E+03	0.00E+00	1.00E+04	1.58E+06	2.29E+04
Mn-56	0.00E+00	1.66E+00	3.12E-01	0.00E+00	1.67E+00	1.31E+04	1.23E+05
Fe-55	4.74E+04	2.52E+04	7.77E+03	0.00E+00	0.00E+00	1.11E+05	2.87E+03
Fe-59	2.07E+04	3.34E+04	1.67E+04	0.00E+00	0.00E+00	1.27E+06	7.07E+04
Co-58	0.00E+00	1.77E+03	3.16E+03	0.00E+00	0.00E+00	1.11E+06	3.44E+04
Co-60	0.00E+00	1.31E+04	2.26E+04	0.00E+00	0.00E+00	7.07E+06	9.62E+04
Ni-63	8.21E+05	4.63E+04	2.80E+04	0.00E+00	0.00E+00	2.75E+05	6.33E+03
Ni-65	2.99E+00	2.96E-01	1.64E-01	0.00E+00	0.00E+00	8.18E+03	8.40E+04
Cu-64	0.00E+00	1.99E+00	1.07E+00	0.00E+00	6.03E+00	9.58E+03	3.67E+04
Zn-65	4.26E+04	1.13E+05	7.03E+04	0.00E+00	7.14E+04	9.95E+05	1.63E+04
Zn-69	6.70E-02	9.66E-02	8.92E-03	0.00E+00	5.85E-02	1.42E+03	1.02E+04
Br-83	0.00E+00	0.00E+00	4.74E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	5.48E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	2.53E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.98E+05	1.14E+05	0.00E+00	0.00E+00	0.00E+00	7.99E+03
Rb-88	0.00E+00	5.62E+02	3.66E+02	0.00E+00	0.00E+00	0.00E+00	1.72E+01
Rb-89	0.00E+00	3.45E+02	2.90E+02	0.00E+00	0.00E+00	0.00E+00	1.89E+00
Sr-89	5.99E+05	0.00E+00	1.72E+04	0.00E+00	0.00E+00	2.16E+06	1.67E+05
Sr-90	3.85E+07	0.00E+00	7.66E+05	0.00E+00	0.00E+00	1.48E+07	3.43E+05
Sr-91	1.21E+02	0.00E+00	4.59E+00	0.00E+00	0.00E+00	5.33E+04	1.74E+05
Sr-92	1.31E+01	0.00E+00	5.25E-01	0.00E+00	0.00E+00	2.40E+04	2.42E+05
Y-90	4.11E+03	0.00E+00	1.11E+02	0.00E+00	0.00E+00	2.62E+05	2.68E+05
Y-91M	5.07E-01	0.00E+00	1.84E-02	0.00E+00	0.00E+00	2.81E+03	1.72E+03
Y-91	9.14E+05	0.00E+00	2.44E+04	0.00E+00	0.00E+00	2.63E+06	1.84E+05
Y-92	2.04E+01	0.00E+00	5.81E-01	0.00E+00	0.00E+00	2.39E+04	2.39E+05
Y-93	1.86E+02	0.00E+00	5.11E+00	0.00E+00	0.00E+00	7.44E+04	3.89E+05
Zr-95	1.90E+05	4.18E+04	3.70E+04	0.00E+00	5.96E+04	2.23E+06	6.11E+04
Zr-97	1.88E+02	2.72E+01	1.60E+01	0.00E+00	3.89E+01	1.13E+05	3.51E+05
Nb-95	2.35E+04	9.18E+03	6.55E+03	0.00E+00	8.62E+03	6.14E+05	3.70E+04
Mo-99	0.00E+00	1.72E+02	4.26E+01	0.00E+00	3.92E+02	1.35E+05	1.27E+05
Tc- 99M	1.78E-03	3.48E-03	5.77E-02	0.00E+00	5.07E-02	9.51E+02	4.81E+03
Tc-101	8.10E-05	8.51E-05	1.08E-03	0.00E+00	1.45E-03	5.85E+02	1.63E+01
Ru-103	2.79E+03	0.00E+00	1.07E+03	0.00E+00	7.03E+03	6.62E+05	4.48E+04
Ru-105	1.53E+00	0.00E+00	5.55E-01	0.00E+00	1.34E+00	1.59E+04	9.95E+04
Ru-106	1.36E+05	0.00E+00	1.69E+04	0.00E+00	1.84E+05	1.43E+07	4.29E+05
Ag-110M	1.69E+04	1.14E+04	9.14E+03	0.00E+00	2.12E+04	5.48E+06	1.00E+05

**Table 4-11 (Continued)**  
**Child Inhalation Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	6.73E+03	2.33E+03	9.14E+02	1.92E+03	0.00E+00	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	6.11E-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+00	5.11E+03
I-131	4.81E+04	4.81E+04	2.73E+04	1.62E+07	7.88E+04	0.00E+00	2.84E+03
I-132	2.12E+03	4.07E+03	1.88E+03	1.94E+05	6.25E+03	0.00E+00	3.20E+03
I-133	1.66E+04	2.03E+04	7.70E+03	3.85E+06	3.38E+04	0.00E+00	5.48E+03
I-134	1.17E+03	2.16E+03	9.95E+02	5.07E+04	3.30E+03	0.00E+00	9.55E+02
I-135	4.92E+03	8.73E+03	4.14E+03	7.92E+05	1.34E+04	0.00E+00	4.44E+03
Cs-134	6.51E+05	1.01E+06	2.25E+05	0.00E+00	3.30E+05	1.21E+05	3.85E+03
Cs-136	6.51E+04	1.71E+05	1.16E+05	0.00E+00	9.55E+04	1.45E+04	4.18E+03
Cs-137	9.07E+05	8.25E+05	1.28E+05	0.00E+00	2.82E+05	1.04E+05	3.62E+03
Cs-138	6.33E+02	8.40E+02	5.55E+02	0.00E+00	6.22E+02	6.81E+01	2.70E+02
Ba-139	1.84E+00	9.84E-04	5.37E-02	0.00E+00	8.62E-04	5.77E+03	5.77E+04
Ba-140	7.40E+04	6.48E+01	4.33E+03	0.00E+00	2.11E+01	1.74E+06	1.02E+05
Ba-141	1.96E-01	1.09E-04	6.36E-03	0.00E+00	9.47E-05	2.92E+03	2.75E+02
Ba-142	5.00E-02	3.60E-05	2.79E-03	0.00E+00	2.91E-05	1.64E+03	2.74E+00
La-140	6.44E+02	2.25E+02	7.55E+01	0.00E+00	0.00E+00	1.83E+05	2.26E+05
La-142	1.30E+00	4.11E-01	1.29E-01	0.00E+00	0.00E+00	8.70E+03	7.59E+04
Ce-141	3.92E+04	1.95E+04	2.90E+03	0.00E+00	8.55E+03	5.44E+05	5.66E+04
Ce-143	3.66E+02	1.99E+02	2.87E+01	0.00E+00	8.36E+01	1.15E+05	1.27E+05
Ce-144	6.77E+06	2.12E+06	3.61E+05	0.00E+00	1.17E+06	1.20E+07	3.89E+05
Pr-143	1.85E+04	5.55E+03	9.14E+02	0.00E+00	3.00E+03	4.33E+05	9.73E+04
Pr-144	5.96E-02	1.85E-02	3.00E-03	0.00E+00	9.77E-03	1.57E+03	1.97E+02
Nd-147	1.08E+04	8.73E+03	6.81E+02	0.00E+00	4.81E+03	3.28E+05	8.21E+04
W-187	1.63E+01	9.66E+00	4.33E+00	0.00E+00	0.00E+00	4.11E+04	9.10E+04
Np-239	4.66E+02	3.01E+02	2.35E+01	0.00E+00	9.73E+01	5.81E+04	6.40E+04

Notes:

- 1) Units are mrem/yr per  $\mu\text{Ci}/\text{m}^3$ .

**Table 4-12**  
**Infant Inhalation Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	3.68E+02	3.68E+02	3.68E+02	3.68E+02	3.68E+02	3.68E+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
Cr-51	0.00E+00	0.00E+00	8.95E+01	5.75E+01	1.32E+01	1.28E+04	3.57E+02
Mn-54	0.00E+00	2.53E+04	4.98E+03	0.00E+00	4.98E+03	1.00E+06	7.06E+03
Mn-56	0.00E+00	1.54E+00	2.21E-01	0.00E+00	1.10E+00	1.25E+04	7.17E+04
Fe-55	1.97E+04	1.17E+04	3.33E+03	0.00E+00	0.00E+00	8.69E+04	1.09E+03
Fe-59	1.36E+04	2.35E+04	9.48E+03	0.00E+00	0.00E+00	1.02E+06	2.48E+04
Co-58	0.00E+00	1.22E+03	1.82E+03	0.00E+00	0.00E+00	7.77E+05	1.11E+04
Co-60	0.00E+00	8.02E+03	1.18E+04	0.00E+00	0.00E+00	4.51E+06	3.19E+04
Ni-63	3.39E+05	2.04E+04	1.16E+04	0.00E+00	0.00E+00	2.09E+05	2.42E+03
Ni-65	2.39E+00	2.84E-01	1.23E-01	0.00E+00	0.00E+00	8.12E+03	5.01E+04
Cu-64	0.00E+00	1.88E+00	7.74E-01	0.00E+00	3.98E+00	9.30E+03	1.50E+04
Zn-65	1.93E+04	6.26E+04	3.11E+04	0.00E+00	3.25E+04	6.47E+05	5.14E+04
Zn-69	5.39E-02	9.67E-02	7.18E-03	0.00E+00	4.02E-02	1.47E+03	1.32E+04
Br-83	0.00E+00	0.00E+00	3.81E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	4.00E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	2.04E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.90E+05	8.82E+04	0.00E+00	0.00E+00	0.00E+00	3.04E+03
Rb-88	0.00E+00	5.57E+02	2.87E+02	0.00E+00	0.00E+00	0.00E+00	3.39E+02
Rb-89	0.00E+00	3.21E+02	2.06E+02	0.00E+00	0.00E+00	0.00E+00	6.82E+01
Sr-89	3.98E+05	0.00E+00	1.14E+04	0.00E+00	0.00E+00	2.03E+06	6.40E+04
Sr-90	1.55E+07	0.00E+00	3.12E+05	0.00E+00	0.00E+00	1.12E+07	1.31E+05
Sr-91	9.56E+01	0.00E+00	3.46E+00	0.00E+00	0.00E+00	5.26E+04	7.34E+04
Sr-92	1.05E+01	0.00E+00	3.91E-01	0.00E+00	0.00E+00	2.38E+04	1.40E+05
Y-90	3.29E+03	0.00E+00	8.82E+01	0.00E+00	0.00E+00	2.69E+05	1.04E+05
Y-91M	4.07E-01	0.00E+00	1.39E-02	0.00E+00	0.00E+00	2.79E+03	2.35E+03
Y-91	5.88E+05	0.00E+00	1.57E+04	0.00E+00	0.00E+00	2.45E+06	7.03E+04
Y-92	1.64E+01	0.00E+00	4.61E-01	0.00E+00	0.00E+00	2.45E+04	1.27E+05
Y-93	1.50E+02	0.00E+00	4.07E+00	0.00E+00	0.00E+00	7.64E+04	1.67E+05
Zr-95	1.15E+05	2.79E+04	2.03E+04	0.00E+00	3.11E+04	1.75E+06	2.17E+04
Zr-97	1.50E+02	2.56E+01	1.17E+01	0.00E+00	2.59E+01	1.10E+05	1.40E+05
Nb-95	1.57E+04	6.43E+03	3.78E+03	0.00E+00	4.72E+03	4.79E+05	1.27E+04
Mo-99	0.00E+00	1.65E+02	3.23E+01	0.00E+00	2.65E+02	1.35E+05	4.87E+04
Tc- 99M	1.40E-03	2.88E-03	3.72E-02	0.00E+00	3.11E-02	8.11E+02	2.03E+03
Tc-101	6.51E-05	8.23E-05	8.12E-04	0.00E+00	9.79E-04	5.84E+02	8.44E+02
Ru-103	2.02E+03	0.00E+00	6.79E+02	0.00E+00	4.24E+03	5.52E+05	1.61E+04
Ru-105	1.22E+00	0.00E+00	4.10E-01	0.00E+00	8.99E-01	1.57E+04	4.84E+04
Ru-106	8.68E+04	0.00E+00	1.09E+04	0.00E+00	1.07E+05	1.16E+07	1.64E+05
Ag-110M	9.98E+03	7.22E+03	5.00E+03	0.00E+00	1.09E+04	3.67E+06	3.30E+04

**Table 4-12 (Continued)**  
**Infant Inhalation Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	4.76E+03	1.99E+03	6.58E+02	1.62E+03	0.00E+00	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+00	1.99E+03
I-131	3.79E+04	4.44E+04	1.96E+04	1.48E+07	5.18E+04	0.00E+00	1.06E+03
I-132	1.69E+03	3.54E+03	1.26E+03	1.69E+05	3.95E+03	0.00E+00	1.90E+03
I-133	1.32E+04	1.92E+04	5.60E+03	3.56E+06	2.24E+04	0.00E+00	2.16E+03
I-134	9.21E+02	1.88E+03	6.65E+02	4.45E+04	2.09E+03	0.00E+00	1.29E+03
I-135	3.86E+03	7.60E+03	2.77E+03	6.96E+05	8.47E+03	0.00E+00	1.83E+03
Cs-134	3.96E+05	7.03E+05	7.45E+04	0.00E+00	1.90E+05	7.97E+04	1.33E+03
Cs-136	4.83E+04	1.35E+05	5.29E+04	0.00E+00	5.64E+04	1.18E+04	1.43E+03
Cs-137	5.49E+05	6.12E+05	4.55E+04	0.00E+00	1.72E+05	7.13E+04	1.33E+03
Cs-138	5.05E+02	7.81E+02	3.98E+02	0.00E+00	4.10E+02	6.54E+01	8.76E+02
Ba-139	1.48E+00	9.84E-04	4.30E-02	0.00E+00	5.92E-04	5.95E+03	5.10E+04
Ba-140	5.60E+04	5.60E+01	2.90E+03	0.00E+00	1.34E+01	1.60E+06	3.84E+04
Ba-141	1.57E-01	1.08E-04	4.97E-03	0.00E+00	6.50E-05	2.97E+03	4.75E+03
Ba-142	3.98E-02	3.30E-05	1.96E-03	0.00E+00	1.90E-05	1.55E+03	6.93E+02
La-140	5.05E+02	2.00E+02	5.15E+01	0.00E+00	0.00E+00	1.68E+05	8.48E+04
La-142	1.03E+00	3.77E-01	9.04E-02	0.00E+00	0.00E+00	8.22E+03	5.95E+04
Ce-141	2.77E+04	1.67E+04	1.99E+03	0.00E+00	5.25E+03	5.17E+05	2.16E+04
Ce-143	2.93E+02	1.93E+02	2.21E+01	0.00E+00	5.64E+01	1.16E+05	4.97E+04
Ce-144	3.19E+06	1.21E+06	1.76E+05	0.00E+00	5.38E+05	9.84E+06	1.48E+05
Pr-143	1.40E+04	5.24E+03	6.99E+02	0.00E+00	1.97E+03	4.33E+05	3.72E+04
Pr-144	4.79E-02	1.85E-02	2.41E-03	0.00E+00	6.72E-03	1.61E+03	4.28E+03
Nd-147	7.94E+03	8.13E+03	5.00E+02	0.00E+00	3.15E+03	3.22E+05	3.12E+04
W-187	1.30E+01	9.02E+00	3.12E+00	0.00E+00	0.00E+00	3.96E+04	3.56E+04
Np-239	3.71E+02	2.98E+02	1.88E+01	0.00E+00	6.62E+01	5.95E+04	2.49E+04

Notes:

- 1) Units are mrem/yr per  $\mu\text{Ci}/\text{m}^3$ .



**Table 4-13**  
**Adult Vegetation Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	1.29E+03	1.29E+03	1.29E+03	1.29E+03	1.29E+03	1.29E+03
C-14	8.97E+05	1.79E+05	1.79E+05	1.79E+05	1.79E+05	1.79E+05	1.79E+05
Na-24	2.69E+05	2.69E+05	2.69E+05	2.69E+05	2.69E+05	2.69E+05	2.69E+05
Cr-51	0.00E+00	0.00E+00	4.64E+04	2.77E+04	1.02E+04	6.15E+04	1.17E+07
Mn-54	0.00E+00	3.13E+08	5.97E+07	0.00E+00	9.31E+07	0.00E+00	9.58E+08
Mn-56	0.00E+00	1.54E+01	2.73E+00	0.00E+00	1.95E+01	0.00E+00	4.91E+02
Fe-55	2.10E+08	1.45E+08	3.38E+07	0.00E+00	0.00E+00	8.08E+07	8.31E+07
Fe-59	1.26E+08	2.96E+08	1.13E+08	0.00E+00	0.00E+00	8.27E+07	9.87E+08
Co-58	0.00E+00	3.08E+07	6.90E+07	0.00E+00	0.00E+00	0.00E+00	6.24E+08
Co-60	0.00E+00	1.67E+08	3.69E+08	0.00E+00	0.00E+00	0.00E+00	3.14E+09
Ni-63	1.04E+10	7.21E+08	3.49E+08	0.00E+00	0.00E+00	0.00E+00	1.50E+08
Ni-65	5.97E+01	7.75E+00	3.54E+00	0.00E+00	0.00E+00	0.00E+00	1.97E+02
Cu-64	0.00E+00	9.09E+03	4.27E+03	0.00E+00	2.29E+04	0.00E+00	7.75E+05
Zn-65	3.17E+08	1.01E+09	4.56E+08	0.00E+00	6.75E+08	0.00E+00	6.36E+08
Zn-69	4.95E-06	9.48E-06	6.59E-07	0.00E+00	6.16E-06	0.00E+00	1.42E-06
Br-83	0.00E+00	0.00E+00	3.00E+00	0.00E+00	0.00E+00	0.00E+00	4.32E+00
Br-84	0.00E+00	0.00E+00	2.20E-11	0.00E+00	0.00E+00	0.00E+00	1.72E-16
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	2.20E+08	1.03E+08	0.00E+00	0.00E+00	0.00E+00	4.34E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	9.95E+09	0.00E+00	2.86E+08	0.00E+00	0.00E+00	0.00E+00	1.60E+09
Sr-90	6.95E+11	0.00E+00	1.40E+10	0.00E+00	0.00E+00	0.00E+00	1.75E+10
Sr-91	3.01E+05	0.00E+00	1.22E+04	0.00E+00	0.00E+00	0.00E+00	1.43E+06
Sr-92	4.12E+02	0.00E+00	1.78E+01	0.00E+00	0.00E+00	0.00E+00	8.17E+03
Y-90	1.33E+04	0.00E+00	3.57E+02	0.00E+00	0.00E+00	0.00E+00	1.41E+08
Y-91M	4.93E-09	0.00E+00	1.91E-10	0.00E+00	0.00E+00	0.00E+00	1.45E-08
Y-91	5.12E+06	0.00E+00	1.37E+05	0.00E+00	0.00E+00	0.00E+00	2.82E+09
Y-92	8.95E-01	0.00E+00	2.62E-02	0.00E+00	0.00E+00	0.00E+00	1.57E+04
Y-93	1.67E+02	0.00E+00	4.62E+00	0.00E+00	0.00E+00	0.00E+00	5.31E+06
Zr-95	1.18E+06	3.77E+05	2.55E+05	0.00E+00	5.92E+05	0.00E+00	1.20E+09
Zr-97	3.35E+02	6.77E+01	3.09E+01	0.00E+00	1.02E+02	0.00E+00	2.10E+07
Nb-95	1.43E+05	7.95E+04	4.27E+04	0.00E+00	7.86E+04	0.00E+00	4.83E+08
Mo-99	0.00E+00	6.14E+06	1.17E+06	0.00E+00	1.39E+07	0.00E+00	1.42E+07
Tc- 99M	3.06E+00	8.64E+00	1.10E+02	0.00E+00	1.31E+02	4.23E+00	5.11E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	4.77E+06	0.00E+00	2.05E+06	0.00E+00	1.82E+07	0.00E+00	5.57E+08
Ru-105	5.27E+01	0.00E+00	2.08E+01	0.00E+00	6.81E+02	0.00E+00	3.23E+04
Ru-106	1.93E+08	0.00E+00	2.44E+07	0.00E+00	3.72E+08	0.00E+00	1.25E+10
Ag-110M	1.05E+07	9.75E+06	5.79E+06	0.00E+00	1.92E+07	0.00E+00	3.98E+09

**Table 4-13 (Continued)**  
**Adult Vegetation Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	9.67E+07	3.50E+07	1.30E+07	2.91E+07	3.93E+08	0.00E+00	3.86E+08
Te-127M	3.49E+08	1.25E+08	4.26E+07	8.92E+07	1.42E+09	0.00E+00	1.17E+09
Te-127	5.68E+03	2.04E+03	1.23E+03	4.21E+03	2.31E+04	0.00E+00	4.48E+05
Te-129M	2.51E+08	9.37E+07	3.97E+07	8.62E+07	1.05E+09	0.00E+00	1.26E+09
Te-129	7.14E-04	2.68E-04	1.74E-04	5.48E-04	3.00E-03	0.00E+00	5.39E-04
Te-131M	9.09E+05	4.45E+05	3.71E+05	7.04E+05	4.50E+06	0.00E+00	4.41E+07
Te-131	1.26E-15	5.26E-16	3.97E-16	1.03E-15	5.51E-15	0.00E+00	1.78E-16
Te-132	4.28E+06	2.77E+06	2.60E+06	3.06E+06	2.67E+07	0.00E+00	1.31E+08
I-130	3.89E+05	1.15E+06	4.52E+05	9.72E+07	1.79E+06	0.00E+00	9.87E+05
I-131	8.07E+07	1.15E+08	6.62E+07	3.78E+10	1.98E+08	0.00E+00	3.05E+07
I-132	5.58E+01	1.49E+02	5.22E+01	5.22E+03	2.38E+02	0.00E+00	2.80E+01
I-133	2.08E+06	3.62E+06	1.10E+06	5.32E+08	6.31E+06	0.00E+00	3.25E+06
I-134	8.55E-05	2.32E-04	8.31E-05	4.02E-03	3.69E-04	0.00E+00	2.02E-07
I-135	3.87E+04	1.01E+05	3.74E+04	6.68E+06	1.62E+05	0.00E+00	1.14E+05
Cs-134	4.67E+09	1.11E+10	9.08E+09	0.00E+00	3.59E+09	1.19E+09	1.94E+08
Cs-136	4.25E+07	1.68E+08	1.21E+08	0.00E+00	9.33E+07	1.28E+07	1.90E+07
Cs-137	6.36E+09	8.70E+09	5.70E+09	0.00E+00	2.95E+09	9.81E+08	1.68E+08
Cs-138	3.32E-11	6.56E-11	3.25E-11	0.00E+00	4.82E-11	4.76E-12	2.80E-16
Ba-139	2.71E-02	1.93E-05	7.92E-04	0.00E+00	1.80E-05	1.09E-05	4.80E-02
Ba-140	1.29E+08	1.61E+05	8.42E+06	0.00E+00	5.49E+04	9.24E+04	2.65E+08
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	1.98E+03	9.97E+02	2.63E+02	0.00E+00	0.00E+00	0.00E+00	7.32E+07
La-142	1.94E-04	8.83E-05	2.20E-05	0.00E+00	0.00E+00	0.00E+00	6.45E-01
Ce-141	1.97E+05	1.33E+05	1.51E+04	0.00E+00	6.19E+04	0.00E+00	5.09E+08
Ce-143	9.94E+02	7.35E+05	8.13E+01	0.00E+00	3.24E+02	0.00E+00	2.75E+07
Ce-144	3.29E+07	1.38E+07	1.77E+06	0.00E+00	8.16E+06	0.00E+00	1.11E+10
Pr-143	6.27E+04	2.51E+04	3.11E+03	0.00E+00	1.45E+04	0.00E+00	2.75E+08
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	3.37E+04	3.90E+04	2.33E+03	0.00E+00	2.28E+04	0.00E+00	1.87E+08
W-187	3.79E+04	3.17E+04	1.11E+04	0.00E+00	0.00E+00	0.00E+00	1.04E+07
Np-239	1.42E+03	1.40E+02	7.72E+01	0.00E+00	4.37E+02	0.00E+00	2.87E+07

## Notes:

- 1) Units are  $\text{m}^2 \text{ mrem/yr}$  per  $\mu\text{Ci/sec}$ .
- 2) For H-3 and C-14, the units are  $\text{mrem/yr}$  per  $\mu\text{Ci/m}^3$ .

**Table 4-14**  
**Teen Vegetation Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	1.47E+03	1.47E+03	1.47E+03	1.47E+03	1.47E+03	1.47E+03
C-14	1.45E+06	2.91E+05	2.91E+05	2.91E+05	2.91E+05	2.91E+05	2.91E+05
Na-24	2.39E+05	2.39E+05	2.39E+05	2.39E+05	2.39E+05	2.39E+05	2.39E+05
Cr-51	0.00E+00	0.00E+00	6.16E+04	3.42E+04	1.35E+04	8.79E+04	1.03E+07
Mn-54	0.00E+00	4.54E+08	9.01E+07	0.00E+00	1.36E+08	0.00E+00	9.32E+08
Mn-56	0.00E+00	1.39E+01	2.47E+00	0.00E+00	1.76E+01	0.00E+00	9.13E+02
Fe-55	3.26E+08	2.31E+08	5.39E+07	0.00E+00	0.00E+00	1.47E+08	1.00E+08
Fe-59	1.79E+08	4.18E+08	1.61E+08	0.00E+00	0.00E+00	1.32E+08	9.89E+08
Co-58	0.00E+00	4.37E+07	1.01E+08	0.00E+00	0.00E+00	0.00E+00	6.02E+08
Co-60	0.00E+00	2.49E+08	5.60E+08	0.00E+00	0.00E+00	0.00E+00	3.24E+09
Ni-63	1.61E+10	1.13E+09	5.45E+08	0.00E+00	0.00E+00	0.00E+00	1.81E+08
Ni-65	5.55E+01	7.10E+00	3.23E+00	0.00E+00	0.00E+00	0.00E+00	3.85E+02
Cu-64	0.00E+00	8.24E+03	3.87E+03	0.00E+00	2.08E+04	0.00E+00	6.39E+05
Zn-65	4.24E+08	1.47E+09	6.86E+08	0.00E+00	9.41E+08	0.00E+00	6.23E+08
Zn-69	4.64E-06	8.84E-06	6.19E-07	0.00E+00	5.78E-06	0.00E+00	1.63E-05
Br-83	0.00E+00	0.00E+00	2.81E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	2.00E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	2.75E+08	1.29E+08	0.00E+00	0.00E+00	0.00E+00	4.06E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	1.51E+10	0.00E+00	4.33E+08	0.00E+00	0.00E+00	0.00E+00	1.80E+09
Sr-90	9.22E+11	0.00E+00	1.84E+10	0.00E+00	0.00E+00	0.00E+00	2.11E+10
Sr-91	2.81E+05	0.00E+00	1.12E+04	0.00E+00	0.00E+00	0.00E+00	1.27E+06
Sr-92	3.84E+02	0.00E+00	1.64E+01	0.00E+00	0.00E+00	0.00E+00	9.78E+03
Y-90	1.24E+04	0.00E+00	3.35E+02	0.00E+00	0.00E+00	0.00E+00	1.02E+08
Y-91M	4.59E-09	0.00E+00	1.75E-10	0.00E+00	0.00E+00	0.00E+00	2.17E-07
Y-91	7.84E+06	0.00E+00	2.10E+05	0.00E+00	0.00E+00	0.00E+00	3.21E+09
Y-92	8.41E-01	0.00E+00	2.43E-02	0.00E+00	0.00E+00	0.00E+00	2.31E+04
Y-93	1.57E+02	0.00E+00	4.30E+00	0.00E+00	0.00E+00	0.00E+00	4.80E+06
Zr-95	1.72E+06	5.44E+05	3.74E+05	0.00E+00	7.99E+05	0.00E+00	1.26E+09
Zr-97	3.10E+02	6.14E+01	2.83E+01	0.00E+00	9.31E+01	0.00E+00	1.66E+07
Nb-95	1.93E+05	1.07E+05	5.90E+04	0.00E+00	1.04E+05	0.00E+00	4.58E+08
Mo-99	0.00E+00	5.63E+06	1.07E+06	0.00E+00	1.29E+07	0.00E+00	1.01E+07
Tc- 99M	2.70E+00	7.52E+00	9.75E+01	0.00E+00	1.12E+02	4.17E+00	4.94E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	6.82E+06	0.00E+00	2.91E+06	0.00E+00	2.40E+07	0.00E+00	5.69E+08
Ru-105	4.90E+01	0.00E+00	1.90E+01	0.00E+00	6.18E+02	0.00E+00	3.95E+04
Ru-106	3.09E+08	0.00E+00	3.90E+07	0.00E+00	5.97E+08	0.00E+00	1.48E+10
Ag-110M	1.52E+07	1.44E+07	8.73E+06	0.00E+00	2.74E+07	0.00E+00	4.03E+09



**Table 4-14 (Continued)**  
**Teen Vegetation Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	1.49E+08	5.35E+07	1.99E+07	4.15E+07	0.00E+00	0.00E+00	4.38E+08
Te-127M	5.51E+08	1.96E+08	6.56E+07	1.31E+08	2.24E+09	0.00E+00	1.37E+09
Te-127	5.36E+03	1.90E+03	1.15E+03	3.70E+03	2.17E+04	0.00E+00	4.14E+05
Te-129M	3.61E+08	1.34E+08	5.72E+07	1.17E+08	1.51E+09	0.00E+00	1.36E+09
Te-129	6.68E-04	2.49E-04	1.63E-04	4.77E-04	2.80E-03	0.00E+00	3.65E-03
Te-131M	8.42E+05	4.04E+05	3.37E+05	6.07E+05	4.21E+06	0.00E+00	3.24E+07
Te-131	1.17E-15	4.82E-16	3.66E-16	9.01E-16	5.11E-15	0.00E+00	9.60E-17
Te-132	3.89E+06	2.46E+06	2.32E+06	2.60E+06	2.36E+07	0.00E+00	7.81E+07
I-130	3.47E+05	1.01E+06	4.01E+05	8.20E+07	1.55E+06	0.00E+00	7.73E+05
I-131	7.68E+07	1.08E+08	5.78E+07	3.14E+10	1.85E+08	0.00E+00	2.13E+07
I-132	5.03E+01	1.32E+02	4.72E+01	4.43E+03	2.07E+02	0.00E+00	5.73E+01
I-133	1.93E+06	3.28E+06	1.00E+06	4.58E+08	5.75E+06	0.00E+00	2.48E+06
I-134	7.73E-05	2.05E-04	7.36E-05	3.41E-03	3.23E-04	0.00E+00	2.70E-06
I-135	3.49E+04	8.99E+04	3.33E+04	5.78E+06	1.42E+05	0.00E+00	9.97E+04
Cs-134	7.10E+09	1.67E+10	7.75E+09	0.00E+00	5.31E+09	2.03E+09	2.08E+08
Cs-136	4.35E+07	1.71E+08	1.15E+08	0.00E+00	9.31E+07	1.47E+07	1.38E+07
Cs-137	1.01E+10	1.35E+10	4.69E+09	0.00E+00	4.59E+09	1.78E+09	1.92E+08
Cs-138	3.07E-11	5.89E-11	2.94E-11	0.00E+00	4.35E-11	5.06E-12	2.67E-14
Ba-139	2.55E-02	1.79E-05	7.42E-04	0.00E+00	1.69E-05	1.23E-05	2.27E-01
Ba-140	1.38E+08	1.69E+05	8.90E+06	0.00E+00	5.74E+04	1.14E+05	2.13E+08
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	1.81E+03	8.88E+02	2.36E+02	0.00E+00	0.00E+00	0.00E+00	5.10E+07
La-142	1.78E-04	7.92E-05	1.97E-05	0.00E+00	0.00E+00	0.00E+00	2.41E+00
Ce-141	2.83E+05	1.89E+05	2.17E+04	0.00E+00	8.89E+04	0.00E+00	5.40E+08
Ce-143	9.29E+02	6.76E+05	7.55E+01	0.00E+00	3.03E+02	0.00E+00	2.03E+07
Ce-144	5.27E+07	2.18E+07	2.83E+06	0.00E+00	1.30E+07	0.00E+00	1.33E+10
Pr-143	7.01E+04	2.80E+04	3.49E+03	0.00E+00	1.63E+04	0.00E+00	2.31E+08
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	3.67E+04	4.00E+04	2.39E+03	0.00E+00	2.35E+04	0.00E+00	1.44E+08
W-187	3.53E+04	2.87E+04	1.01E+04	0.00E+00	0.00E+00	0.00E+00	7.78E+06
Np-239	1.38E+03	1.30E+02	7.24E+01	0.00E+00	4.09E+02	0.00E+00	2.10E+07

## Notes:

- 1) Units are m<sup>2</sup> mrem/yr per  $\mu$ Ci/sec.
- 2) For H-3 and C-14, the units are mrem/yr per  $\mu$ Ci/m<sup>3</sup>.

**Table 4-15**  
**Child Vegetation Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	2.29E+03	2.29E+03	2.29E+03	2.29E+03	2.29E+03	2.29E+03
C-14	3.50E+06	7.01E+05	7.01E+05	7.01E+05	7.01E+05	7.01E+05	7.01E+05
Na-24	3.73E+05	3.73E+05	3.73E+05	3.73E+05	3.73E+05	3.73E+05	3.73E+05
Cr-51	0.00E+00	0.00E+00	1.17E+05	6.49E+04	1.77E+04	1.18E+05	6.20E+06
Mn-54	0.00E+00	6.65E+08	1.77E+08	0.00E+00	1.86E+08	0.00E+00	5.58E+08
Mn-56	0.00E+00	1.82E+01	4.10E+00	0.00E+00	2.20E+01	0.00E+00	2.63E+03
Fe-55	8.01E+08	4.25E+08	1.32E+08	0.00E+00	0.00E+00	2.40E+08	7.87E+07
Fe-59	3.97E+08	6.42E+08	3.20E+08	0.00E+00	0.00E+00	1.86E+08	6.69E+08
Co-58	0.00E+00	6.45E+07	1.97E+08	0.00E+00	0.00E+00	0.00E+00	3.76E+08
Co-60	0.00E+00	3.78E+08	1.12E+09	0.00E+00	0.00E+00	0.00E+00	2.10E+09
Ni-63	3.95E+10	2.11E+09	1.34E+09	0.00E+00	0.00E+00	0.00E+00	1.42E+08
Ni-65	1.02E+02	9.59E+00	5.60E+00	0.00E+00	0.00E+00	0.00E+00	1.18E+03
Cu-64	0.00E+00	1.09E+04	6.56E+03	0.00E+00	2.62E+04	0.00E+00	5.10E+05
Zn-65	8.12E+08	2.16E+09	1.35E+09	0.00E+00	1.36E+09	0.00E+00	3.80E+08
Zn-69	8.56E-06	1.24E-05	1.14E-06	0.00E+00	7.50E-06	0.00E+00	7.80E-04
Br-83	0.00E+00	0.00E+00	5.18E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	3.39E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	4.54E+08	2.79E+08	0.00E+00	0.00E+00	0.00E+00	2.92E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	3.59E+10	0.00E+00	1.03E+09	0.00E+00	0.00E+00	0.00E+00	1.39E+09
Sr-90	1.87E+12	0.00E+00	3.77E+10	0.00E+00	0.00E+00	0.00E+00	1.67E+10
Sr-91	5.17E+05	0.00E+00	1.95E+04	0.00E+00	0.00E+00	0.00E+00	1.14E+06
Sr-92	7.04E+02	0.00E+00	2.82E+01	0.00E+00	0.00E+00	0.00E+00	1.33E+04
Y-90	2.31E+04	0.00E+00	6.18E+02	0.00E+00	0.00E+00	0.00E+00	6.57E+07
Y-91M	8.42E-09	0.00E+00	3.06E-10	0.00E+00	0.00E+00	0.00E+00	1.65E-05
Y-91	1.87E+07	0.00E+00	4.99E+05	0.00E+00	0.00E+00	0.00E+00	2.49E+09
Y-92	1.55E+00	0.00E+00	4.43E-02	0.00E+00	0.00E+00	0.00E+00	4.47E+04
Y-93	2.89E+02	0.00E+00	7.94E+00	0.00E+00	0.00E+00	0.00E+00	4.31E+06
Zr-95	3.86E+06	8.50E+05	7.56E+05	0.00E+00	1.22E+06	0.00E+00	8.86E+08
Zr-97	5.67E+02	8.19E+01	4.83E+01	0.00E+00	1.18E+02	0.00E+00	1.24E+07
Nb-95	4.12E+05	1.61E+05	1.15E+05	0.00E+00	1.51E+05	0.00E+00	2.97E+08
Mo-99	0.00E+00	7.69E+06	1.90E+06	0.00E+00	1.64E+07	0.00E+00	6.36E+06
Tc- 99M	4.64E+00	9.10E+00	1.51E+02	0.00E+00	1.32E+02	4.62E+00	5.18E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.53E+07	0.00E+00	5.89E+06	0.00E+00	3.86E+07	0.00E+00	3.96E+08
Ru-105	8.97E+01	0.00E+00	3.25E+01	0.00E+00	7.89E+02	0.00E+00	5.86E+04
Ru-106	7.45E+08	0.00E+00	9.30E+07	0.00E+00	1.01E+09	0.00E+00	1.16E+10
Ag-110M	3.21E+07	2.17E+07	1.74E+07	0.00E+00	4.04E+07	0.00E+00	2.58E+09

**Table 4-15 (Continued)**  
**Child Vegetation Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	3.51E+08	9.52E+07	4.68E+07	9.86E+07	0.00E+00	0.00E+00	3.39E+08
Te-127M	1.32E+09	3.56E+08	1.57E+08	3.16E+08	3.77E+09	0.00E+00	1.07E+09
Te-127	9.89E+03	2.67E+03	2.12E+03	6.84E+03	2.81E+04	0.00E+00	3.86E+05
Te-129M	8.40E+08	2.35E+08	1.30E+08	2.71E+08	2.47E+09	0.00E+00	1.02E+09
Te-129	1.24E-03	3.45E-04	2.94E-04	8.83E-04	3.62E-03	0.00E+00	7.70E-02
Te-131M	1.54E+06	5.32E+05	5.66E+05	1.09E+06	5.15E+06	0.00E+00	2.16E+07
Te-131	2.15E-15	6.57E-16	6.41E-16	1.65E-15	6.51E-15	0.00E+00	1.13E-14
Te-132	6.97E+06	3.09E+06	3.73E+06	4.49E+06	2.86E+07	0.00E+00	3.11E+07
I-130	6.10E+05	1.23E+06	6.35E+05	1.36E+08	1.84E+06	0.00E+00	5.76E+05
I-131	1.43E+08	1.44E+08	8.17E+07	4.75E+10	2.36E+08	0.00E+00	1.28E+07
I-132	8.93E+01	1.64E+02	7.54E+01	7.61E+03	2.51E+02	0.00E+00	1.93E+02
I-133	3.52E+06	4.36E+06	1.65E+06	8.09E+08	7.26E+06	0.00E+00	1.76E+06
I-134	1.37E-04	2.55E-04	1.17E-04	5.86E-03	3.90E-04	0.00E+00	1.69E-04
I-135	6.20E+04	1.12E+05	5.28E+04	9.89E+06	1.71E+05	0.00E+00	8.51E+04
Cs-134	1.60E+10	2.63E+10	5.55E+09	0.00E+00	8.16E+09	2.93E+09	1.42E+08
Cs-136	8.18E+07	2.25E+08	1.46E+08	0.00E+00	1.20E+08	1.79E+07	7.90E+06
Cs-137	2.39E+10	2.29E+10	3.38E+09	0.00E+00	7.46E+09	2.68E+09	1.43E+08
Cs-138	5.58E-11	7.75E-11	4.92E-11	0.00E+00	5.45E-11	5.87E-12	3.57E-11
Ba-139	4.69E-02	2.51E-05	1.36E-03	0.00E+00	2.19E-05	1.47E-05	2.71E+00
Ba-140	2.77E+08	2.43E+05	1.62E+07	0.00E+00	7.90E+04	1.45E+05	1.40E+08
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	3.25E+03	1.13E+03	3.82E+02	0.00E+00	0.00E+00	0.00E+00	3.16E+07
La-142	3.23E-04	1.03E-04	3.22E-05	0.00E+00	0.00E+00	0.00E+00	2.04E+01
Ce-141	6.55E+05	3.27E+05	4.85E+04	0.00E+00	1.43E+05	0.00E+00	4.08E+08
Ce-143	1.71E+03	9.28E+05	1.34E+02	0.00E+00	3.89E+02	0.00E+00	1.36E+07
Ce-144	1.27E+08	3.98E+07	6.78E+06	0.00E+00	2.21E+07	0.00E+00	1.04E+10
Pr-143	1.46E+05	4.38E+04	7.24E+03	0.00E+00	2.37E+04	0.00E+00	1.57E+08
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	7.27E+04	5.89E+04	4.56E+03	0.00E+00	3.23E+04	0.00E+00	9.33E+07
W-187	6.41E+04	3.80E+04	1.70E+04	0.00E+00	0.00E+00	0.00E+00	5.34E+06
Np-239	2.55E+03	1.83E+02	1.29E+02	0.00E+00	5.30E+02	0.00E+00	1.36E+07

## Notes:

- 1) Units are m<sup>2</sup> mrem/yr per  $\mu\text{Ci/sec}$ .
- 2) For H-3 and C-14, the units are mrem/yr per  $\mu\text{Ci/m}^3$ .
- 3) The infant age group is assumed to receive no dose through the vegetation ingestion pathway therefore no dose factors are supplied.

**Table 4-16**  
**Adult Grass-Cow-Milk Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02
C-14	3.63E+05	7.26E+04	7.26E+04	7.26E+04	7.26E+04	7.26E+04	7.26E+04
Na-24	2.46E+06	2.46E+06	2.46E+06	2.46E+06	2.46E+06	2.46E+06	2.46E+06
Cr-51	0.00E+00	0.00E+00	2.86E+04	1.71E+04	6.29E+03	3.79E+04	7.18E+06
Mn-54	0.00E+00	8.41E+06	1.61E+06	0.00E+00	2.50E+06	0.00E+00	2.58E+07
Mn-56	0.00E+00	4.13E-03	7.32E-04	0.00E+00	5.24E-03	0.00E+00	1.32E-01
Fe-55	2.51E+07	1.74E+07	4.05E+06	0.00E+00	0.00E+00	9.68E+06	9.95E+06
Fe-59	2.97E+07	6.98E+07	2.67E+07	0.00E+00	0.00E+00	1.95E+07	2.33E+08
Co-58	0.00E+00	4.72E+06	1.06E+07	0.00E+00	0.00E+00	0.00E+00	9.56E+07
Co-60	0.00E+00	1.64E+07	3.62E+07	0.00E+00	0.00E+00	0.00E+00	3.08E+08
Ni-63	6.73E+09	4.66E+08	2.26E+08	0.00E+00	0.00E+00	0.00E+00	9.73E+07
Ni-65	3.70E-01	4.81E-02	2.19E-02	0.00E+00	0.00E+00	0.00E+00	1.22E+00
Cu-64	0.00E+00	2.36E+04	1.11E+04	0.00E+00	5.95E+04	0.00E+00	2.01E+06
Zn-65	1.37E+09	4.36E+09	1.97E+09	0.00E+00	2.92E+09	0.00E+00	2.75E+09
Zn-69	2.01E-12	3.84E-12	2.67E-13	0.00E+00	2.50E-12	0.00E+00	5.78E-13
Br-83	0.00E+00	0.00E+00	9.65E-02	0.00E+00	0.00E+00	0.00E+00	1.39E-01
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	2.60E+09	1.21E+09	0.00E+00	0.00E+00	0.00E+00	5.12E+08
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	1.45E+09	0.00E+00	4.16E+07	0.00E+00	0.00E+00	0.00E+00	2.33E+08
Sr-90	5.38E+10	0.00E+00	1.08E+09	0.00E+00	0.00E+00	0.00E+00	1.35E+09
Sr-91	2.87E+04	0.00E+00	1.16E+03	0.00E+00	0.00E+00	0.00E+00	1.37E+05
Sr-92	4.84E-01	0.00E+00	2.09E-02	0.00E+00	0.00E+00	0.00E+00	9.58E+00
Y-90	7.10E+01	0.00E+00	1.90E+00	0.00E+00	0.00E+00	0.00E+00	7.52E+05
Y-91M	6.42E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.89E-19
Y-91	8.59E+03	0.00E+00	2.30E+02	0.00E+00	0.00E+00	0.00E+00	4.73E+06
Y-92	5.57E-05	0.00E+00	1.63E-06	0.00E+00	0.00E+00	0.00E+00	9.75E-01
Y-93	2.22E-01	0.00E+00	6.12E-03	0.00E+00	0.00E+00	0.00E+00	7.03E+03
Zr-95	9.44E+02	3.03E+02	2.05E+02	0.00E+00	4.75E+02	0.00E+00	9.59E+05
Zr-97	4.32E-01	8.72E-02	3.99E-02	0.00E+00	1.32E-01	0.00E+00	2.70E+04
Nb-95	8.26E+04	4.60E+04	2.47E+04	0.00E+00	4.54E+04	0.00E+00	2.79E+08
Mo-99	0.00E+00	2.47E+07	4.70E+06	0.00E+00	5.60E+07	0.00E+00	5.73E+07
Tc- 99M	3.31E+00	9.35E+00	1.19E+02	0.00E+00	1.42E+02	4.58E+00	5.53E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.02E+03	0.00E+00	4.39E+02	0.00E+00	3.88E+03	0.00E+00	1.19E+05
Ru-105	8.51E-04	0.00E+00	3.36E-04	0.00E+00	1.10E-02	0.00E+00	5.20E-01
Ru-106	2.04E+04	0.00E+00	2.58E+03	0.00E+00	3.94E+04	0.00E+00	1.32E+06
Ag-110M	5.82E+07	5.39E+07	3.20E+07	0.00E+00	1.06E+08	0.00E+00	2.20E+10



**Table 4-16 (Continued)**  
**Adult Grass-Cow-Milk Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	1.63E+07	5.91E+06	2.18E+06	4.90E+06	6.63E+07	0.00E+00	6.51E+07
Te-127M	4.58E+07	1.64E+07	5.58E+06	1.17E+07	1.86E+08	0.00E+00	1.54E+08
Te-127	6.66E+02	2.39E+02	1.44E+02	4.94E+02	2.71E+03	0.00E+00	5.26E+04
Te-129M	6.02E+07	2.24E+07	9.52E+06	2.07E+07	2.51E+08	0.00E+00	3.03E+08
Te-129	2.83E-10	1.06E-10	6.88E-11	2.17E-10	1.19E-09	0.00E+00	2.13E-10
Te-131M	3.61E+05	1.76E+05	1.47E+05	2.79E+05	1.79E+06	0.00E+00	1.75E+07
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	2.39E+06	1.55E+06	1.45E+06	1.71E+06	1.49E+07	0.00E+00	7.32E+07
I-130	4.18E+05	1.23E+06	4.86E+05	1.04E+08	1.92E+06	0.00E+00	1.06E+06
I-131	2.96E+08	4.23E+08	2.43E+08	1.39E+11	7.26E+08	0.00E+00	1.12E+08
I-132	1.65E-01	4.40E-01	1.54E-01	1.54E+01	7.02E-01	0.00E+00	8.27E-02
I-133	3.88E+06	6.74E+06	2.06E+06	9.91E+08	1.18E+07	0.00E+00	6.06E+06
I-134	1.89E-12	5.13E-12	1.83E-12	8.89E-11	8.16E-12	0.00E+00	4.47E-15
I-135	1.29E+04	3.38E+04	1.25E+04	2.23E+06	5.42E+04	0.00E+00	3.82E+04
Cs-134	5.65E+09	1.35E+10	1.10E+10	0.00E+00	4.35E+09	1.45E+09	2.35E+08
Cs-136	2.63E+08	1.04E+09	7.46E+08	0.00E+00	5.77E+08	7.91E+07	1.18E+08
Cs-137	7.38E+09	1.01E+10	6.61E+09	0.00E+00	3.43E+09	1.14E+09	1.95E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	4.43E-08	3.16E-11	1.30E-09	0.00E+00	2.95E-11	1.79E-11	7.86E-08
Ba-140	2.69E+07	3.38E+04	1.76E+06	0.00E+00	1.15E+04	1.93E+04	5.54E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	4.52E+00	2.28E+00	6.02E-01	0.00E+00	0.00E+00	0.00E+00	1.67E+05
La-142	1.89E-11	8.59E-12	2.14E-12	0.00E+00	0.00E+00	0.00E+00	6.28E-08
Ce-141	4.84E+03	3.28E+03	3.72E+02	0.00E+00	1.52E+03	0.00E+00	1.25E+07
Ce-143	4.15E+01	3.07E+04	3.39E+00	0.00E+00	1.35E+01	0.00E+00	1.15E+06
Ce-144	3.58E+05	1.50E+05	1.92E+04	0.00E+00	8.87E+04	0.00E+00	1.21E+08
Pr-143	1.58E+02	6.34E+01	7.83E+00	0.00E+00	3.66E+01	0.00E+00	6.92E+05
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	9.48E+01	1.10E+02	6.56E+00	0.00E+00	6.41E+01	0.00E+00	5.26E+05
W-187	6.51E+03	5.44E+03	1.90E+03	0.00E+00	0.00E+00	0.00E+00	1.78E+06
Np-239	3.67E+00	3.61E-01	1.99E-01	0.00E+00	1.12E+00	0.00E+00	7.40E+04

**Notes:**

- 1) Units are m<sup>2</sup> mrem/yr per  $\mu$ Ci/sec.
- 2) For H-3 and C-14, the units are mrem/yr per  $\mu$ Ci/m<sup>3</sup>.

**Table 4-17**  
**Teen Grass-Cow-Milk Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	5.66E+02	5.66E+02	5.66E+02	5.66E+02	5.66E+02	5.66E+02
C-14	6.70E+05	1.34E+05	1.34E+05	1.34E+05	1.34E+05	1.34E+05	1.34E+05
Na-24	4.29E+06	4.29E+06	4.29E+06	4.29E+06	4.29E+06	4.29E+06	4.29E+06
Cr-51	0.00E+00	0.00E+00	4.99E+04	2.77E+04	1.09E+04	7.12E+04	8.38E+06
Mn-54	0.00E+00	1.40E+07	2.78E+06	0.00E+00	4.18E+06	0.00E+00	2.87E+07
Mn-56	0.00E+00	7.32E-03	1.30E-03	0.00E+00	9.27E-03	0.00E+00	4.82E-01
Fe-55	4.45E+07	3.16E+07	7.36E+06	0.00E+00	0.00E+00	2.00E+07	1.37E+07
Fe-59	5.18E+07	1.21E+08	4.67E+07	0.00E+00	0.00E+00	3.81E+07	2.86E+08
Co-58	0.00E+00	7.94E+06	1.83E+07	0.00E+00	0.00E+00	0.00E+00	1.09E+08
Co-60	0.00E+00	2.78E+07	6.26E+07	0.00E+00	0.00E+00	0.00E+00	3.62E+08
Ni-63	1.18E+10	8.35E+08	4.01E+08	0.00E+00	0.00E+00	0.00E+00	1.33E+08
Ni-65	6.78E-01	8.66E-02	3.94E-02	0.00E+00	0.00E+00	0.00E+00	4.70E+00
Cu-64	0.00E+00	4.21E+04	1.98E+04	0.00E+00	1.06E+05	0.00E+00	3.26E+06
Zn-65	2.11E+09	7.31E+09	3.41E+09	0.00E+00	4.68E+09	0.00E+00	3.10E+09
Zn-69	3.70E-12	7.05E-12	4.94E-13	0.00E+00	4.61E-12	0.00E+00	1.30E-11
Br-83	0.00E+00	0.00E+00	1.78E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	4.73E+09	2.22E+09	0.00E+00	0.00E+00	0.00E+00	7.01E+08
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	2.67E+09	0.00E+00	7.66E+07	0.00E+00	0.00E+00	0.00E+00	3.18E+08
Sr-90	8.13E+10	0.00E+00	1.63E+09	0.00E+00	0.00E+00	0.00E+00	1.86E+09
Sr-91	5.27E+04	0.00E+00	2.10E+03	0.00E+00	0.00E+00	0.00E+00	2.39E+05
Sr-92	8.85E-01	0.00E+00	3.77E-02	0.00E+00	0.00E+00	0.00E+00	2.26E+01
Y-90	1.30E+02	0.00E+00	3.51E+00	0.00E+00	0.00E+00	0.00E+00	1.08E+06
Y-91M	1.18E-19	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.55E-18
Y-91	1.58E+04	0.00E+00	4.24E+02	0.00E+00	0.00E+00	0.00E+00	6.48E+06
Y-92	1.03E-04	0.00E+00	2.98E-06	0.00E+00	0.00E+00	0.00E+00	2.82E+00
Y-93	4.09E-01	0.00E+00	1.12E-02	0.00E+00	0.00E+00	0.00E+00	1.25E+04
Zr-95	1.65E+03	5.21E+02	3.58E+02	0.00E+00	7.65E+02	0.00E+00	1.20E+06
Zr-97	7.87E-01	1.56E-01	7.17E-02	0.00E+00	2.36E-01	0.00E+00	4.22E+04
Nb-95	1.41E+05	7.82E+04	4.30E+04	0.00E+00	7.58E+04	0.00E+00	3.34E+08
Mo-99	0.00E+00	4.46E+07	8.51E+06	0.00E+00	1.02E+08	0.00E+00	8.00E+07
Tc- 99M	5.74E+00	1.60E+01	2.07E+02	0.00E+00	2.39E+02	8.89E+00	1.05E+04
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.81E+03	0.00E+00	7.74E+02	0.00E+00	6.38E+03	0.00E+00	1.51E+05
Ru-105	1.55E-03	0.00E+00	6.03E-04	0.00E+00	1.96E-02	0.00E+00	1.25E+00
Ru-106	3.75E+04	0.00E+00	4.73E+03	0.00E+00	7.24E+04	0.00E+00	1.80E+06
Ag-110M	9.63E+07	9.11E+07	5.54E+07	0.00E+00	1.74E+08	0.00E+00	2.56E+10

**Table 4-17 (Continued)**  
**Teen Grass-Cow-Milk Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	3.01E+07	1.08E+07	4.02E+06	8.40E+06	0.00E+00	0.00E+00	8.87E+07
Te-127M	8.44E+07	2.99E+07	1.00E+07	2.01E+07	3.42E+08	0.00E+00	2.10E+08
Te-127	1.24E+03	4.38E+02	2.66E+02	8.52E+02	5.00E+03	0.00E+00	9.54E+04
Te-129M	1.10E+08	4.09E+07	1.74E+07	3.55E+07	4.61E+08	0.00E+00	4.13E+08
Te-129	5.20E-10	1.94E-10	1.27E-10	3.72E-10	2.18E-09	0.00E+00	2.84E-09
Te-131M	6.57E+05	3.15E+05	2.63E+05	4.74E+05	3.28E+06	0.00E+00	2.53E+07
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	4.27E+06	2.71E+06	2.55E+06	2.85E+06	2.60E+07	0.00E+00	8.57E+07
I-130	7.35E+05	2.13E+06	8.49E+05	1.73E+08	3.27E+06	0.00E+00	1.63E+06
I-131	5.37E+08	7.52E+08	4.04E+08	2.19E+11	1.29E+09	0.00E+00	1.49E+08
I-132	2.92E-01	7.64E-01	2.74E-01	2.57E+01	1.20E+00	0.00E+00	3.33E-01
I-133	7.08E+06	1.20E+07	3.66E+06	1.68E+09	2.11E+07	0.00E+00	9.09E+06
I-134	3.35E-12	8.89E-12	3.19E-12	1.48E-10	1.40E-11	0.00E+00	1.17E-13
I-135	2.29E+04	5.91E+04	2.19E+04	3.80E+06	9.33E+04	0.00E+00	6.54E+04
Cs-134	9.82E+09	2.31E+10	1.07E+10	0.00E+00	7.34E+09	2.80E+09	2.87E+08
Cs-136	4.47E+08	1.76E+09	1.18E+09	0.00E+00	9.58E+08	1.51E+08	1.42E+08
Cs-137	1.34E+10	1.78E+10	6.20E+09	0.00E+00	6.06E+09	2.35E+09	2.53E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	8.20E-08	5.77E-11	2.39E-09	0.00E+00	5.44E-11	3.98E-11	7.31E-07
Ba-140	4.85E+07	5.95E+04	3.13E+06	0.00E+00	2.02E+04	4.00E+04	7.49E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	8.12E+00	3.99E+00	1.06E+00	0.00E+00	0.00E+00	0.00E+00	2.29E+05
La-142	3.41E-11	1.51E-11	3.77E-12	0.00E+00	0.00E+00	0.00E+00	4.61E-07
Ce-141	8.88E+03	5.93E+03	6.81E+02	0.00E+00	2.79E+03	0.00E+00	1.70E+07
Ce-143	7.62E+01	5.55E+04	6.20E+00	0.00E+00	2.49E+01	0.00E+00	1.67E+06
Ce-144	6.58E+05	2.72E+05	3.54E+04	0.00E+00	1.63E+05	0.00E+00	1.66E+08
Pr-143	2.90E+02	1.16E+02	1.44E+01	0.00E+00	6.74E+01	0.00E+00	9.55E+05
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	1.82E+02	1.98E+02	1.19E+01	0.00E+00	1.17E+02	0.00E+00	7.16E+05
W-187	1.19E+04	9.71E+03	3.40E+03	0.00E+00	0.00E+00	0.00E+00	2.63E+06
Np-239	7.00E+00	6.60E-01	3.67E-01	0.00E+00	2.07E+00	0.00E+00	1.06E+05

**Notes:**

- 1) Units are m<sup>2</sup> mrem/yr per  $\mu$ Ci/sec.
- 2) For H-3 and C-14, the units are mrem/yr per  $\mu$ Ci/m<sup>3</sup>.

**Table 4-18**  
**Child Grass-Cow-Milk Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	8.97E+02	8.97E+02	8.97E+02	8.97E+02	8.97E+02	8.97E+02
C-14	1.65E+06	3.29E+05	3.29E+05	3.29E+05	3.29E+05	3.29E+05	3.29E+05
Na-24	8.93E+06	8.93E+06	8.93E+06	8.93E+06	8.93E+06	8.93E+06	8.93E+06
Cr-51	0.00E+00	0.00E+00	1.02E+05	5.65E+04	1.54E+04	1.03E+05	5.39E+06
Mn-54	0.00E+00	2.10E+07	5.59E+06	0.00E+00	5.88E+06	0.00E+00	1.76E+07
Mn-56	0.00E+00	1.28E-02	2.88E-03	0.00E+00	1.54E-02	0.00E+00	1.85E+00
Fe-55	1.12E+08	5.93E+07	1.84E+07	0.00E+00	0.00E+00	3.35E+07	1.10E+07
Fe-59	1.20E+08	1.94E+08	9.69E+07	0.00E+00	0.00E+00	5.64E+07	2.02E+08
Co-58	0.00E+00	1.21E+07	3.71E+07	0.00E+00	0.00E+00	0.00E+00	7.08E+07
Co-60	0.00E+00	4.32E+07	1.27E+08	0.00E+00	0.00E+00	0.00E+00	2.39E+08
Ni-63	2.96E+10	1.59E+09	1.01E+09	0.00E+00	0.00E+00	0.00E+00	1.07E+08
Ni-65	1.66E+00	1.56E-01	9.11E-02	0.00E+00	0.00E+00	0.00E+00	1.91E+01
Cu-64	0.00E+00	7.39E+04	4.47E+04	0.00E+00	1.79E+05	0.00E+00	3.47E+06
Zn-65	4.13E+09	1.10E+10	6.85E+09	0.00E+00	6.94E+09	0.00E+00	1.93E+09
Zn-69	9.10E-12	1.32E-11	1.22E-12	0.00E+00	7.98E-12	0.00E+00	8.29E-10
Br-83	0.00E+00	0.00E+00	4.37E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	8.78E+09	5.40E+09	0.00E+00	0.00E+00	0.00E+00	5.65E+08
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	6.62E+09	0.00E+00	1.89E+08	0.00E+00	0.00E+00	0.00E+00	2.56E+08
Sr-90	1.68E+11	0.00E+00	3.38E+09	0.00E+00	0.00E+00	0.00E+00	1.51E+09
Sr-91	1.29E+05	0.00E+00	4.88E+03	0.00E+00	0.00E+00	0.00E+00	2.86E+05
Sr-92	2.16E+00	0.00E+00	8.67E-02	0.00E+00	0.00E+00	0.00E+00	4.09E+01
Y-90	3.23E+02	0.00E+00	8.64E+00	0.00E+00	0.00E+00	0.00E+00	9.19E+05
Y-91M	2.87E-19	0.00E+00	1.04E-20	0.00E+00	0.00E+00	0.00E+00	5.62E-16
Y-91	3.90E+04	0.00E+00	1.04E+03	0.00E+00	0.00E+00	0.00E+00	5.20E+06
Y-92	2.53E-04	0.00E+00	7.23E-06	0.00E+00	0.00E+00	0.00E+00	7.30E+00
Y-93	1.00E+00	0.00E+00	2.75E-02	0.00E+00	0.00E+00	0.00E+00	1.50E+04
Zr-95	3.83E+03	8.43E+02	7.50E+02	0.00E+00	1.21E+03	0.00E+00	8.79E+05
Zr-97	1.91E+00	2.77E-01	1.63E-01	0.00E+00	3.97E-01	0.00E+00	4.19E+04
Nb-95	3.18E+05	1.24E+05	8.85E+04	0.00E+00	1.16E+05	0.00E+00	2.29E+08
Mo-99	0.00E+00	8.12E+07	2.01E+07	0.00E+00	1.73E+08	0.00E+00	6.72E+07
Tc- 99M	1.32E+01	2.58E+01	4.28E+02	0.00E+00	3.75E+02	1.31E+01	1.47E+04
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	4.28E+03	0.00E+00	1.65E+03	0.00E+00	1.08E+04	0.00E+00	1.11E+05
Ru-105	3.79E-03	0.00E+00	1.38E-03	0.00E+00	3.33E-02	0.00E+00	2.48E+00
Ru-106	9.24E+04	0.00E+00	1.15E+04	0.00E+00	1.25E+05	0.00E+00	1.44E+06
Ag-110M	2.09E+08	1.41E+08	1.13E+08	0.00E+00	2.63E+08	0.00E+00	1.68E+10



**Table 4-18 (Continued)**  
**Child Grass-Cow-Milk Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	7.38E+07	2.00E+07	9.84E+06	2.07E+07	0.00E+00	0.00E+00	7.12E+07
Te-127M	2.08E+08	5.60E+07	2.47E+07	4.97E+07	5.93E+08	0.00E+00	1.68E+08
Te-127	3.04E+03	8.19E+02	6.51E+02	2.10E+03	8.64E+03	0.00E+00	1.19E+05
Te-129M	2.71E+08	7.58E+07	4.21E+07	8.75E+07	7.97E+08	0.00E+00	3.31E+08
Te-129	1.28E-09	3.58E-10	3.05E-10	9.16E-10	3.75E-09	0.00E+00	7.99E-08
Te-131M	1.60E+06	5.53E+05	5.88E+05	1.14E+06	5.35E+06	0.00E+00	2.24E+07
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	1.02E+07	4.52E+06	5.46E+06	6.58E+06	4.19E+07	0.00E+00	4.55E+07
I-130	1.72E+06	3.47E+06	1.79E+06	3.82E+08	5.19E+06	0.00E+00	1.62E+06
I-131	1.30E+09	1.31E+09	7.45E+08	4.33E+11	2.15E+09	0.00E+00	1.17E+08
I-132	6.91E-01	1.27E+00	5.84E-01	5.89E+01	1.94E+00	0.00E+00	1.49E+00
I-133	1.72E+07	2.13E+07	8.05E+06	3.95E+09	3.55E+07	0.00E+00	8.57E+06
I-134	7.94E-12	1.47E-11	6.79E-12	3.39E-10	2.26E-11	0.00E+00	9.78E-12
I-135	5.43E+04	9.78E+04	4.62E+04	8.66E+06	1.50E+05	0.00E+00	7.45E+04
Cs-134	2.26E+10	3.72E+10	7.84E+09	0.00E+00	1.15E+10	4.13E+09	2.00E+08
Cs-136	1.01E+09	2.77E+09	1.80E+09	0.00E+00	1.48E+09	2.20E+08	9.75E+07
Cs-137	3.22E+10	3.09E+10	4.55E+09	0.00E+00	1.01E+10	3.62E+09	1.93E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	2.01E-07	1.08E-10	5.84E-09	0.00E+00	9.39E-11	6.33E-11	1.16E-05
Ba-140	1.17E+08	1.03E+05	6.84E+06	0.00E+00	3.34E+04	6.12E+04	5.94E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	1.95E+01	6.80E+00	2.29E+00	0.00E+00	0.00E+00	0.00E+00	1.90E+05
La-142	8.24E-11	2.63E-11	8.22E-12	0.00E+00	0.00E+00	0.00E+00	5.20E-06
Ce-141	2.19E+04	1.09E+04	1.62E+03	0.00E+00	4.78E+03	0.00E+00	1.36E+07
Ce-143	1.87E+02	1.01E+05	1.47E+01	0.00E+00	4.26E+01	0.00E+00	1.49E+06
Ce-144	1.62E+06	5.09E+05	8.66E+04	0.00E+00	2.82E+05	0.00E+00	1.33E+08
Pr-143	7.18E+02	2.16E+02	3.57E+01	0.00E+00	1.17E+02	0.00E+00	7.75E+05
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	4.48E+02	3.63E+02	2.81E+01	0.00E+00	1.99E+02	0.00E+00	5.75E+05
W-187	2.89E+04	1.71E+04	7.67E+03	0.00E+00	0.00E+00	0.00E+00	2.40E+06
Np-239	1.72E+01	1.24E+00	8.69E-01	0.00E+00	3.58E+00	0.00E+00	9.15E+04

**Notes:**

- 1) Units are m<sup>2</sup> mrem/yr per  $\mu$ Ci/sec.
- 2) For H-3 and C-14, the units are mrem/yr per  $\mu$ Ci/m<sup>3</sup>.

**Table 4-19**  
**Infant Grass-Cow-Milk Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	1.36E+03	1.36E+03	1.36E+03	1.36E+03	1.36E+03	1.36E+03
C-14	3.23E+06	6.89E+05	6.89E+05	6.89E+05	6.89E+05	6.89E+05	6.89E+05
Na-24	1.56E+07	1.56E+07	1.56E+07	1.56E+07	1.56E+07	1.56E+07	1.56E+07
Cr-51	0.00E+00	0.00E+00	1.61E+05	1.05E+05	2.30E+04	2.05E+05	4.70E+06
Mn-54	0.00E+00	3.90E+07	8.84E+06	0.00E+00	8.64E+06	0.00E+00	1.43E+07
Mn-56	0.00E+00	3.13E-02	5.39E-03	0.00E+00	2.69E-02	0.00E+00	2.84E+00
Fe-55	1.35E+08	8.73E+07	2.33E+07	0.00E+00	0.00E+00	4.27E+07	1.11E+07
Fe-59	2.24E+08	3.92E+08	1.54E+08	0.00E+00	0.00E+00	1.16E+08	1.87E+08
Co-58	0.00E+00	2.43E+07	6.05E+07	0.00E+00	0.00E+00	0.00E+00	6.04E+07
Co-60	0.00E+00	8.82E+07	2.08E+08	0.00E+00	0.00E+00	0.00E+00	2.10E+08
Ni-63	3.49E+10	2.16E+09	1.21E+09	0.00E+00	0.00E+00	0.00E+00	1.07E+08
Ni-65	3.51E+00	3.97E-01	1.81E-01	0.00E+00	0.00E+00	0.00E+00	3.02E+01
Cu-64	0.00E+00	1.84E+05	8.51E+04	0.00E+00	3.11E+05	0.00E+00	3.77E+06
Zn-65	5.55E+09	1.90E+10	8.78E+09	0.00E+00	9.23E+09	0.00E+00	1.61E+10
Zn-69	1.94E-11	3.49E-11	2.60E-12	0.00E+00	1.45E-11	0.00E+00	2.85E-09
Br-83	0.00E+00	0.00E+00	9.27E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	2.23E+10	1.10E+10	0.00E+00	0.00E+00	0.00E+00	5.70E+08
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	1.26E+10	0.00E+00	3.61E+08	0.00E+00	0.00E+00	0.00E+00	2.59E+08
Sr-90	1.86E+11	0.00E+00	3.77E+09	0.00E+00	0.00E+00	0.00E+00	1.52E+09
Sr-91	2.70E+05	0.00E+00	9.76E+03	0.00E+00	0.00E+00	0.00E+00	3.19E+05
Sr-92	4.60E+00	0.00E+00	1.71E-01	0.00E+00	0.00E+00	0.00E+00	4.96E+01
Y-90	6.82E+02	0.00E+00	1.83E+01	0.00E+00	0.00E+00	0.00E+00	9.42E+05
Y-91M	6.09E-19	0.00E+00	2.07E-20	0.00E+00	0.00E+00	0.00E+00	2.03E-15
Y-91	7.33E+04	0.00E+00	1.95E+03	0.00E+00	0.00E+00	0.00E+00	5.25E+06
Y-92	5.37E-04	0.00E+00	1.51E-05	0.00E+00	0.00E+00	0.00E+00	1.02E+01
Y-93	2.14E+00	0.00E+00	5.83E-02	0.00E+00	0.00E+00	0.00E+00	1.69E+04
Zr-95	6.81E+03	1.66E+03	1.18E+03	0.00E+00	1.79E+03	0.00E+00	8.26E+05
Zr-97	4.05E+00	6.96E-01	3.18E-01	0.00E+00	7.01E-01	0.00E+00	4.44E+04
Nb-95	5.94E+05	2.45E+05	1.41E+05	0.00E+00	1.75E+05	0.00E+00	2.07E+08
Mo-99	0.00E+00	2.08E+08	4.05E+07	0.00E+00	3.10E+08	0.00E+00	6.84E+07
Tc- 99M	2.74E+01	5.65E+01	7.27E+02	0.00E+00	6.08E+02	2.95E+01	1.64E+04
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	8.67E+03	0.00E+00	2.90E+03	0.00E+00	1.80E+04	0.00E+00	1.05E+05
Ru-105	8.00E-03	0.00E+00	2.69E-03	0.00E+00	5.88E-02	0.00E+00	3.18E+00
Ru-106	1.90E+05	0.00E+00	2.38E+04	0.00E+00	2.25E+05	0.00E+00	1.44E+06
Ag-110M	3.86E+08	2.82E+08	1.86E+08	0.00E+00	4.03E+08	0.00E+00	1.46E+10

**Table 4-19 (Continued)**  
**Infant Grass-Cow-Milk Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	1.51E+08	5.04E+07	2.04E+07	5.08E+07	0.00E+00	0.00E+00	7.19E+07
Te-127M	4.21E+08	1.40E+08	5.10E+07	1.22E+08	1.04E+09	0.00E+00	1.70E+08
Te-127	6.45E+03	2.16E+03	1.39E+03	5.25E+03	1.57E+04	0.00E+00	1.35E+05
Te-129M	5.57E+08	1.91E+08	8.58E+07	2.14E+08	1.39E+09	0.00E+00	3.33E+08
Te-129	2.72E-09	9.38E-10	6.35E-10	2.28E-09	6.77E-09	0.00E+00	2.17E-07
Te-131M	3.37E+06	1.36E+06	1.12E+06	2.75E+06	9.35E+06	0.00E+00	2.29E+07
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	2.10E+07	1.04E+07	9.71E+06	1.54E+07	6.51E+07	0.00E+00	3.85E+07
I-130	3.53E+06	7.77E+06	3.12E+06	8.71E+08	8.53E+06	0.00E+00	1.67E+06
I-131	2.72E+09	3.20E+09	1.41E+09	1.05E+12	3.74E+09	0.00E+00	1.14E+08
I-132	1.43E+00	2.91E+00	1.04E+00	1.36E+02	3.25E+00	0.00E+00	2.36E+00
I-133	3.63E+07	5.29E+07	1.55E+07	9.62E+09	6.22E+07	0.00E+00	8.95E+06
I-134	1.65E-11	3.37E-11	1.20E-11	7.87E-10	3.77E-11	0.00E+00	3.49E-11
I-135	1.13E+05	2.25E+05	8.19E+04	2.01E+07	2.50E+05	0.00E+00	8.13E+04
Cs-134	3.65E+10	6.80E+10	6.87E+09	0.00E+00	1.75E+10	7.18E+09	1.85E+08
Cs-136	1.97E+09	5.80E+09	2.16E+09	0.00E+00	2.31E+09	4.72E+08	8.80E+07
Cs-137	5.15E+10	6.02E+10	4.27E+09	0.00E+00	1.62E+10	6.55E+09	1.88E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	4.29E-07	2.84E-10	1.24E-08	0.00E+00	1.71E-10	1.72E-10	2.72E-05
Ba-140	2.41E+08	2.41E+05	1.24E+07	0.00E+00	5.72E+04	1.48E+05	5.92E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	4.06E+01	1.60E+01	4.12E+00	0.00E+00	0.00E+00	0.00E+00	1.88E+05
La-142	1.73E-10	6.35E-11	1.52E-11	0.00E+00	0.00E+00	0.00E+00	1.08E-05
Ce-141	4.34E+04	2.64E+04	3.11E+03	0.00E+00	8.15E+03	0.00E+00	1.37E+07
Ce-143	3.96E+02	2.63E+05	3.00E+01	0.00E+00	7.65E+01	0.00E+00	1.53E+06
Ce-144	2.33E+06	9.52E+05	1.30E+05	0.00E+00	3.85E+05	0.00E+00	1.33E+08
Pr-143	1.49E+03	5.56E+02	7.37E+01	0.00E+00	2.07E+02	0.00E+00	7.84E+05
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	8.88E+02	9.12E+02	5.59E+01	0.00E+00	3.51E+02	0.00E+00	5.78E+05
W-187	6.08E+04	4.23E+04	1.46E+04	0.00E+00	0.00E+00	0.00E+00	2.48E+06
Np-239	3.64E+01	3.26E+00	1.84E+00	0.00E+00	6.50E+00	0.00E+00	9.42E+04

**Notes:**

- 1) Units are  $\text{m}^2 \text{ mrem/yr}$  per  $\mu\text{Ci/sec}$ .
- 2) For H-3 and C-14, the units are  $\text{mrem/yr}$  per  $\mu\text{Ci/m}^3$ .

**Table 4-20**  
**Adult Grass-Goat-Milk Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	8.88E+02	8.88E+02	8.88E+02	8.88E+02	8.88E+02	8.88E+02
C-14	3.63E+05	7.26E+04	7.26E+04	7.26E+04	7.26E+04	7.26E+04	7.26E+04
Na-24	2.95E+05	2.95E+05	2.95E+05	2.95E+05	2.95E+05	2.95E+05	2.95E+05
Cr-51	0.00E+00	0.00E+00	3.43E+03	2.05E+03	7.55E+02	4.55E+03	8.62E+05
Mn-54	0.00E+00	1.01E+06	1.93E+05	0.00E+00	3.00E+05	0.00E+00	3.09E+06
Mn-56	0.00E+00	4.95E-04	8.79E-05	0.00E+00	6.29E-04	0.00E+00	1.58E-02
Fe-55	3.26E+05	2.26E+05	5.26E+04	0.00E+00	0.00E+00	1.26E+05	1.29E+05
Fe-59	3.86E+05	9.07E+05	3.48E+05	0.00E+00	0.00E+00	2.53E+05	3.02E+06
Co-58	0.00E+00	5.66E+05	1.27E+06	0.00E+00	0.00E+00	0.00E+00	1.15E+07
Co-60	0.00E+00	1.97E+06	4.34E+06	0.00E+00	0.00E+00	0.00E+00	3.70E+07
Ni-63	8.07E+08	5.60E+07	2.71E+07	0.00E+00	0.00E+00	0.00E+00	1.17E+07
Ni-65	4.44E-02	5.77E-03	2.63E-03	0.00E+00	0.00E+00	0.00E+00	1.46E-01
Cu-64	0.00E+00	2.63E+03	1.23E+03	0.00E+00	6.63E+03	0.00E+00	2.24E+05
Zn-65	1.65E+08	5.24E+08	2.37E+08	0.00E+00	3.50E+08	0.00E+00	3.30E+08
Zn-69	2.41E-13	4.61E-13	3.21E-14	0.00E+00	3.00E-13	0.00E+00	6.93E-14
Br-83	0.00E+00	0.00E+00	1.16E-02	0.00E+00	0.00E+00	0.00E+00	1.67E-02
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	3.12E+08	1.45E+08	0.00E+00	0.00E+00	0.00E+00	6.15E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	3.05E+09	0.00E+00	8.74E+07	0.00E+00	0.00E+00	0.00E+00	4.88E+08
Sr-90	1.13E+11	0.00E+00	2.27E+09	0.00E+00	0.00E+00	0.00E+00	2.84E+09
Sr-91	6.03E+04	0.00E+00	2.44E+03	0.00E+00	0.00E+00	0.00E+00	2.87E+05
Sr-92	1.02E+00	0.00E+00	4.39E-02	0.00E+00	0.00E+00	0.00E+00	2.01E+01
Y-90	8.52E+00	0.00E+00	2.28E-01	0.00E+00	0.00E+00	0.00E+00	9.03E+04
Y-91M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.26E-20
Y-91	1.03E+03	0.00E+00	2.76E+01	0.00E+00	0.00E+00	0.00E+00	5.67E+05
Y-92	6.68E-06	0.00E+00	1.95E-07	0.00E+00	0.00E+00	0.00E+00	1.17E-01
Y-93	2.66E-02	0.00E+00	7.34E-04	0.00E+00	0.00E+00	0.00E+00	8.43E+02
Zr-95	1.13E+02	3.63E+01	2.46E+01	0.00E+00	5.70E+01	0.00E+00	1.15E+05
Zr-97	5.19E-02	1.05E-02	4.79E-03	0.00E+00	1.58E-02	0.00E+00	3.24E+03
Nb-95	9.92E+03	5.52E+03	2.97E+03	0.00E+00	5.45E+03	0.00E+00	3.35E+07
Mo-99	0.00E+00	2.97E+06	5.65E+05	0.00E+00	6.72E+06	0.00E+00	6.88E+06
Tc- 99M	3.97E-01	1.12E+00	1.43E+01	0.00E+00	1.70E+01	5.50E-01	6.64E+02
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.22E+02	0.00E+00	5.26E+01	0.00E+00	4.66E+02	0.00E+00	1.43E+04
Ru-105	1.02E-04	0.00E+00	4.03E-05	0.00E+00	1.32E-03	0.00E+00	6.25E-02
Ru-106	2.45E+03	0.00E+00	3.10E+02	0.00E+00	4.73E+03	0.00E+00	1.58E+05
Ag-110M	6.99E+06	6.46E+06	3.84E+06	0.00E+00	1.27E+07	0.00E+00	2.64E+09



**Table 4-20 (Continued)**  
**Adult Grass-Goat-Milk Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	1.96E+06	7.09E+05	2.62E+05	5.88E+05	7.95E+06	0.00E+00	7.81E+06
Te-127M	5.49E+06	1.96E+06	6.69E+05	1.40E+06	2.23E+07	0.00E+00	1.84E+07
Te-127	8.00E+01	2.87E+01	1.73E+01	5.92E+01	3.26E+02	0.00E+00	6.31E+03
Te-129M	7.22E+06	2.69E+06	1.14E+06	2.48E+06	3.01E+07	0.00E+00	3.64E+07
Te-129	3.39E-11	1.27E-11	8.26E-12	2.60E-11	1.43E-10	0.00E+00	2.56E-11
Te-131M	4.33E+04	2.12E+04	1.76E+04	3.35E+04	2.14E+05	0.00E+00	2.10E+06
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	2.87E+05	1.86E+05	1.74E+05	2.05E+05	1.79E+06	0.00E+00	8.78E+06
I-130	5.01E+05	1.48E+06	5.84E+05	1.25E+08	2.31E+06	0.00E+00	1.27E+06
I-131	3.55E+08	5.08E+08	2.91E+08	1.67E+11	8.71E+08	0.00E+00	1.34E+08
I-132	1.98E-01	5.29E-01	1.85E-01	1.85E+01	8.42E-01	0.00E+00	9.93E-02
I-133	4.65E+06	8.09E+06	2.47E+06	1.19E+09	1.41E+07	0.00E+00	7.27E+06
I-134	2.27E-12	6.15E-12	2.20E-12	1.07E-10	9.79E-12	0.00E+00	5.36E-15
I-135	1.55E+04	4.06E+04	1.50E+04	2.68E+06	6.51E+04	0.00E+00	4.58E+04
Cs-134	1.70E+10	4.04E+10	3.30E+10	0.00E+00	1.31E+10	4.34E+09	7.06E+08
Cs-136	7.88E+08	3.11E+09	2.24E+09	0.00E+00	1.73E+09	2.37E+08	3.53E+08
Cs-137	2.21E+10	3.03E+10	1.98E+10	0.00E+00	1.03E+10	3.42E+09	5.86E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	5.32E-09	3.79E-12	1.56E-10	0.00E+00	3.54E-12	2.15E-12	9.44E-09
Ba-140	3.23E+06	4.05E+03	2.11E+05	0.00E+00	1.38E+03	2.32E+03	6.64E+06
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	5.43E-01	2.74E-01	7.23E-02	0.00E+00	0.00E+00	0.00E+00	2.01E+04
La-142	2.27E-12	1.03E-12	2.57E-13	0.00E+00	0.00E+00	0.00E+00	7.53E-09
Ce-141	5.81E+02	3.93E+02	4.46E+01	0.00E+00	1.83E+02	0.00E+00	1.50E+06
Ce-143	4.98E+00	3.68E+03	4.07E-01	0.00E+00	1.62E+00	0.00E+00	1.38E+05
Ce-144	4.29E+04	1.79E+04	2.30E+03	0.00E+00	1.06E+04	0.00E+00	1.45E+07
Pr-143	1.90E+01	7.60E+00	9.40E-01	0.00E+00	4.39E+00	0.00E+00	8.31E+04
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	1.14E+01	1.32E+01	7.87E-01	0.00E+00	7.69E+00	0.00E+00	6.31E+04
W-187	7.82E+02	6.53E+02	2.28E+02	0.00E+00	0.00E+00	0.00E+00	2.14E+05
Np-239	4.40E-01	4.33E-02	2.39E-02	0.00E+00	1.35E-01	0.00E+00	8.88E+03

**Notes:**

- 1) Units are m<sup>2</sup> mrem/yr per  $\mu$ Ci/sec.
- 2) For H-3 and C-14, the units are mrem/yr per  $\mu$ Ci/m<sup>3</sup>.

**Table 4-21**  
**Teen Grass-Goat-Milk Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	1.16E+03	1.16E+03	1.16E+03	1.16E+03	1.16E+03	1.16E+03
C-14	6.70E+05	1.34E+05	1.34E+05	1.34E+05	1.34E+05	1.34E+05	1.34E+05
Na-24	5.15E+05	5.15E+05	5.15E+05	5.15E+05	5.15E+05	5.15E+05	5.15E+05
Cr-51	0.00E+00	0.00E+00	5.99E+03	3.33E+03	1.31E+03	8.55E+03	1.01E+06
Mn-54	0.00E+00	1.68E+06	3.34E+05	0.00E+00	5.02E+05	0.00E+00	3.45E+06
Mn-56	0.00E+00	8.78E-04	1.56E-04	0.00E+00	1.11E-03	0.00E+00	5.78E-02
Fe-55	5.79E+05	4.11E+05	9.57E+04	0.00E+00	0.00E+00	2.60E+05	1.78E+05
Fe-59	6.74E+05	1.57E+06	6.07E+05	0.00E+00	0.00E+00	4.96E+05	3.72E+06
Co-58	0.00E+00	9.53E+05	2.20E+06	0.00E+00	0.00E+00	0.00E+00	1.31E+07
Co-60	0.00E+00	3.34E+06	7.52E+06	0.00E+00	0.00E+00	0.00E+00	4.35E+07
Ni-63	1.42E+09	1.00E+08	4.81E+07	0.00E+00	0.00E+00	0.00E+00	1.59E+07
Ni-65	8.13E-02	1.04E-02	4.73E-03	0.00E+00	0.00E+00	0.00E+00	5.63E-01
Cu-64	0.00E+00	4.69E+03	2.20E+03	0.00E+00	1.19E+04	0.00E+00	3.64E+05
Zn-65	2.53E+08	8.78E+08	4.09E+08	0.00E+00	5.62E+08	0.00E+00	3.72E+08
Zn-69	4.44E-13	8.46E-13	5.92E-14	0.00E+00	5.53E-13	0.00E+00	1.56E-12
Br-83	0.00E+00	0.00E+00	2.13E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	5.68E+08	2.67E+08	0.00E+00	0.00E+00	0.00E+00	8.41E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	5.61E+09	0.00E+00	1.61E+08	0.00E+00	0.00E+00	0.00E+00	6.69E+08
Sr-90	1.71E+11	0.00E+00	3.41E+09	0.00E+00	0.00E+00	0.00E+00	3.90E+09
Sr-91	1.11E+05	0.00E+00	4.41E+03	0.00E+00	0.00E+00	0.00E+00	5.02E+05
Sr-92	1.86E+00	0.00E+00	7.92E-02	0.00E+00	0.00E+00	0.00E+00	4.74E+01
Y-90	1.56E+01	0.00E+00	4.21E-01	0.00E+00	0.00E+00	0.00E+00	1.29E+05
Y-91M	1.41E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.66E-19
Y-91	1.90E+03	0.00E+00	5.08E+01	0.00E+00	0.00E+00	0.00E+00	7.77E+05
Y-92	1.23E-05	0.00E+00	3.57E-07	0.00E+00	0.00E+00	0.00E+00	3.39E-01
Y-93	4.90E-02	0.00E+00	1.34E-03	0.00E+00	0.00E+00	0.00E+00	1.50E+03
Zr-95	1.98E+02	6.25E+01	4.30E+01	0.00E+00	9.18E+01	0.00E+00	1.44E+05
Zr-97	9.44E-02	1.87E-02	8.61E-03	0.00E+00	2.83E-02	0.00E+00	5.06E+03
Nb-95	1.69E+04	9.38E+03	5.16E+03	0.00E+00	9.09E+03	0.00E+00	4.01E+07
Mo-99	0.00E+00	5.36E+06	1.02E+06	0.00E+00	1.23E+07	0.00E+00	9.59E+06
Tc- 99M	6.89E-01	1.92E+00	2.49E+01	0.00E+00	2.86E+01	1.07E+00	1.26E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	2.17E+02	0.00E+00	9.29E+01	0.00E+00	7.66E+02	0.00E+00	1.81E+04
Ru-105	1.86E-04	0.00E+00	7.24E-05	0.00E+00	2.35E-03	0.00E+00	1.51E-01
Ru-106	4.50E+03	0.00E+00	5.67E+02	0.00E+00	8.68E+03	0.00E+00	2.16E+05
Ag-110M	1.16E+07	1.09E+07	6.65E+06	0.00E+00	2.09E+07	0.00E+00	3.07E+09

**Table 4-21 (Continued)**  
**Teen Grass-Goat-Milk Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	3.61E+06	1.30E+06	4.82E+05	1.01E+06	0.00E+00	0.00E+00	1.06E+07
Te-127M	1.01E+07	3.59E+06	1.20E+06	2.41E+06	4.10E+07	0.00E+00	2.52E+07
Te-127	1.48E+02	5.25E+01	3.19E+01	1.02E+02	6.00E+02	0.00E+00	1.14E+04
Te-129M	1.32E+07	4.90E+06	2.09E+06	4.26E+06	5.53E+07	0.00E+00	4.96E+07
Te-129	6.24E-11	2.33E-11	1.52E-11	4.46E-11	2.62E-10	0.00E+00	3.41E-10
Te-131M	7.88E+04	3.78E+04	3.15E+04	5.68E+04	3.94E+05	0.00E+00	3.03E+06
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	5.13E+05	3.25E+05	3.06E+05	3.42E+05	3.12E+06	0.00E+00	1.03E+07
I-130	8.82E+05	2.55E+06	1.02E+06	2.08E+08	3.93E+06	0.00E+00	1.96E+06
I-131	6.45E+08	9.02E+08	4.85E+08	2.63E+11	1.55E+09	0.00E+00	1.78E+08
I-132	3.50E-01	9.17E-01	3.29E-01	3.09E+01	1.44E+00	0.00E+00	3.99E-01
I-133	8.50E+06	1.44E+07	4.40E+06	2.01E+09	2.53E+07	0.00E+00	1.09E+07
I-134	4.03E-12	1.07E-11	3.83E-12	1.78E-10	1.68E-11	0.00E+00	1.41E-13
I-135	2.75E+04	7.09E+04	2.63E+04	4.56E+06	1.12E+05	0.00E+00	7.85E+04
Cs-134	2.94E+10	6.93E+10	3.22E+10	0.00E+00	2.20E+10	8.41E+09	8.62E+08
Cs-136	1.34E+09	5.28E+09	3.54E+09	0.00E+00	2.87E+09	4.53E+08	4.25E+08
Cs-137	4.02E+10	5.34E+10	1.86E+10	0.00E+00	1.82E+10	7.06E+09	7.60E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	9.84E-09	6.92E-12	2.87E-10	0.00E+00	6.53E-12	4.77E-12	8.78E-08
Ba-140	5.82E+06	7.14E+03	3.75E+05	0.00E+00	2.42E+03	4.80E+03	8.98E+06
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	9.75E-01	4.79E-01	1.27E-01	0.00E+00	0.00E+00	0.00E+00	2.75E+04
La-142	4.09E-12	1.82E-12	4.53E-13	0.00E+00	0.00E+00	0.00E+00	5.53E-08
Ce-141	1.07E+03	7.12E+02	8.17E+01	0.00E+00	3.35E+02	0.00E+00	2.04E+06
Ce-143	9.15E+00	6.66E+03	7.44E-01	0.00E+00	2.99E+00	0.00E+00	2.00E+05
Ce-144	7.90E+04	3.27E+04	4.24E+03	0.00E+00	1.95E+04	0.00E+00	1.99E+07
Pr-143	3.48E+01	1.39E+01	1.73E+00	0.00E+00	8.08E+00	0.00E+00	1.15E+05
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	2.19E+01	2.38E+01	1.43E+00	0.00E+00	1.40E+01	0.00E+00	8.59E+04
W-187	1.43E+03	1.17E+03	4.08E+02	0.00E+00	0.00E+00	0.00E+00	3.15E+05
Np-239	8.40E-01	7.92E-02	4.40E-02	0.00E+00	2.49E-01	0.00E+00	1.27E+04

## Notes:

- 1) Units are  $\text{m}^2 \text{ mrem/yr}$  per  $\mu\text{Ci/sec}$ .
- 2) For H-3 and C-14, the units are  $\text{mrem/yr}$  per  $\mu\text{Ci/m}^3$ .

**Table 4-22**  
**Child Grass-Goat-Milk Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	1.83E+03	1.83E+03	1.83E+03	1.83E+03	1.83E+03	1.83E+03
C-14	1.65E+06	3.29E+05	3.29E+05	3.29E+05	3.29E+05	3.29E+05	3.29E+05
Na-24	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06
Cr-51	0.00E+00	0.00E+00	1.22E+04	6.78E+03	1.85E+03	1.24E+04	6.47E+05
Mn-54	0.00E+00	2.52E+06	6.70E+05	0.00E+00	7.06E+05	0.00E+00	2.11E+06
Mn-56	0.00E+00	1.53E-03	3.46E-04	0.00E+00	1.85E-03	0.00E+00	2.22E-01
Fe-55	1.45E+06	7.71E+05	2.39E+05	0.00E+00	0.00E+00	4.36E+05	1.43E+05
Fe-59	1.56E+06	2.53E+06	1.26E+06	0.00E+00	0.00E+00	7.33E+05	2.63E+06
Co-58	0.00E+00	1.46E+06	4.46E+06	0.00E+00	0.00E+00	0.00E+00	8.49E+06
Co-60	0.00E+00	5.18E+06	1.53E+07	0.00E+00	0.00E+00	0.00E+00	2.87E+07
Ni-63	3.56E+09	1.90E+08	1.21E+08	0.00E+00	0.00E+00	0.00E+00	1.28E+07
Ni-65	1.99E-01	1.87E-02	1.09E-02	0.00E+00	0.00E+00	0.00E+00	2.29E+00
Cu-64	0.00E+00	8.24E+03	4.98E+03	0.00E+00	1.99E+04	0.00E+00	3.87E+05
Zn-65	4.96E+08	1.32E+09	8.22E+08	0.00E+00	8.33E+08	0.00E+00	2.32E+08
Zn-69	1.09E-12	1.58E-12	1.46E-13	0.00E+00	9.57E-13	0.00E+00	9.95E-11
Br-83	0.00E+00	0.00E+00	5.24E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	1.05E+09	6.48E+08	0.00E+00	0.00E+00	0.00E+00	6.78E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	1.39E+10	0.00E+00	3.97E+08	0.00E+00	0.00E+00	0.00E+00	5.38E+08
Sr-90	3.53E+11	0.00E+00	7.11E+09	0.00E+00	0.00E+00	0.00E+00	3.16E+09
Sr-91	2.72E+05	0.00E+00	1.03E+04	0.00E+00	0.00E+00	0.00E+00	6.00E+05
Sr-92	4.54E+00	0.00E+00	1.82E-01	0.00E+00	0.00E+00	0.00E+00	8.60E+01
Y-90	3.87E+01	0.00E+00	1.04E+00	0.00E+00	0.00E+00	0.00E+00	1.10E+05
Y-91M	3.45E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.75E-17
Y-91	4.68E+03	0.00E+00	1.25E+02	0.00E+00	0.00E+00	0.00E+00	6.24E+05
Y-92	3.03E-05	0.00E+00	8.67E-07	0.00E+00	0.00E+00	0.00E+00	8.75E-01
Y-93	1.20E-01	0.00E+00	3.31E-03	0.00E+00	0.00E+00	0.00E+00	1.80E+03
Zr-95	4.60E+02	1.01E+02	9.00E+01	0.00E+00	1.45E+02	0.00E+00	1.05E+05
Zr-97	2.30E-01	3.32E-02	1.96E-02	0.00E+00	4.77E-02	0.00E+00	5.03E+03
Nb-95	3.82E+04	1.49E+04	1.06E+04	0.00E+00	1.40E+04	0.00E+00	2.75E+07
Mo-99	0.00E+00	9.75E+06	2.41E+06	0.00E+00	2.08E+07	0.00E+00	8.06E+06
Tc- 99M	1.58E+00	3.10E+00	5.14E+01	0.00E+00	4.50E+01	1.57E+00	1.76E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	5.14E+02	0.00E+00	1.97E+02	0.00E+00	1.29E+03	0.00E+00	1.33E+04
Ru-105	4.55E-04	0.00E+00	1.65E-04	0.00E+00	4.00E-03	0.00E+00	2.97E-01
Ru-106	1.11E+04	0.00E+00	1.38E+03	0.00E+00	1.50E+04	0.00E+00	1.72E+05
Ag-110M	2.51E+07	1.69E+07	1.35E+07	0.00E+00	3.15E+07	0.00E+00	2.01E+09



**Table 4-22 (Continued)**  
**Child Grass-Goat-Milk Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	8.86E+06	2.40E+06	1.18E+06	2.49E+06	0.00E+00	0.00E+00	8.55E+06
Te-127M	2.50E+07	6.72E+06	2.96E+06	5.97E+06	7.12E+07	0.00E+00	2.02E+07
Te-127	3.64E+02	9.83E+01	7.82E+01	2.52E+02	1.04E+03	0.00E+00	1.42E+04
Te-129M	3.26E+07	9.09E+06	5.05E+06	1.05E+07	9.56E+07	0.00E+00	3.97E+07
Te-129	1.54E-10	4.30E-11	3.66E-11	1.10E-10	4.51E-10	0.00E+00	9.59E-09
Te-131M	1.92E+05	6.63E+04	7.06E+04	1.36E+05	6.42E+05	0.00E+00	2.69E+06
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	1.22E+06	5.42E+05	6.55E+05	7.89E+05	5.03E+06	0.00E+00	5.46E+06
I-130	2.06E+06	4.17E+06	2.15E+06	4.59E+08	6.23E+06	0.00E+00	1.95E+06
I-131	1.56E+09	1.57E+09	8.94E+08	5.20E+11	2.58E+09	0.00E+00	1.40E+08
I-132	8.29E-01	1.52E+00	7.00E-01	7.07E+01	2.33E+00	0.00E+00	1.79E+00
I-133	2.06E+07	2.55E+07	9.66E+06	4.74E+09	4.25E+07	0.00E+00	1.03E+07
I-134	9.53E-12	1.77E-11	8.14E-12	4.07E-10	2.71E-11	0.00E+00	1.17E-11
I-135	6.52E+04	1.17E+05	5.55E+04	1.04E+07	1.80E+05	0.00E+00	8.94E+04
Cs-134	6.79E+10	1.11E+11	2.35E+10	0.00E+00	3.45E+10	1.24E+10	6.01E+08
Cs-136	3.03E+09	8.32E+09	5.39E+09	0.00E+00	4.43E+09	6.61E+08	2.92E+08
Cs-137	9.67E+10	9.26E+10	1.37E+10	0.00E+00	3.02E+10	1.09E+10	5.80E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	2.42E-08	1.29E-11	7.01E-10	0.00E+00	1.13E-11	7.59E-12	1.40E-06
Ba-140	1.41E+07	1.23E+04	8.21E+05	0.00E+00	4.01E+03	7.34E+03	7.12E+06
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	2.33E+00	8.16E-01	2.75E-01	0.00E+00	0.00E+00	0.00E+00	2.27E+04
La-142	9.88E-12	3.15E-12	9.87E-13	0.00E+00	0.00E+00	0.00E+00	6.24E-07
Ce-141	2.62E+03	1.31E+03	1.94E+02	0.00E+00	5.74E+02	0.00E+00	1.63E+06
Ce-143	2.25E+01	1.22E+04	1.76E+00	0.00E+00	5.11E+00	0.00E+00	1.78E+05
Ce-144	1.95E+05	6.11E+04	1.04E+04	0.00E+00	3.38E+04	0.00E+00	1.59E+07
Pr-143	8.62E+01	2.59E+01	4.28E+00	0.00E+00	1.40E+01	0.00E+00	9.30E+04
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	5.37E+01	4.35E+01	3.37E+00	0.00E+00	2.39E+01	0.00E+00	6.89E+04
W-187	3.47E+03	2.05E+03	9.21E+02	0.00E+00	0.00E+00	0.00E+00	2.88E+05
Np-239	2.07E+00	1.48E-01	1.04E-01	0.00E+00	4.29E-01	0.00E+00	1.10E+04

## Notes:

- 1) Units are  $\text{m}^2 \text{ mrem/yr}$  per  $\mu\text{Ci/sec}$ .
- 2) For H-3 and C-14, the units are  $\text{mrem/yr}$  per  $\mu\text{Ci/m}^3$ .

Table 4-23

## Infant Grass-Goat-Milk Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	2.78E+03	2.78E+03	2.78E+03	2.78E+03	2.78E+03	2.78E+03
C-14	3.23E+06	6.89E+05	6.89E+05	6.89E+05	6.89E+05	6.89E+05	6.89E+05
Na-24	1.87E+06	1.87E+06	1.87E+06	1.87E+06	1.87E+06	1.87E+06	1.87E+06
Cr-51	0.00E+00	0.00E+00	1.93E+04	1.26E+04	2.76E+03	2.46E+04	5.64E+05
Mn-54	0.00E+00	4.68E+06	1.06E+06	0.00E+00	1.04E+06	0.00E+00	1.72E+06
Mn-56	0.00E+00	3.75E-03	6.47E-04	0.00E+00	3.22E-03	0.00E+00	3.41E-01
Fe-55	1.76E+06	1.13E+06	3.03E+05	0.00E+00	0.00E+00	5.55E+05	1.44E+05
Fe-59	2.92E+06	5.09E+06	2.01E+06	0.00E+00	0.00E+00	1.51E+06	2.43E+06
Co-58	0.00E+00	2.91E+06	7.26E+06	0.00E+00	0.00E+00	0.00E+00	7.25E+06
Co-60	0.00E+00	1.06E+07	2.50E+07	0.00E+00	0.00E+00	0.00E+00	2.52E+07
Ni-63	4.19E+09	2.59E+08	1.45E+08	0.00E+00	0.00E+00	0.00E+00	1.29E+07
Ni-65	4.21E-01	4.77E-02	2.17E-02	0.00E+00	0.00E+00	0.00E+00	3.63E+00
Cu-64	0.00E+00	2.05E+04	9.48E+03	0.00E+00	3.46E+04	0.00E+00	4.20E+05
Zn-65	6.66E+08	2.28E+09	1.05E+09	0.00E+00	1.11E+09	0.00E+00	1.93E+09
Zn-69	2.33E-12	4.19E-12	3.12E-13	0.00E+00	1.74E-12	0.00E+00	3.42E-10
Br-83	0.00E+00	0.00E+00	1.11E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	2.67E+09	1.32E+09	0.00E+00	0.00E+00	0.00E+00	6.84E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	2.64E+10	0.00E+00	7.58E+08	0.00E+00	0.00E+00	0.00E+00	5.43E+08
Sr-90	3.91E+11	0.00E+00	7.92E+09	0.00E+00	0.00E+00	0.00E+00	3.19E+09
Sr-91	5.66E+05	0.00E+00	2.05E+04	0.00E+00	0.00E+00	0.00E+00	6.70E+05
Sr-92	9.65E+00	0.00E+00	3.59E-01	0.00E+00	0.00E+00	0.00E+00	1.04E+02
Y-90	8.19E+01	0.00E+00	2.20E+00	0.00E+00	0.00E+00	0.00E+00	1.13E+05
Y-91M	7.31E-20	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.44E-16
Y-91	8.79E+03	0.00E+00	2.34E+02	0.00E+00	0.00E+00	0.00E+00	6.30E+05
Y-92	6.44E-05	0.00E+00	1.81E-06	0.00E+00	0.00E+00	0.00E+00	1.23E+00
Y-93	2.57E-01	0.00E+00	6.99E-03	0.00E+00	0.00E+00	0.00E+00	2.03E+03
Zr-95	8.17E+02	1.99E+02	1.41E+02	0.00E+00	2.15E+02	0.00E+00	9.91E+04
Zr-97	4.87E-01	8.35E-02	3.81E-02	0.00E+00	8.42E-02	0.00E+00	5.33E+03
Nb-95	7.13E+04	2.94E+04	1.70E+04	0.00E+00	2.10E+04	0.00E+00	2.48E+07
Mo-99	0.00E+00	2.49E+07	4.86E+06	0.00E+00	3.72E+07	0.00E+00	8.21E+06
Tc- 99M	3.29E+00	6.78E+00	8.73E+01	0.00E+00	7.29E+01	3.54E+00	1.97E+03
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.04E+03	0.00E+00	3.48E+02	0.00E+00	2.16E+03	0.00E+00	1.27E+04
Ru-105	9.60E-04	0.00E+00	3.23E-04	0.00E+00	7.06E-03	0.00E+00	3.82E-01
Ru-106	2.28E+04	0.00E+00	2.85E+03	0.00E+00	2.70E+04	0.00E+00	1.73E+05
Ag-110M	4.63E+07	3.38E+07	2.24E+07	0.00E+00	4.84E+07	0.00E+00	1.75E+09

**Table 4-23 (Continued)**  
**Infant Grass-Goat-Milk Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	1.81E+07	6.05E+06	2.45E+06	6.09E+06	0.00E+00	0.00E+00	8.62E+06
Te-127M	5.05E+07	1.68E+07	6.12E+06	1.46E+07	1.24E+08	0.00E+00	2.04E+07
Te-127	7.74E+02	2.59E+02	1.66E+02	6.30E+02	1.89E+03	0.00E+00	1.63E+04
Te-129M	6.68E+07	2.29E+07	1.03E+07	2.57E+07	1.67E+08	0.00E+00	3.99E+07
Te-129	3.26E-10	1.13E-10	7.62E-11	2.74E-10	8.13E-10	0.00E+00	2.61E-08
Te-131M	4.05E+05	1.63E+05	1.35E+05	3.30E+05	1.12E+06	0.00E+00	2.74E+06
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	2.52E+06	1.25E+06	1.17E+06	1.84E+06	7.81E+06	0.00E+00	4.62E+06
I-130	4.24E+06	9.32E+06	3.74E+06	1.04E+09	1.02E+07	0.00E+00	2.00E+06
I-131	3.26E+09	3.85E+09	1.69E+09	1.26E+12	4.49E+09	0.00E+00	1.37E+08
I-132	1.72E+00	3.49E+00	1.24E+00	1.64E+02	3.90E+00	0.00E+00	2.83E+00
I-133	4.36E+07	6.35E+07	1.86E+07	1.15E+10	7.46E+07	0.00E+00	1.07E+07
I-134	1.98E-11	4.05E-11	1.44E-11	9.44E-10	4.53E-11	0.00E+00	4.19E-11
I-135	1.36E+05	2.70E+05	9.83E+04	2.42E+07	3.01E+05	0.00E+00	9.76E+04
Cs-134	1.09E+11	2.04E+11	2.06E+10	0.00E+00	5.25E+10	2.15E+10	5.54E+08
Cs-136	5.91E+09	1.74E+10	6.49E+09	0.00E+00	6.93E+09	1.42E+09	2.64E+08
Cs-137	1.54E+11	1.81E+11	1.28E+10	0.00E+00	4.85E+10	1.96E+10	5.65E+08
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	5.14E-08	3.41E-11	1.49E-09	0.00E+00	2.05E-11	2.07E-11	3.26E-06
Ba-140	2.89E+07	2.89E+04	1.49E+06	0.00E+00	6.87E+03	1.78E+04	7.11E+06
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	4.88E+00	1.92E+00	4.95E-01	0.00E+00	0.00E+00	0.00E+00	2.26E+04
La-142	2.08E-11	7.62E-12	1.82E-12	0.00E+00	0.00E+00	0.00E+00	1.29E-06
Ce-141	5.20E+03	3.17E+03	3.73E+02	0.00E+00	9.78E+02	0.00E+00	1.64E+06
Ce-143	4.75E+01	3.15E+04	3.60E+00	0.00E+00	9.19E+00	0.00E+00	1.84E+05
Ce-144	2.79E+05	1.14E+05	1.56E+04	0.00E+00	4.62E+04	0.00E+00	1.60E+07
Pr-143	1.78E+02	6.67E+01	8.84E+00	0.00E+00	2.48E+01	0.00E+00	9.41E+04
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	1.07E+02	1.09E+02	6.70E+00	0.00E+00	4.22E+01	0.00E+00	6.93E+04
W-187	7.29E+03	5.07E+03	1.75E+03	0.00E+00	0.00E+00	0.00E+00	2.98E+05
Np-239	4.37E+00	3.91E-01	2.21E-01	0.00E+00	7.80E-01	0.00E+00	1.13E+04

**Notes:**

- 1) Units are m<sup>2</sup> mrem/yr per  $\mu$ Ci/sec.
- 2) For H-3 and C-14, the units are mrem/yr per  $\mu$ Ci/m<sup>3</sup>.

**Table 4-24**  
**Adult Grass-Cow-Meat Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	1.85E+02	1.85E+02	1.85E+02	1.85E+02	1.85E+02	1.85E+02
C-14	3.33E+05	6.66E+04	6.66E+04	6.66E+04	6.66E+04	6.66E+04	6.66E+04
Na-24	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03
Cr-51	0.00E+00	0.00E+00	7.04E+03	4.21E+03	1.55E+03	9.34E+03	1.77E+06
Mn-54	0.00E+00	9.18E+06	1.75E+06	0.00E+00	2.73E+06	0.00E+00	2.81E+07
Mn-56	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-55	2.93E+08	2.03E+08	4.72E+07	0.00E+00	0.00E+00	1.13E+08	1.16E+08
Fe-59	2.65E+08	6.24E+08	2.39E+08	0.00E+00	0.00E+00	1.74E+08	2.08E+09
Co-58	0.00E+00	1.82E+07	4.09E+07	0.00E+00	0.00E+00	0.00E+00	3.70E+08
Co-60	0.00E+00	7.52E+07	1.66E+08	0.00E+00	0.00E+00	0.00E+00	1.41E+09
Ni-63	1.89E+09	1.31E+08	6.33E+07	0.00E+00	0.00E+00	0.00E+00	2.73E+07
Ni-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cu-64	0.00E+00	2.52E-07	1.18E-07	0.00E+00	6.36E-07	0.00E+00	2.15E-05
Zn-65	3.56E+08	1.13E+09	5.12E+08	0.00E+00	7.57E+08	0.00E+00	7.13E+08
Zn-69	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	4.88E+08	2.28E+08	0.00E+00	0.00E+00	0.00E+00	9.63E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	3.01E+08	0.00E+00	8.65E+06	0.00E+00	0.00E+00	0.00E+00	4.83E+07
Sr-90	1.43E+10	0.00E+00	2.87E+08	0.00E+00	0.00E+00	0.00E+00	3.59E+08
Sr-91	1.43E-10	0.00E+00	5.79E-12	0.00E+00	0.00E+00	0.00E+00	6.83E-10
Sr-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-90	1.08E+02	0.00E+00	2.91E+00	0.00E+00	0.00E+00	0.00E+00	1.15E+06
Y-91M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-91	1.13E+06	0.00E+00	3.03E+04	0.00E+00	0.00E+00	0.00E+00	6.23E+08
Y-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-93	4.39E-12	0.00E+00	1.21E-13	0.00E+00	0.00E+00	0.00E+00	1.39E-07
Zr-95	1.87E+06	6.01E+05	4.07E+05	0.00E+00	9.43E+05	0.00E+00	1.91E+09
Zr-97	2.04E-05	4.12E-06	1.88E-06	0.00E+00	6.22E-06	0.00E+00	1.28E+00
Nb-95	2.30E+06	1.28E+06	6.89E+05	0.00E+00	1.27E+06	0.00E+00	7.78E+09
Mo-99	0.00E+00	9.93E+04	1.89E+04	0.00E+00	2.25E+05	0.00E+00	2.30E+05
Tc- 99M	0.00E+00	1.22E-20	1.56E-19	0.00E+00	1.85E-19	0.00E+00	7.23E-18
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.05E+08	0.00E+00	4.53E+07	0.00E+00	4.01E+08	0.00E+00	1.23E+10
Ru-105	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-106	2.80E+09	0.00E+00	3.54E+08	0.00E+00	5.40E+09	0.00E+00	1.81E+11
Ag-110M	6.68E+06	6.18E+06	3.67E+06	0.00E+00	1.22E+07	0.00E+00	2.52E+09



**Table 4-24 (Continued)**  
**Adult Grass-Cow-Meat Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	3.59E+08	1.30E+08	4.81E+07	1.08E+08	1.46E+09	0.00E+00	1.43E+09
Te-127M	1.12E+09	3.99E+08	1.36E+08	2.85E+08	4.53E+09	0.00E+00	3.74E+09
Te-127	2.50E-10	8.98E-11	5.41E-11	1.85E-10	1.02E-09	0.00E+00	1.97E-08
Te-129M	1.13E+09	4.23E+08	1.79E+08	3.89E+08	4.73E+09	0.00E+00	5.71E+09
Te-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-131M	4.49E+02	2.20E+02	1.83E+02	3.48E+02	2.23E+03	0.00E+00	2.18E+04
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	1.40E+06	9.03E+05	8.48E+05	9.98E+05	8.70E+06	0.00E+00	4.27E+07
I-130	2.03E-06	5.98E-06	2.36E-06	5.07E-04	9.33E-06	0.00E+00	5.15E-06
I-131	1.07E+07	1.54E+07	8.80E+06	5.03E+09	2.63E+07	0.00E+00	4.05E+06
I-132	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	3.70E-01	6.43E-01	1.96E-01	9.45E+01	1.12E+00	0.00E+00	5.78E-01
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	4.66E-17	1.22E-16	4.50E-17	8.04E-15	1.95E-16	0.00E+00	1.38E-16
Cs-134	6.58E+08	1.57E+09	1.28E+09	0.00E+00	5.07E+08	1.68E+08	2.74E+07
Cs-136	1.20E+07	4.73E+07	3.40E+07	0.00E+00	2.63E+07	3.61E+06	5.37E+06
Cs-137	8.72E+08	1.19E+09	7.81E+08	0.00E+00	4.05E+08	1.35E+08	2.31E+07
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-140	2.88E+07	3.61E+04	1.88E+06	0.00E+00	1.23E+04	2.07E+04	5.92E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	3.76E-02	1.90E-02	5.01E-03	0.00E+00	0.00E+00	0.00E+00	1.39E+03
La-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ce-141	1.40E+04	9.49E+03	1.08E+03	0.00E+00	4.41E+03	0.00E+00	3.63E+07
Ce-143	1.99E-02	1.47E+01	1.63E-03	0.00E+00	6.47E-03	0.00E+00	5.49E+02
Ce-144	1.46E+06	6.09E+05	7.83E+04	0.00E+00	3.61E+05	0.00E+00	4.93E+08
Pr-143	2.10E+04	8.42E+03	1.04E+03	0.00E+00	4.86E+03	0.00E+00	9.20E+07
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	7.21E+03	8.33E+03	4.98E+02	0.00E+00	4.87E+03	0.00E+00	4.00E+07
W-187	2.07E-02	1.73E-02	6.04E-03	0.00E+00	0.00E+00	0.00E+00	5.66E+00
Np-239	2.57E-01	2.53E-02	1.40E-02	0.00E+00	7.90E-02	0.00E+00	5.19E+03

## Notes:

- 1) Units are m<sup>2</sup> mrem/yr per  $\mu$ Ci/sec.
- 2) For H-3 and C-14, the units are mrem/yr per  $\mu$ Ci/m<sup>3</sup>.

**Table 4-25**  
**Teen Grass-Cow-Meat Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	1.10E+02	1.10E+02	1.10E+02	1.10E+02	1.10E+02	1.10E+02
C-14	2.81E+05	5.62E+04	5.62E+04	5.62E+04	5.62E+04	5.62E+04	5.62E+04
Na-24	1.16E-03	1.16E-03	1.16E-03	1.16E-03	1.16E-03	1.16E-03	1.16E-03
Cr-51	0.00E+00	0.00E+00	5.63E+03	3.13E+03	1.23E+03	8.04E+03	9.46E+05
Mn-54	0.00E+00	7.00E+06	1.39E+06	0.00E+00	2.09E+06	0.00E+00	1.44E+07
Mn-56	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-55	2.38E+08	1.69E+08	3.94E+07	0.00E+00	0.00E+00	1.07E+08	7.31E+07
Fe-59	2.12E+08	4.95E+08	1.91E+08	0.00E+00	0.00E+00	1.56E+08	1.17E+09
Co-58	0.00E+00	1.41E+07	3.24E+07	0.00E+00	0.00E+00	0.00E+00	1.94E+08
Co-60	0.00E+00	5.83E+07	1.31E+08	0.00E+00	0.00E+00	0.00E+00	7.60E+08
Ni-63	1.52E+09	1.07E+08	5.15E+07	0.00E+00	0.00E+00	0.00E+00	1.71E+07
Ni-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cu-64	0.00E+00	2.06E-07	9.68E-08	0.00E+00	5.21E-07	0.00E+00	1.60E-05
Zn-65	2.50E+08	8.69E+08	4.05E+08	0.00E+00	5.56E+08	0.00E+00	3.68E+08
Zn-69	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	4.08E+08	1.91E+08	0.00E+00	0.00E+00	0.00E+00	6.03E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	2.54E+08	0.00E+00	7.28E+06	0.00E+00	0.00E+00	0.00E+00	3.03E+07
Sr-90	9.89E+09	0.00E+00	1.98E+08	0.00E+00	0.00E+00	0.00E+00	2.26E+08
Sr-91	1.21E-10	0.00E+00	4.80E-12	0.00E+00	0.00E+00	0.00E+00	5.47E-10
Sr-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-90	9.13E+01	0.00E+00	2.46E+00	0.00E+00	0.00E+00	0.00E+00	7.53E+05
Y-91M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-91	9.54E+05	0.00E+00	2.56E+04	0.00E+00	0.00E+00	0.00E+00	3.91E+08
Y-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-93	3.71E-12	0.00E+00	1.02E-13	0.00E+00	0.00E+00	0.00E+00	1.13E-07
Zr-95	1.50E+06	4.74E+05	3.26E+05	0.00E+00	6.96E+05	0.00E+00	1.09E+09
Zr-97	1.70E-05	3.37E-06	1.55E-06	0.00E+00	5.10E-06	0.00E+00	9.11E-01
Nb-95	1.80E+06	9.98E+05	5.49E+05	0.00E+00	9.67E+05	0.00E+00	4.27E+09
Mo-99	0.00E+00	8.21E+04	1.57E+04	0.00E+00	1.88E+05	0.00E+00	1.47E+05
Tc- 99M	0.00E+00	0.00E+00	1.24E-19	0.00E+00	1.43E-19	0.00E+00	6.29E-18
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	8.56E+07	0.00E+00	3.66E+07	0.00E+00	3.02E+08	0.00E+00	7.15E+09
Ru-105	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-106	2.36E+09	0.00E+00	2.97E+08	0.00E+00	4.55E+09	0.00E+00	1.13E+11
Ag-110M	5.06E+06	4.79E+06	2.91E+06	0.00E+00	9.13E+06	0.00E+00	1.35E+09

**Table 4-25 (Continued)**  
**Teen Grass-Cow-Meat Dose Factors**

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
Te-125M	3.03E+08	1.09E+08	4.06E+07	8.47E+07	0.00E+00	0.00E+00	8.95E+08
Te-127M	9.41E+08	3.34E+08	1.12E+08	2.24E+08	3.82E+09	0.00E+00	2.35E+09
Te-127	2.12E-10	7.53E-11	4.57E-11	1.46E-10	8.60E-10	0.00E+00	1.64E-08
Te-129M	9.49E+08	3.52E+08	1.50E+08	3.06E+08	3.97E+09	0.00E+00	3.56E+09
Te-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-131M	3.75E+02	1.80E+02	1.50E+02	2.70E+02	1.87E+03	0.00E+00	1.44E+04
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	1.14E+06	7.24E+05	6.81E+05	7.63E+05	6.94E+06	0.00E+00	2.29E+07
I-130	1.63E-06	4.72E-06	1.88E-06	3.85E-04	7.27E-06	0.00E+00	3.63E-06
I-131	8.92E+06	1.25E+07	6.71E+06	3.64E+09	2.15E+07	0.00E+00	2.47E+06
I-132	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	3.09E-01	5.25E-01	1.60E-01	7.32E+01	9.20E-01	0.00E+00	3.97E-01
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	3.79E-17	9.75E-17	3.61E-17	6.27E-15	1.54E-16	0.00E+00	1.08E-16
Cs-134	5.23E+08	1.23E+09	5.71E+08	0.00E+00	3.91E+08	1.49E+08	1.53E+07
Cs-136	9.34E+06	3.68E+07	2.47E+07	0.00E+00	2.00E+07	3.15E+06	2.96E+06
Cs-137	7.24E+08	9.63E+08	3.36E+08	0.00E+00	3.28E+08	1.27E+08	1.37E+07
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-140	2.38E+07	2.91E+04	1.53E+06	0.00E+00	9.88E+03	1.96E+04	3.67E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	3.09E-02	1.52E-02	4.04E-03	0.00E+00	0.00E+00	0.00E+00	8.73E+02
La-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ce-141	1.18E+04	7.87E+03	9.04E+02	0.00E+00	3.70E+03	0.00E+00	2.25E+07
Ce-143	1.67E-02	1.22E+01	1.36E-03	0.00E+00	5.46E-03	0.00E+00	3.66E+02
Ce-144	1.23E+06	5.08E+05	6.60E+04	0.00E+00	3.04E+05	0.00E+00	3.09E+08
Pr-143	1.77E+04	7.05E+03	8.79E+02	0.00E+00	4.10E+03	0.00E+00	5.81E+07
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	6.35E+03	6.90E+03	4.14E+02	0.00E+00	4.05E+03	0.00E+00	2.49E+07
W-187	1.73E-02	1.41E-02	4.94E-03	0.00E+00	0.00E+00	0.00E+00	3.82E+00
Np-239	2.25E-01	2.12E-02	1.18E-02	0.00E+00	6.66E-02	0.00E+00	3.41E+03

**Notes:**

- 1) Units are  $\text{m}^2 \text{ mrem/yr per } \mu\text{Ci/sec}$ .
- 2) For H-3 and C-14, the units are  $\text{mrem/yr per } \mu\text{Ci/m}^3$ .

**Table 4-26**  
**Child Grass-Cow-Meat Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
H-3	0.00E+00	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02
C-14	5.29E+05	1.06E+05	1.06E+05	1.06E+05	1.06E+05	1.06E+05	1.06E+05
Na-24	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03
Cr-51	0.00E+00	0.00E+00	8.78E+03	4.87E+03	1.33E+03	8.90E+03	4.66E+05
Mn-54	0.00E+00	8.01E+06	2.13E+06	0.00E+00	2.25E+06	0.00E+00	6.72E+06
Mn-56	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-55	4.57E+08	2.42E+08	7.51E+07	0.00E+00	0.00E+00	1.37E+08	4.49E+07
Fe-59	3.76E+08	6.08E+08	3.03E+08	0.00E+00	0.00E+00	1.76E+08	6.34E+08
Co-58	0.00E+00	1.64E+07	5.03E+07	0.00E+00	0.00E+00	0.00E+00	9.59E+07
Co-60	0.00E+00	6.93E+07	2.04E+08	0.00E+00	0.00E+00	0.00E+00	3.84E+08
Ni-63	2.91E+09	1.56E+08	9.91E+07	0.00E+00	0.00E+00	0.00E+00	1.05E+07
Ni-65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cu-64	0.00E+00	2.77E-07	1.67E-07	0.00E+00	6.68E-07	0.00E+00	1.30E-05
Zn-65	3.75E+08	1.00E+09	6.22E+08	0.00E+00	6.30E+08	0.00E+00	1.76E+08
Zn-69	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-83	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-84	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Br-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-86	0.00E+00	5.78E+08	3.55E+08	0.00E+00	0.00E+00	0.00E+00	3.72E+07
Rb-88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rb-89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-89	4.81E+08	0.00E+00	1.37E+07	0.00E+00	0.00E+00	0.00E+00	1.86E+07
Sr-90	1.57E+10	0.00E+00	3.15E+08	0.00E+00	0.00E+00	0.00E+00	1.40E+08
Sr-91	2.26E-10	0.00E+00	8.54E-12	0.00E+00	0.00E+00	0.00E+00	5.00E-10
Sr-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-90	1.73E+02	0.00E+00	4.62E+00	0.00E+00	0.00E+00	0.00E+00	4.92E+05
Y-91M	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-91	1.80E+06	0.00E+00	4.82E+04	0.00E+00	0.00E+00	0.00E+00	2.40E+08
Y-92	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-93	6.97E-12	0.00E+00	1.91E-13	0.00E+00	0.00E+00	0.00E+00	1.04E-07
Zr-95	2.67E+06	5.86E+05	5.22E+05	0.00E+00	8.39E+05	0.00E+00	6.11E+08
Zr-97	3.16E-05	4.57E-06	2.70E-06	0.00E+00	6.56E-06	0.00E+00	6.93E-01
Nb-95	3.11E+06	1.21E+06	8.64E+05	0.00E+00	1.14E+06	0.00E+00	2.24E+09
Mo-99	0.00E+00	1.14E+05	2.82E+04	0.00E+00	2.44E+05	0.00E+00	9.44E+04
Tc- 99M	0.00E+00	1.18E-20	1.96E-19	0.00E+00	1.72E-19	0.00E+00	6.72E-18
Tc-101	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-103	1.55E+08	0.00E+00	5.95E+07	0.00E+00	3.90E+08	0.00E+00	4.00E+09
Ru-105	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ru-106	4.44E+09	0.00E+00	5.54E+08	0.00E+00	5.99E+09	0.00E+00	6.90E+10
Ag-110M	8.39E+06	5.67E+06	4.53E+06	0.00E+00	1.06E+07	0.00E+00	6.74E+08



**Table 4-26 (Continued)**  
**Child Grass-Cow-Meat Dose Factors**

<b>Nuclide</b>	<b>Bone</b>	<b>Liver</b>	<b>T Body</b>	<b>Thyroid</b>	<b>Kidney</b>	<b>Lung</b>	<b>GI-LLI</b>
Te-125M	5.70E+08	1.54E+08	7.59E+07	1.60E+08	0.00E+00	0.00E+00	5.50E+08
Te-127M	1.77E+09	4.78E+08	2.11E+08	4.24E+08	5.06E+09	0.00E+00	1.44E+09
Te-127	3.99E-10	1.08E-10	8.56E-11	2.76E-10	1.14E-09	0.00E+00	1.56E-08
Te-129M	1.79E+09	5.00E+08	2.78E+08	5.77E+08	5.25E+09	0.00E+00	2.18E+09
Te-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-131M	6.97E+02	2.41E+02	2.57E+02	4.96E+02	2.33E+03	0.00E+00	9.78E+03
Te-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Te-132	2.09E+06	9.23E+05	1.12E+06	1.34E+06	8.57E+06	0.00E+00	9.30E+06
I-130	2.92E-06	5.89E-06	3.04E-06	6.49E-04	8.81E-06	0.00E+00	2.76E-06
I-131	1.65E+07	1.66E+07	9.45E+06	5.50E+09	2.73E+07	0.00E+00	1.48E+06
I-132	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-133	5.75E-01	7.10E-01	2.69E-01	1.32E+02	1.18E+00	0.00E+00	2.86E-01
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-135	6.86E-17	1.23E-16	5.84E-17	1.09E-14	1.89E-16	0.00E+00	9.40E-17
Cs-134	9.22E+08	1.51E+09	3.19E+08	0.00E+00	4.69E+08	1.68E+08	8.16E+06
Cs-136	1.61E+07	4.43E+07	2.87E+07	0.00E+00	2.36E+07	3.52E+06	1.56E+06
Cs-137	1.33E+09	1.28E+09	1.88E+08	0.00E+00	4.16E+08	1.50E+08	7.99E+06
Cs-138	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-139	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-140	4.39E+07	3.84E+04	2.56E+06	0.00E+00	1.25E+04	2.29E+04	2.22E+07
Ba-141	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ba-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
La-140	5.66E-02	1.98E-02	6.67E-03	0.00E+00	0.00E+00	0.00E+00	5.52E+02
La-142	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ce-141	2.22E+04	1.11E+04	1.64E+03	0.00E+00	4.85E+03	0.00E+00	1.38E+07
Ce-143	3.14E-02	1.70E+01	2.46E-03	0.00E+00	7.14E-03	0.00E+00	2.49E+02
Ce-144	2.32E+06	7.26E+05	1.24E+05	0.00E+00	4.02E+05	0.00E+00	1.89E+08
Pr-143	3.34E+04	1.00E+04	1.66E+03	0.00E+00	5.44E+03	0.00E+00	3.61E+07
Pr-144	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Nd-147	1.19E+04	9.65E+03	7.47E+02	0.00E+00	5.29E+03	0.00E+00	1.53E+07
W-187	3.21E-02	1.90E-02	8.52E-03	0.00E+00	0.00E+00	0.00E+00	2.67E+00
Np-239	4.23E-01	3.04E-02	2.14E-02	0.00E+00	8.79E-02	0.00E+00	2.25E+03

**Notes:**

- 1) Units are  $\text{m}^2 \text{ mrem/yr per } \mu\text{Ci/sec}$ .
- 2) For H-3 and C-14, the units are  $\text{mrem/yr per } \mu\text{Ci/m}^3$ .
- 3) The infant age group is assumed to receive no dose through the meat ingestion pathway therefore no dose factors are supplied.

Table 4-27

**Byron Station Characteristics**

LOCATION: 3.7 miles SSW of Byron, Illinois

Characteristics of Elevated Release Point: Not applicable (NA)

- 1) Release Height = \_\_\_\_m                      2) Diameter = \_\_\_\_m  
 3) Exit Speed = \_\_\_\_ms<sup>-1</sup>                      4) Heat Content \_\_\_\_Kcal s<sup>-1</sup>

Characteristics of Vent Stack Release Point

- 1) Release Height = 60.66 m<sup>a</sup>                      2) Diameter = 2.80 m  
 3) Exit Speed = 13.00 ms<sup>-1a</sup>

Characteristics of Ground Level Point

- 1) Release Height = 0 m  
 2) Building Factor (D) = 60.6 m<sup>a</sup>

Meteorological Data

A 250 ft Tower is Located 1036 m SW of vent stack release point

Tower Data Used in Calculations

<u>Release Point</u>	<u>Wind Speed and Direction</u>	<u>Differential Temperature</u>
<u>Elevated</u>	<u>(NA)</u>	<u>(NA)</u>
<u>Vent</u>	<u>250 ft</u>	<u>250-30 ft</u>
<u>Ground</u>	<u>30 ft</u>	<u>250-30 ft</u>

<sup>a</sup> Used in calculating the meteorological and dose factors in Table 4-1 and Table 4-4.

Table 4-28

## Dose Factors for Noble Gases

	Beta Air Dose Factor	Beta Skin Dose Factor	Gamma Air Dose Factor	Gamma Total Body Dose Factor
<u>Nuclide</u>	<u>N<sub>i</sub></u> <u>(mrad/yr per</u> <u>uCi/m<sup>3</sup>)</u>	<u>L<sub>i</sub></u> <u>(mrem/yr per</u> <u>uCi/m<sup>3</sup>)</u>	<u>M<sub>i</sub></u> <u>(mrad/yr per</u> <u>uCi/m<sup>3</sup>)</u>	<u>K<sub>i</sub></u> <u>(mrem/yr per</u> <u>uCi/m<sup>3</sup>)</u>
Kr-83m	2.88E+02	---	1.93E+01	7.56E-02
Kr-85m	1.97E+03	1.46E+03	1.23E+03	1.17E+03
Kr-85	1.95E+03	1.34E+03	1.72E+01	1.61E+01
Kr-87	1.03E+04	9.73E+03	6.17E+03	5.92E+03
Kr-88	2.93E+03	2.37E+03	1.52E+04	1.47E+04
Kr-89	1.06E+04	1.01E+04	1.73E+04	1.66E+04
Kr-90	7.83E+03	7.29E+03	1.63E+04	1.56E+04
Xe-131m	1.11E+03	4.76E+02	1.56E+02	9.15E+01
Xe-133m	1.48E+03	9.94E+02	3.27E+02	2.51E+02
Xe-133	1.05E+03	3.06E+02	3.53E+02	2.94E+02
Xe-135m	7.39E+02	7.11E+02	3.36E+03	3.12E+03
Xe-135	2.46E+03	1.86E+03	1.92E+03	1.81E+03
Xe-137	1.27E+04	1.22E+04	1.51E+03	1.42E+03
Xe-138	4.75E+03	4.13E+03	9.21E+03	8.83E+03
Ar-41	3.28E+03	2.69E+03	9.30E+03	8.84E+03

Source: Table B-1 of US NRC Regulatory Guide 1.109

## 5. TOTAL DOSE

### 5.1. Total Dose Calculation Requirements

#### 5.1.1. Total Effective Dose Equivalent Limits; 10CFR20 and 40CFR190

1. The Byron Station is required to determine the total dose to a member of the public due to all uranium fuel cycle sources in order to assess compliance with 40CFR190 as part of demonstrating compliance with 10CFR20.
2. The total dose for the uranium fuel cycle is the sum of doses due to radioactivity in airborne and liquid effluents and the doses due to direct radiation from contained sources at the nuclear power station. When evaluation of total dose is required for a station, the following contributions are summed:
  - A. Doses due to airborne and liquid effluents from the station.
  - B. Doses due to liquid effluents from nuclear power stations upstream.
  - C. Doses due to any onsite radioactive waste storage facilities, if applicable.
  - D. Doses due to ISFSI
3. 10CFR20 requires compliance to dose limits expressed as "Total Effective Dose Equivalent" (TEDE). Although annual dose limits in 10CFR20 are now expressed in terms of TEDEs, 40CFR190 limits remain stated as organ dose. The NRC continues to require 10CFR50 Appendix I and 40CFR190 doses to be reported in terms of organ dose and not TEDE. Due to the fact that organ dose limits set forth in 40CFR190 are substantially lower than those of 10CFR20 (25 mrem/yr vs. 100 mrem/yr), the NRC has stated that demonstration of compliance with the dose limits in 40CFR190 will be deemed as demonstration of compliance with the dose limits of 10CFR20 for most facilities (Reference 104). In addition to compliance with 40CFR190, it may be necessary for a nuclear power plant to address dose from on-site activity by members of the public.

**5.1.2. ISFSI**

1. 10CFR72.104 dose limits are the same as those specified by 40CFR190.
2. ISFSI dose contribution is in the form of direct radiation as no liquid or gas releases are expected to occur. The 10CFR72.212 report prepared in accordance with ISFSI requirements assumes a certain array of casks exists on the pad. The dose contribution from this array of casks in combination with historical uranium fuel cycle operations prior to ISFSI operations was analyzed to be within the 40CFR190 and 10CFR72.104 limits, and is documented in Holtec Report No. HI-2146048, Dose Versus Distance from a HI-STORM 100S version B containing the MPC-32 for Byron/Braidwood.
3. If the dose limits of 40CFR190 or 10CFR72.104 are exceeded, a special report to the NRC as well as an appropriate request for exemption/variance is required to be submitted to the NRC.
4. The requirement that the dose limits of 10CFR72.104 apply to "any real individual" is controlled for ISFSI activities in the ISFSI 72.212 report. Therefore, for the purposes of analyzing dose from the ISFSI, the member of the public as defined in 40CFR190 is the same as the "real individual" identified in the 72.212 report.

**5.1.3. Total Dose Calculation Methodology**

1. In addition to the total body, skin and single organ dose assessments previously described, an additional assessment is required. The additional assessment addresses radiation dose due to radioactivity contained within the nuclear power station and its structures.
2. Pressurized water reactors have the potential to affect off-site doses from contained sources of radioactivity, primarily due to gamma rays associated with radioactive material contained in onsite radwaste and radioactive material storage facilities.

**5.2. Onsite Radwaste and Rad Material Storage Facilities**

1. A 10CFR50.59 analysis is required for radwaste storage facilities.

**5.2.1. Process Waste Storage Facilities**

- A. Interim Radwaste Storage Facility (IRSF) structure
- B. Concrete vaults containing radwaste liners

- 5.2.2. DAW Storage Facilities
1. Dry Active Waste (DAW) facilities (may include Butler buildings/warehouses)

2. Seavans or other temporary warehouses
- 5.2.3. Replaced Steam Generator Storage Facilities
- 5.2.4. ISFSI Facilities
1. Independent spent fuel storage installation facilities.
- 5.3. Methodology
1. The external total body dose is comprised of the following parts:

A. Total body dose due to noble gas radionuclides in gaseous effluents (Section 4.2.2.3),

B. Dose due to other contained sources and

C. Total body dose due to radioactivity deposited on the ground (Section 4.2.3.1).

2. The external total body dose due to radioactivity deposited on the ground is accounted for in the determination of the non-noble gas dose and is considered in section 5.7.

3. The total external total body dose,  $D^{Ex}$ , is given by:

$$D^{Ex} = D^{TB} + D^{OSF}$$

(5-1)

$D^{Ex}$	Total External Total Body Dose	[mrem]
	Total external total body dose due to irradiation by external sources at the location of interest.	
$D^{TB}$	Noble Gas Total Body Dose	[mrem]
	External total body dose due to gamma radiation from noble gas radionuclides released in gaseous effluents at the location of interest. See Section 4.2.2.3.	
$D^{OSF}$	Dose From On-Site Storage Facilities	[mrem]
	External total body dose due to gamma radiation from on-site storage facilities at the location of interest. See Section 5.2.	



5.4. Total Dose

1. The total dose,  $D^{Tot}$ , in the unrestricted area to a member of the public due to plant operations is given by:

$$D^{Tot} = D^{Ex} + D_{aj}^{Liq} + D_{aj}^{NNG}$$

(5-2)

where:

$D^{Tot}$	Total Dose To Member of Public	[mrem]
	Total off-site dose to a member of public due to plant operations.	
$D^{Ex}$	Total External Total Body Dose	[mrem]
	Total body dose due to external exposure to noble gases, N-16 skyshine and on-site storage facilities.	
$D_{aj}^{Liq}$	Liquid Effluent Dose	[mrem]
	Dose due to liquid effluents to age group a and organ j. The age group and organ with the highest dose from liquid effluents is used.	
$D_{aj}^{NNG}$	Non-Noble Gaseous Effluent Dose	[mrem]
	Dose due to non-noble gaseous effluents to age group a and organ j. The age group and organ with the highest dose from non-noble gas effluents is used.	

5.5. COMPLIANCE TO TOTAL DOSE LIMITS

5.5.1. Total Effective Dose Equivalent Limit - 10CFR20 Compliance

1. Each station's RE limits the Total Effective Dose Equivalent (TEDE) to an annual limit of 100 mrem, as required by 10CFR20.1301 (a)(1). Demonstration of compliance with the limits of 40CFR190 (per Section 4.2.2) will be considered to demonstrate compliance with the 100 mrem/year limit.

5.5.2. Dose to a Member of the Public in the Unrestricted Area

1. The NRC has stated that demonstration of compliance with the limits of 40CFR190 or with the design objectives of Appendix I to 10CFR50 will be deemed to demonstrate compliance with the limits of 10CFR20.1301(a)(1). Power reactors that comply with Appendix I may also have to demonstrate that they are within the 25 mrem limit of 40CFR190 (See Reference 104).

### 5.5.3. Dose to a Member of the Public in the Restricted Area

1. In August of 1995, a revision to 10CFR20 was implemented that changed the definition of a member of the public. As a result, for each nuclear station, estimated doses were calculated for a member of the public who enters the site boundary, but is not authorized for unescorted access to the protected area of the site and does not enter any radiologically posted areas on the site. Realistic assumptions were made for occupancy times and locations visited while within the site boundary.
2. These evaluations indicate that the doses estimated for these members of the public are well within the 10CFR20 limits. These dose evaluations will be performed annually and if necessary, a model will be developed and included in the ODCM.
3. Evaluation of the 40CFR190 dose is used to demonstrate compliance to 10CFR20 and satisfy station TRM and Technical Specifications (see ODCM Part 1)

### 5.5.4. Total Dose due to the Uranium Fuel Cycle (40CFR190)

1. RE and 40CFR190 limit 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 to the following:
  - A. Less than or equal to 25 mrem to the total body.
  - B. Less than or equal to 25 mrem to any organ except the thyroid.
  - C. Less than or equal to 75 mrem to the thyroid.
2. Total Dose Components
  - A. This requirement includes the total dose from operations at the nuclear power station. This includes doses due to radioactive effluents (airborne and liquid) and dose due to direct radiation from non-effluent sources (e.g., sources contained in systems on site). It also includes dose due to plants under consideration, neighboring plants and dose due to other facilities in the uranium fuel cycle.

3. The operations comprising the uranium fuel cycle are specified in 40CFR190.02(b). The following are included to the extent that they directly support the production of electrical power for public use utilizing nuclear energy:
    - A. Milling of uranium ore.
    - B. Chemical conversion of uranium.
    - C. Isotopic enrichment of uranium.
    - D. Fabrication of uranium fuel.
    - E. Generation of electricity by a light-watered-cooled nuclear power plant using uranium fuel.
    - F. Reprocessing of spent uranium fuel.
  4. Excluded are:
    - A. Mining operations.
    - B. Operations at waste disposal sites.
    - C. Transportation of any radioactive material in support of these operations.
    - D. The re-use of recovered non-uranium special nuclear and by-product materials from the cycle.
- 5.6. When Compliance Assessment is Required
1. Compliance with the 40CFR190 regulations is now required as part of demonstration of compliance to 10CFR20 regulations per 10CFR20.1301(d).
  2. The dose due to the uranium fuel cycle is determined by equation 5-2

**6. RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM**

1. The radiological environmental monitoring program for the environs around Byron Station is given in Table 6-1.
2. Figures 6-1 through 6-4 show sampling and monitoring locations.

**Table 6-1**  
**Radiological Environmental Monitoring Program**

<u>Exposure Pathway and/or Sample</u>	<u>Sampling or Monitoring Locations</u>	<u>Sampling or Collection Frequency</u>	<u>Type or Frequency of Analysis</u>
1. <u>Airborne</u>			
<u>Radioiodine and Particulates</u>	<p>a. <u>Indicators-Near Field</u></p> <p>BY-21</p> <p>BY-22</p> <p>BY-23</p> <p>BY-24</p>	<p>Continuous sampler operation with particulate sample collection weekly, or more frequently if required by dust loading, and radioiodine canister collection weekly.</p>	<p>Radioiodine Canister: I-131 analysis weekly on near field and control samples.<sup>1</sup></p> <p>Particulate Sampler:</p> <p>Gross beta analysis following weekly filter change<sup>2</sup> and gamma isotopic analysis<sup>3</sup> quarterly on composite filters by location on near field and control samples.</p>
	<p>b. <u>Indicators-Far Field</u></p> <p>BY-01, Byron</p> <p>BY-04, Paynes Pt.</p> <p>BY-06, Oregon</p>		
	<p>c. <u>Controls</u></p> <p>BY-08, Leaf River</p>		

**Table 6-1 (Cont.)  
Radiological Environmental Monitoring Program**

<u>Exposure Pathway and/or Sample</u>	<u>Sampling or Monitoring Locations</u>	<u>Sampling or Collection Frequency</u>	<u>Type or Frequency of Analysis</u>
2. <u>Direct Radiation</u> (Two dosimeters at each location)	a. <u>Indicators-Inner Ring</u>  BY-101-1 BY-101-2 BY-102-1 BY-102-2 BY-103-1 BY-103-2 BY-103-3 BY-104-1 BY-104-2 BY-104-3 BY-105-1 BY-105-2 BY-106-1 BY-106-2 BY-107-1 BY-107-2 BY-107-3 BY-108-1 BY-108-2 BY-109-1 BY-109-2 BY-110-1 BY-110-2 BY-111-3 BY-111-4 BY-112-3 BY-112-4	Quarterly	Gamma Dose Quarterly



**Table 6-1 (Cont.)**  
**Radiological Environmental Monitoring Program**

<u>Exposure Pathway and/or Sample</u>	<u>Sampling or Monitoring Locations</u>	<u>Sampling or Collection Frequency</u>	<u>Type or Frequency of Analysis</u>
2. <u>Direct Radiation</u>  (cont'd)	<u>Indicators-Inner Ring (cont'd)</u>  BY-113-1 BY-113-2 BY-114-1 BY-114-2 BY-115-1 BY-115-2 BY-116-1 BY-116-2 BY-116-3		
	b. <u>Indicators- Outer Ring</u>  BY-201-3 BY-201-4 BY-202-1 BY-202-2 BY-203-1 BY-203-2 BY-204-1 BY-204-2 BY-205-1 BY-205-2 BY-206-1 BY-206-2 BY-207-1 BY-207-2	Quarterly	Gamma Dose Quarterly

**Table 6-1 (Cont.)  
Radiological Environmental Monitoring Program**

<u>Exposure Pathway and/or Sample</u>	<u>Sampling or Monitoring Locations</u>	<u>Sampling or Collection Frequency</u>	<u>Type of Frequency of Analysis</u>
2. <u>Direct Radiation</u> (cont'd)	<u>Indicators-Outer Ring (cont'd)</u> BY-208-1 BY-208-2 BY-209-1 BY-209-4 BY-210-3 BY-210-4 BY-211-1 BY-211-4 BY-212-1 BY-212-4 BY-213-1 BY-213-4 BY-214-1 BY-214-4 BY-215-1 BY-215-4 BY-216-1 BY-216-2		
	c. <u>Indicators</u> At all airborne indicator locations listed in Section 1	Quarterly	Gamma Dose Quarterly

**Table 6-1 (Cont.)  
Radiological Environmental Monitoring Program**

<u>Exposure Pathway and/or Sample</u>	<u>Sampling or Monitoring Locations</u>	<u>Sampling or Collection Frequency</u>	<u>Type of Frequency of Analysis</u>
2. <u>Direct Radiation</u> (cont'd)			
	d. <u>Control</u> At the control airborne location listed in Section 1	Quarterly	Gamma dose quarterly
	e. <u>Special Interest</u>  BY-301-1 BY-301-2 BY-309-1 BY-309-2 BY-309-3 BY-309-4 BY-314-2	Quarterly	Gamma dose quarterly

**Table 6-1 (Cont.)  
Radiological Environmental Monitoring Program**

<u>Exposure Pathway and/or Sample</u>	<u>Sampling or Monitoring Locations</u>	<u>Sampling or Collection Frequency</u>	<u>Type or Frequency of Analysis</u>
3. <u>Waterborne Ground/Well</u>	a. <u>Indicators</u>  BY-14-1, 3200 German Church Rd  BY-18-1, Calhoun Well  BY-32, Welford Well  BY-35, Vancko Well  BY-38, Storz Well  BY-37, Alexander Well	Quarterly	Gamma isotopic <sup>3</sup> and tritium analysis quarterly.
<u>Drinking</u>	There is no drinking water pathway within 6.2 mi downstream of the station.		
<u>Surface</u>	a. <u>Indicators</u> BY-12, Oregon Pool of Rock River, Downstream of Discharge  b. <u>Control</u> BY-29, Byron, Upstream of Intake	Weekly grab samples.	Gross beta and gamma isotopic analysis <sup>3</sup> on monthly composite; tritium analysis on quarterly composite.
<u>Sediment</u>	a. <u>Indicators</u> BY-12, Oregon Pool of Rock River, Downstream of Discharge  b. <u>Control</u> BY-34, Rock River Upstream of discharge	Semiannually	Gamma isotopic <sup>3</sup> analysis semiannually.

**Table 6-1 (Cont.)  
Radiological Environmental Monitoring Program**

<u>Exposure Pathway and/or Sample</u>	<u>Sampling or Monitoring Locations</u>	<u>Sampling or Collection Frequency</u>	<u>Type or Frequency of Analysis</u>
4. <u>Ingestion</u>			
<u>Milk</u>	a. <u>Indicators</u>  BY-20-1 R. Snodgrass,Dairy Farm	Biweekly: May through October; monthly: November through April.	Gamma isotopic <sup>3</sup> and I-131 analysis <sup>4</sup> on each sample.
	b. <u>Controls</u>  BY-26-2, Akins Dairy		
<u>Fish</u>	a. <u>Indicator</u>  BY-31, Rock River in vicinity of Discharge	Two times annually	Gamma isotopic <sup>3</sup> analysis on edible portions.
	b. <u>Control</u>  BY-29, Byron, Upstream of Intake		
<u>Food Products</u>	a. <u>Indicators</u>  Two samples from each of the four major quadrants within 6.2 miles of the station.	Annually	Gamma isotopic <sup>3</sup> analysis on each sample.

**Table 6-1 (Cont.)  
Radiological Environmental Monitoring Program**

<u>Exposure Pathway and/or Sample</u>	<u>Sampling or Monitoring Locations</u>	<u>Sampling or Collection Frequency</u>	<u>Type of Frequency of Analysis</u>
<u>Food Products (cont'd)</u>	b. <u>Control</u>  Two samples within 9.3 to 18.6 miles of the station.  Sample locations for food products may vary based on availability and therefore are not required to be identified here but shall be taken.	Annually	Gamma Isotopic <sup>3</sup> analysis on each sample.



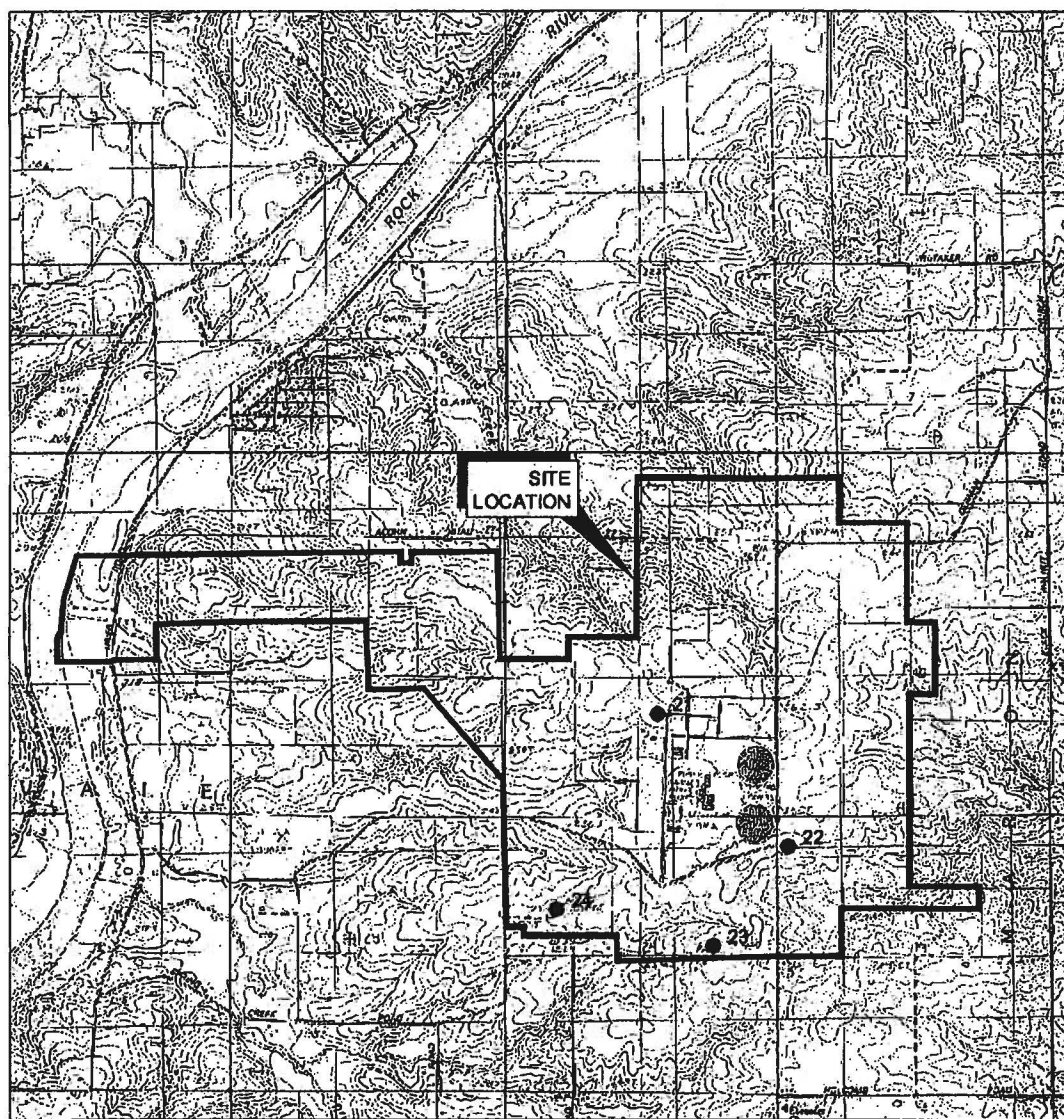
**Table 6-1 (Cont'd)**  
**Radiological Environmental Monitoring Program**

<sup>1</sup>Far field samples are not required to be analyzed, unless the respective near field sample results are inconsistent with previous measurements and radioactivity is confirmed as having its origin in airborne effluents from the station, or at the discretion of the Chemistry Manager.

<sup>2</sup>Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than ten times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

<sup>3</sup>Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the station.

<sup>4</sup>I-131 analysis means the analytical separation and counting procedure are specific for this radionuclide.



**REFERENCE:**

UNITED STATES GEOLOGIC SURVEY  
STILLMAN VALLEY QUADRANGLE, OR  
TOPOGRAPHIC, 7.5 MINUTES SERIES 1976

0 1/2 1 KM

0 1/2 1 MILE



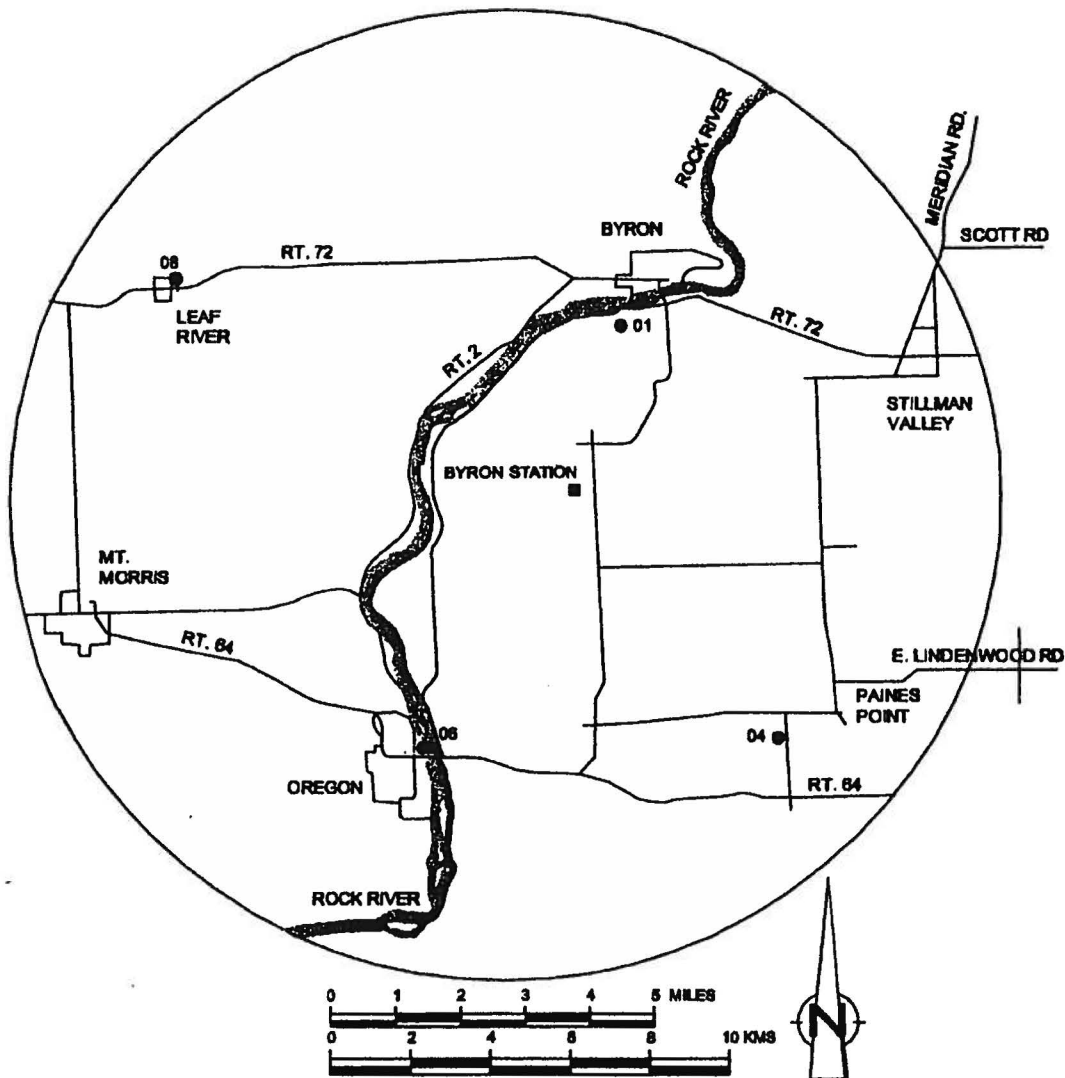
● AIR SAMPLING LOCATION



**OFFSITE DOSE CALCULATION MANUAL  
BYRON STATION**

**FIGURE 6-1**

**ONSITE AIR SAMPLING LOCATIONS  
and Unrestricted Area Boundary**



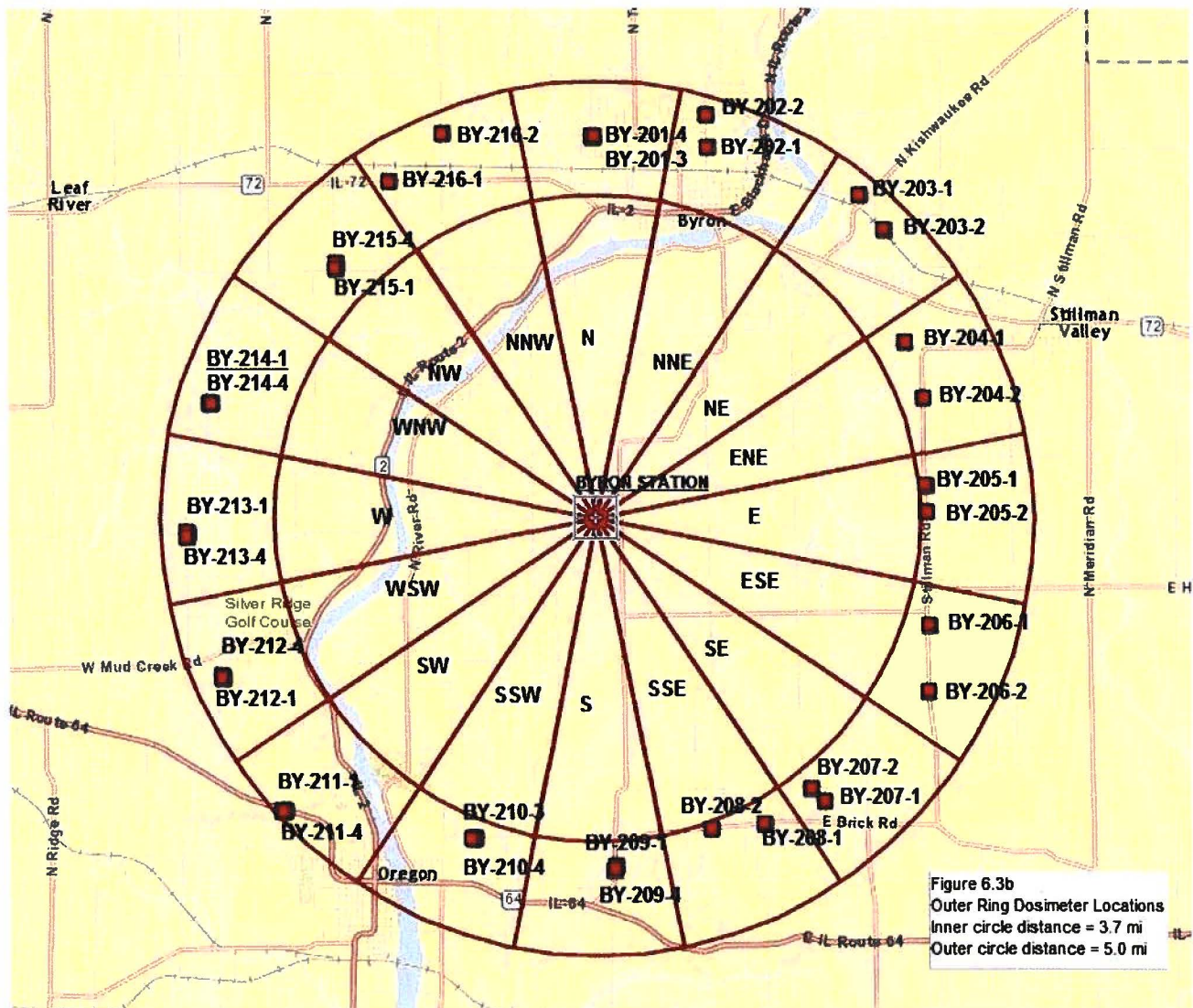
- AIR SAMPLING LOCATION
- BYRON STATION

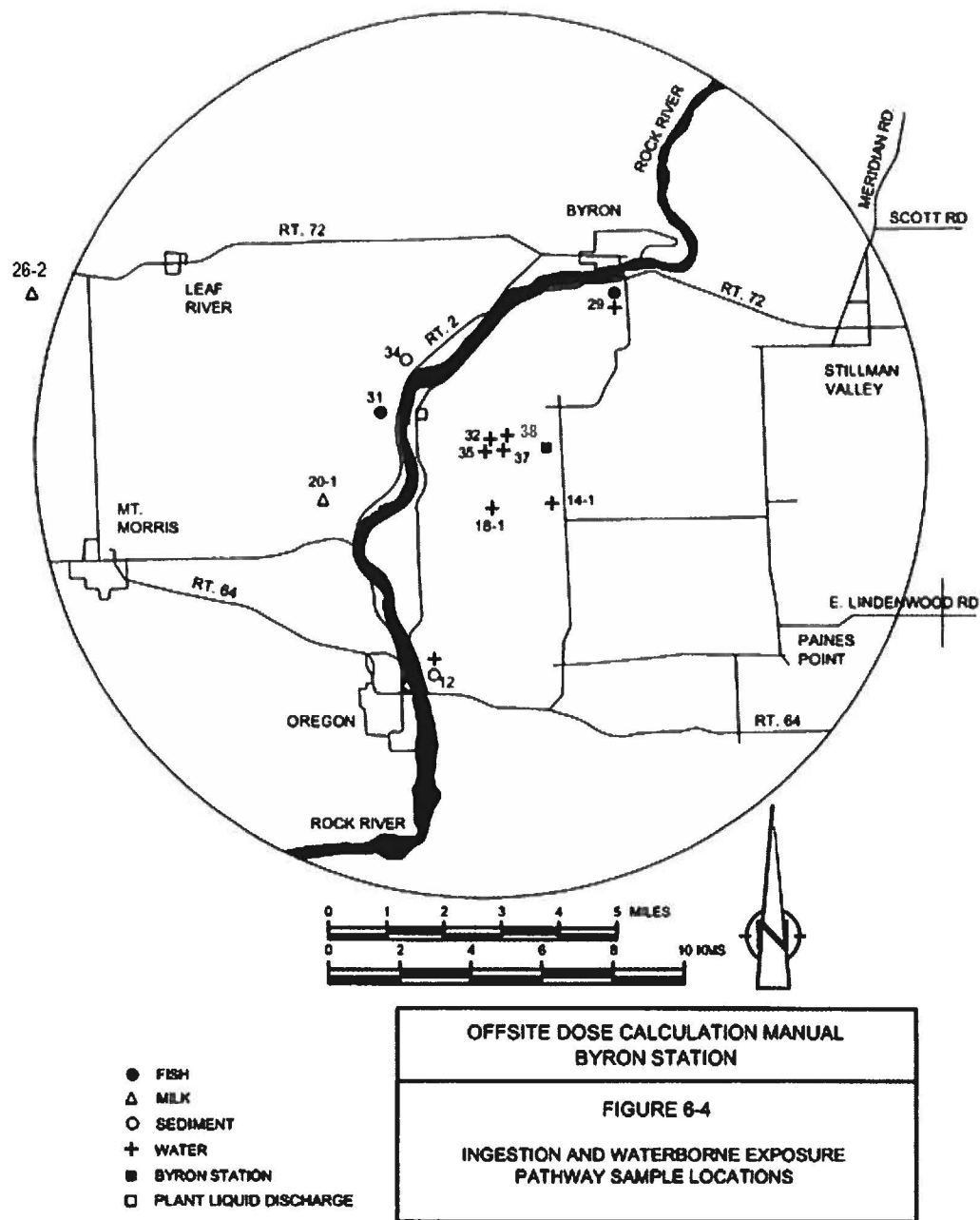
OFFSITE DOSE CALCULATION MANUAL BYRON STATION
FIGURE 6-2 OFFSITE AIR SAMPLING LOCATIONS





Figure 6.3b  
Outer Ring Dosimeter Locations







**Latitude/Longitude Positions of REMP Samples**

**Table 6-2**

<b>Sampling Location</b>	<b>Latitude (deg)</b>	<b>Longitude (deg)</b>	<b>Distance (km)</b>	<b>Distance (mi)</b>	<b>Direction (deg)</b>	<b>Sector Desig</b>	<b>Compass Dir</b>
<b>Release (Reference) Point</b>							
Vent Stack	42.07472	-89.28264	N/A	N/A	N/A	N/A	N/A
<b>Air Sampling Stations</b>							
BY-01	42.11762	-89.27993	4.77	2.96	3	A	N
BY-04	42.01867	-89.22213	7.98	4.96	142	G	SE
BY-06	42.01577	-89.33010	7.63	4.74	211	K	SSW
BY-08	42.12668	-89.39918	11.20	6.96	301	P	WNW
BY-21	42.07908	-89.28213	0.49	0.30	5	A	N
BY-22	42.07168	-89.27693	0.58	0.36	125	G	SE
BY-23	42.06585	-89.28230	0.98	0.61	178	J	S
BY-24	42.06790	-89.29278	1.13	0.70	228	L	SW
<b>Surface Water</b>							
BY-12	42.01717	-89.32603	7.33	4.55	209	K	SSW
BY-29	42.11773	-89.27990	4.78	2.97	3	A	N
<b>Sediment</b>							
BY-12	42.01717	-89.32603	7.33	4.55	209	K	SSW
BY-34	42.09355	-89.32638	4.18	2.60	300	P	WNW
<b>Fish</b>							
BY-29	42.11773	-89.27990	4.78	2.97	3	A	N
BY-31	42.09353	-89.32623	4.16	2.58	300	P	WNW
<b>Milk</b>							
BY-20-1	42.05898	-89.37455	7.80	4.85	257	M	WSW
BY-26-2	42.12221	-89.51107	19.60	12.20	286	P	WNW
<b>Well Water</b>							
BY-14-1	42.06102	-89.27753	1.58	0.98	164	H	SSE
BY-18-1	42.06578	-89.29051	1.19	0.74	213	K	SSW
BY-32	42.07527	-89.31863	3.00	1.86	271	N	W
BY-35	42.08097	-89.31802	3.01	1.87	283	P	WNW
BY-38	42.08259	-89.32021	3.23	2.00	286	P	WNW
BY-37	42.08225	-89.31928	3.14	1.95	285	P	WNW
<b>Vegetation</b>							
BY-Control	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year
BY-Quad 1	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year
BY-Quad 2	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year
BY-Quad 3	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year
BY-Quad 4	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year	Varies by year

**LATITUDE/LONGITUDE POSITIONS OF REMP SAMPLES****Table 6-2  
Dosimeter Locations**

Note: Dosimeters are also located at each air sampling station

Sampling Location	Latitude (deg)	Longitude (deg)	Distance (km)	Distance (mi)	Direction (deg) From Stack	Sector	Sector
<b>Inner Ring</b>							
BY-101-1	42.07908	-89.28243	0.48	0.30	2	A	N
BY-101-2	42.07912	-89.28188	0.49	0.30	8	A	N
BY-102-1	42.08757	-89.27522	1.56	0.97	23	B	NNE
BY-102-2	42.08752	-89.27438	1.58	0.98	26	B	NNE
BY-103-1	42.09068	-89.25822	2.69	1.67	49	C	NE
BY-103-2	42.09020	-89.25802	2.67	1.66	50	C	NE
BY-103-3	42.07893	-89.27692	0.67	0.42	45	C	NE
BY-104-1	42.08345	-89.25798	2.26	1.40	65	D	ENE
BY-104-2	42.08303	-89.25797	2.24	1.39	66	D	ENE
BY-104-3	42.07720	-89.27717	0.53	0.33	59	D	ENE
BY-105-1	42.07462	-89.25777	2.06	1.28	59	E	E
BY-105-2	42.07598	-89.25760	2.08	1.29	90	E	E
BY-106-1	42.06822	-89.25770	2.19	1.36	109	F	ESE
BY-106-2	42.06770	-89.25758	2.22	1.38	111	F	ESE
BY-107-1	42.05870	-89.26647	2.23	1.39	143	G	SE
BY-107-2	42.05873	-89.26580	2.26	1.40	142	G	SE
BY-107-3	42.07027	-89.27730	0.66	0.41	138	G	SE
BY-108-1	42.06588	-89.27790	1.06	0.66	158	H	SSE
BY-108-2	42.06578	-89.27920	1.03	0.64	164	H	SSE
BY-109-1	42.06580	-89.28417	1.00	0.62	187	J	S
BY-109-2	42.06583	-89.28427	1.00	0.62	188	J	S
BY-110-1	42.06578	-89.28738	1.07	0.66	201	K	SSW
BY-110-2	42.06577	-89.28793	1.08	0.67	204	K	SSW
BY-111-3	42.06573	-89.29173	1.25	0.78	217	L	SW

**LATITUDE/LONGITUDE POSITIONS OF REMP SAMPLES****Table 6-2****Dosimeter Locations (Continued)**

<b>Sampling Location</b>	<b>Latitude (deg)</b>	<b>Longitude (deg)</b>	<b>Distance (km)</b>	<b>Distance (mi)</b>	<b>Direction (deg) From Stack</b>	<b>Sector</b>	<b>Sector</b>
<b>Inner Ring</b>							
BY-111-4	42.06565	-89.29363	1.36	0.85	222	L	SW
BY-112-3	42.06967	-89.29660	1.28	0.80	244	M	WSW
BY-112-4	42.07010	-89.29653	1.26	0.78	246	M	WSW
BY-113-1	42.07385	-89.29670	1.16	0.72	265	N	W
BY-113-2	42.07432	-89.29662	1.15	0.71	268	N	W
BY-114-1	42.07955	-89.29665	1.27	0.79	295	P	WNW
BY-114-2	42.08000	-89.29673	1.30	0.81	297	P	WNW
BY-115-1	42.08433	-89.29705	1.60	0.99	312	Q	NW
BY-115-2	42.08473	-89.29702	1.63	1.01	313	Q	NW
BY-116-1	42.09185	-89.29697	2.24	1.39	328	R	NNW
BY-116-2	42.09227	-89.29705	2.28	1.42	329	R	NNW
BY-116-3	42.08702	-89.28810	1.44	0.89	342	R	NNW

**LATITUDE/LONGITUDE POSITIONS OF REMP SAMPLES****Table 6-2  
Dosimeter Locations (Continued)**

<b>Sampling Location</b>	<b>Latitude (deg)</b>	<b>Longitude (deg)</b>	<b>Distance (km)</b>	<b>Distance (mi)</b>	<b>Direction (deg) From Stack</b>	<b>Sector</b>	<b>Sector</b>
<b>Outer Ring</b>							
BY-201-3	42.13811	-89.28378	7.04	4.37	359	A	N
BY-201-4	42.13810	-89.28316	7.04	4.37	360	A	N
BY-202-1	42.13623	-89.25798	7.13	4.43	17	B	NNE
BY-202-2	42.14157	-89.25817	7.70	4.78	15	B	NNE
BY-203-1	42.12840	-89.22405	7.69	4.78	39	C	NE
BY-203-2	42.12258	-89.21855	7.51	4.67	45	C	NE
BY-204-1	42.10407	-89.21380	6.57	4.08	60	D	ENE
BY-204-2	42.09472	-89.20980	6.43	4.00	70	D	ENE
BY-205-1	42.08028	-89.20923	6.11	3.80	84	E	E
BY-205-2	42.07587	-89.20907	6.09	3.78	89	E	E
BY-206-1	42.05707	-89.20862	6.44	4.00	108	F	ESE
BY-206-2	42.04622	-89.20870	6.89	4.28	117	F	ESE
BY-207-1	42.02793	-89.23200	6.68	4.15	141	G	SE
BY-207-2	42.03008	-89.23523	6.32	3.93	142	G	SE
BY-208-1	42.02425	-89.24565	6.39	3.97	151	H	SSE
BY-208-2	42.02340	-89.25740	6.07	3.77	160	H	SSE
BY-209-1	42.01717	-89.27887	6.40	3.98	177	J	S
BY-209-4	42.01657	-89.27917	6.47	4.02	177	J	S
BY-210-3	42.02180	-89.31012	6.30	3.91	201	K	SSW
BY-210-4	42.02180	-89.31083	6.32	3.93	202	K	SSW
BY-211-1	42.02658	-89.35338	7.93	4.93	228	L	SW
BY-211-4	42.02645	-89.35278	7.90	4.91	227	L	SW

**LATITUDE/LONGITUDE POSITIONS OF REMP SAMPLES****Table 6-2****Dosimeter Locations (Continued)**

<b>Sampling Location</b>	<b>Latitude (deg)</b>	<b>Longitude (deg)</b>	<b>Distance (km)</b>	<b>Distance (mi)</b>	<b>Direction (deg) From Stack</b>	<b>Sector</b>	<b>Sector</b>
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**Outer Ring**

BY-212-1	42.04847	-89.36643	7.52	4.67	247	M	WSW
BY-212-4	42.04888	-89.36672	7.52	4.67	248	M	WSW
BY-213-1	42.07263	-89.37440	7.59	4.72	268	N	W
BY-213-4	42.07183	-89.37440	7.60	4.72	268	N	W
BY-214-1	42.09397	-89.36945	7.49	4.65	287	P	WNW
BY-214-4	42.09397	-89.36890	7.45	4.63	287	P	WNW
BY-215-1	42.11618	-89.34107	6.68	4.15	314	Q	NW
BY-215-4	42.11710	-89.34100	6.74	4.19	314	Q	NW
BY-216-1	42.13058	-89.32910	7.30	4.54	328	R	NNW
BY-216-2	42.13847	-89.31702	7.63	4.74	338	R	NNW

**Special Interest**

BY-301-1	42.07830	-89.28338	0.40	0.25	352	A	N
BY-301-2	42.07685	-89.28230	0.24	0.15	7	A	N
BY-309-1	42.06995	-89.28268	0.53	0.33	183	J	S
BY-309-2	42.06887	-89.28200	0.65	0.40	175	J	S
BY-309-3	42.06865	-89.28358	0.68	0.42	186	J	S
BY-309-4	42.06850	-89.28472	0.71	0.44	194	K	SSW
BY-314-2	42.07618	-89.28806	0.48	0.29	290	P	WNW