Table 3-8 (cont.) Bioaccumulation Factors (BF_i) to be Used in the Absence of Site-Specific Data		
Cd	2.0E+03	Footnote 11
In	2.2E+03	Footnote 13
Sn	2.4E+03	Footnote 12
Sb	1.0E+00	98
Ag	2.3E+00	56
Te	4.0E+02	6
I	1.5E+01	6
Xe	NA	NA
Cs	2.0E+03	6
Ba	4.0E+00	6
La	2.5E+01	6
Ce	1.0E+00	6
Pr	2.5E+01	6
Nd	2.5E+01	6
Pm	3.0E+01	98
Sm	3.0E+01	Footnote 3
Eu	1.0E+02	Footnote 3
Gd	2.6E+01	Footnote 3
Dy	2.2E+03	Footnote 3
Er	3.3E+04	Footnote 3
Tm	4.0E+02	Footnote 3
Yb	2.2E+02	Footnote 3
Lu	2.5E+01	Footnote 3
Hf	3.3E+00	Footnote 4
Ta	3.0E+04	Footnote 5
W	1.2E+03	6
Re	2.1E+02	Footnote 6
Os	5.5E+01	Footnote 7
Ir	3.0E+01	Footnote 8
Pt	1.0E+02	Footnote 9
Au	2.6E+01	Footnote 10
Hg	2.0E+03	Footnote 11
Tl	2.2E+03	Footnote 13
Pb	3.0E+02	98
Bi	2.0E+01	98
Ra	5.0E+01	98
Th	3.0E+01	98
U	1.0E+01	98
Np	1.0E+01	6
Am	3.0E+01	98

Footnotes:
NA = It is assumed that noble gases are not accumulated.

In Reference 6, see Table A-1 in the ODCM Training and Reference Material.

A number of bioaccumulation factors could not be found in literature. In this case, the periodic table was used in conjunction with published element values. This method was used for periodic table columns except where there were no values for column 3A so the average of columns 2B and 4A was assigned.

1. Value is the average of Reference 6 values in literature for H, Na, Rb and Cs.
2. Value is the average of Ref. 6 values in literature for Sr, Ba and Ref. 98 values for Ra.
3. Value is the same as the Reference 6 value used for Y.
4. Value is the same as the Reference 6 value used for Zr.
5. Value is the same as the Reference 6 value used for Nb.
6. Value is the average of Reference 6 values in literature for Mn and Tc.
7. Value is the average of Reference 6 values in literature for Fe and Ru.
8. Value is the average of Reference 6 values in literature for Co and Rh.
9. Value is the same as the Reference 6 value used for Ni.
10. Value is the average of Reference 6 values in literature for Cu and Reference 56 value for Ag.
11. Value used is the same as the Reference 6 value used for Zn.
12. Value is the average of Reference 6 value in literature for C and Reference 98 value for Pb.
13. Value is the average of columns 2B and 4A, where column 2B is the "Reference 6 value for Zn" and column 4A is the average of "Reference 6 value for C and Reference 98 value for Pb".
14. Value is the average of Ref. 6 value found in literature for P and the Ref. 98 values for Bi and Sb.
15. Value is the same as the Reference 6 value used for Te.
16. Value is the average of Reference 6 values found in literature for Br and I.

4.0 GASEOUS EFFLUENTS

4.1 Gaseous Effluents – General Information

This section reviews the offsite radiological limits applicable to the nuclear power stations and presents in detail the equations and procedures used to assess compliance with these limits. This calculational approach uses the methodology of NUREG-0133 (Reference 14), and incorporates certain simplifications such as the use of average meteorology.

4.1.1 Pre-calculated atmospheric transport parameters are based on historical average atmospheric conditions. These historical meteorological conditions have resulted in the dispersion parameters shown in Table 4-1, Table 4-2 and Table 4-8.

4.1.2 The equations and parameters of this section are for use in calculating offsite radiation doses during routine operating conditions. They are not for use in calculating doses due to non-routine releases (e.g., accident releases).

4.1.3 An overview of the required compliance is given in Table 1-1. The dose components are itemized and referenced, and an indication of their regulatory application is noted. Additionally, the locations of dose receivers for each dose component are given in Table 1-2.

4.1.4 Airborne Release Point Classifications

The pattern of dispersion of airborne releases is dependent on the height of the release point relative to adjacent structures. Each release point is classified as one of the following three height-dependent types:

- Stack (or Elevated) Release Point (denoted by the letter S or subscript s)
- Ground Level Release Point (denoted by the letter G or subscript g)
- Vent (or Mixed Mode) Release Point (denoted by the letter V or subscript v)

4.1.5 Operability and Use of Gaseous Effluent Treatment Systems

10CFR50 Appendix I and ODCM Part I require that the ventilation exhaust treatment system and the waste gas holdup system be used when projected offsite doses in 31 days, due to gaseous effluent releases, from each reactor unit, exceed any of the following limits:

- 0.2 mrad to air from gamma radiation.
- 0.4 mrad to air from beta radiation.
- 0.3 mrem to any organ of a member of the public.

The station must project doses due to gaseous releases from the site at least once per 31 days. The calculational methods shown in sections 4.2.2 and 4.2.3 are used for this dose projection.

4.1.6 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 Gaseous Effluents – Dose and Dose Rate Calculation Requirements

4.2.1 Instantaneous Dose Rates

4.2.1.1 Noble Gas: Total Body Dose Rate

ODCM Part I limits the total body 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 500 mrem/yr at all times.

The total body dose rate due to noble gases released in gaseous effluents is calculated by the following expression:

$$\dot{D}_{TB} = \sum_i K_i \left\{ (\chi/Q)^r_s Q_{is} + (\chi/Q)^r_v Q_{iv} + (\chi/Q)^r_g Q_{ig} \right\} \qquad (4\text{-}1)$$

The summation is over noble gas radionuclides I.

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

$\dot{D}_{TB}$ Total Body Dose Rate [mrem/yr]

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

Q_{is}, Q_{iv}, Q_{ig} Release Rate [µCi/sec]

Measured release rate of radionuclide I from a stack, vent or ground level release point, respectively.

K_i Gamma Total Body Dose Conversion Factor [(mrem/yr)/(µCi/m^3)]

Gamma total body dose factor due to gamma emissions for noble gas radionuclide i. K values are taken from Table 4-28

Relative Concentration Factor [sec/m^3]

$(\chi/Q)_s$
$(\chi/Q)_v$
$(\chi/Q)_g$ 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.

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 II 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

ODCM Part I 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)

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

$$\dot{D}_{sk} = \sum_i \{L_i[(\chi/Q)_s Q_{is} + (\chi/Q)_v Q_{iv} + (\chi/Q)_g Q_{ig}] + (1.11) M_i[(\chi/Q)'_s Q_{is} + (\chi/Q)'_v Q_{iv} + (\chi/Q)'_g Q_{ig}]\} \quad (4\text{-}2)$$

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^3)]

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^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).

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

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 II 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

ODCM Part I 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)

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.

The dose rate to any child organ due to inhalation is calculated by the following expression:

$$\dot{D}^{NNG}_{(Child)(Inhal)j} = \sum_i R_{(Child)(Inhal)i}\left\{(\chi/Q)_v Q_{iv} + (\chi/Q)_r Q_{ir} + (\chi/Q)_g Q_{ig}\right\} \qquad (4\text{-}3)$$

The summation is over non-noble gas radionuclides I.

$\dot{D}^{NNG}_{(Child)(Inhal)j}$ Inhalation Dose Rate [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.

$R_{(Child)(Inhal)i}$ Inhalation Dose Factor [(mrem/yr)/(μCi/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

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

ODCM Part I 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.

The child organ dose rate due to inhalation is calculated in each sector at the location of the highest offsite χ/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

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:

- Less than or equal to 5 mrad per calendar quarter.
- 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:

$$D_\gamma = (3.17E-8)\sum_i M_i\left\{(\chi/Q)^\gamma_e A_{ie} + (\chi/Q)^\gamma_v A_{iv} + (\chi/Q)^\gamma_g A_{ig}\right\} \qquad (4\text{-}4)$$

The summation is over noble gas radionuclides i.

D_γ 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)/(μCi/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).

$(\chi/Q)^\gamma_e, (\chi/Q)^\gamma_v, (\chi/Q)^\gamma_g$ Gamma-χ/Q Factor [sec/m^3]

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-χ/Q Factors.

A_{ie}, A_{iv}, A_{ig} Cumulative Radionuclide Release [μCi]

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_{ie} term is not used.

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.

Gamma air dose is calculated for the sector with the highest offsite $(\chi/Q)^{\gamma}$ and is compared with the Part I limits on gamma air dose.

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

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:

- Less than or equal to 10 mrad per calendar quarter.
- Less than or equal to 20 mrad per calendar year.

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

$$D_{\beta} = (3.17E-8)\sum_{i}\{N_i[(\chi/Q)_v A_{vi} + (\chi/Q)_w A_{wi} + (\chi/Q)_p A_{pi}]\} \qquad (4\text{-}5)$$

The summation is over noble gas radionuclides i.

D_{β} 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)/(μCi/m^3)]

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^3]

$(\chi/Q)_v$

$(\chi/Q)_g$ 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 [μCi]

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.

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.

Beta air dose is calculated for the sector with the highest offsite (χ/Q) and is compared with the ODCM Part I limit on beta air dose.

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

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.

The total body dose component due to gamma radiation from noble gases released in gaseous effluents is calculated by the following expression:

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

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)/(μCi/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 [μCi]

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

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 II Table 1-1).

4.2.2.4 Skin Dose

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.

The part of skin dose due to noble gases released in gaseous effluents is calculated by the following expression:

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

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)/(μCi/m^3)]

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

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:

- Less than or equal to 7.5 mrem to any organ during any calendar quarter
- Less than or equal to 15 mrem to any organ during any calendar year

The individual dose components are also required as part of the 40CFR190 assessments and combined as part of the 10CFR20 assessment (Part II 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.

The dose is calculated for releases in the time period under consideration.

Specifically, the dose is calculated as follows:

$$D_{aj}^{nng} = (3.17E-8)\sum_{p}\sum_{i}\left[W_s R_{aipl} A_{is} + W_v R_{aipl} A_{iv} + W_g R_{aipl} A_{ig}\right] \qquad (4\text{-}8)$$

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^3]

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^2]

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 mrem/yr)/(μCi/sec)] or [(mrem/yr)/(μCi/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 [μCi]

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.

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.

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 (χ/Q) and (D/Q) are shown in Table 4-1 through Table 4-6 and correspond to the applicable pathway location.

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.

The dose evaluated is also included as part of the 10CFR20 and 40CFR190 assessment (See Part II Section 5).

4.2.3.1 Ground Plane

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:

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

$R_{a(GP)j}[D/Q]$ Ground Plane Deposition Dose Factor [(m^2 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_i Ground Plane Dose Conversion Factor [(mrem/hr)/(pCi/m^2)]

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_i Radiological Decay Constant [hr^{-1}]

Radiological decay constant for radionuclide i.

t_b Time Period of Ground Deposition [hr]

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

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

4.2.3.2 Inhalation

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

$$R_{a(pathway)i}[\chi/Q] = K' BR_a DFA_{aij} \qquad (4\text{-}10)$$

$R_{a(pathway)i}[\chi/Q]$ Inhalation Pathway Dose Factor [(mrem/yr)/(μCi/m^3)]

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

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

BR_a Individual Air Inhalation Rate [m^3/yr]

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

DFA_{aij} 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 value for H-3 is taken from NUREG 4013 (Reference 107).

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

4.2.3.3 Ingestion: Vegetation

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.

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

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

$R_{a(veg)j}[D/Q]$ Vegetation Ingestion Pathway Dose Factor [$(m^2$ mrem/yr)/(μCi/sec)]

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

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

r Vegetation Retention Factor [dimensionless]

Y_v Agricultural Productivity Yield [kg/ m^2]

λ_i Radiological Decay Constant [1/sec]

Radiological decay constant for radionuclide I

λ_w Weathering Decay Constant [1/sec]

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

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

Ingestion dose conversion factor for age group a, nuclide I and organ j. Converts pCi ingested to mrem. Taken from Tables E-11 though E-14 of Regulatory Guide 1.109. The value for H-3 is taken from NUREG 4013 (Reference 107).

U_a^L Consumption Rate for Fresh Leafy Vegetation [kg/yr]

Consumption rate for fresh leafy vegetation for age group a.

U_a^S Consumption Rate for Stored Vegetation [kg/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.

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:

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

$R_{a(H-3)(veg)j}[\chi/Q]$ Tritium Vegetation Ingestion Pathway Dose Factor[(mrem/yr)/(μCi/m3)]

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/m3]

0.75 Water Fraction [dimensionless]
The fraction of total vegetation that is water.

0.5 Specific Activity Ratio [dimensionless]

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:

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

K'	a constant of unit conversion, 1 E 6 pCi/uCi
K'''	gm/kg
U_a^L	Leafy veg consumption rate adult (kg/yr)
f_L	Fraction of annual intake of fresh, leafy vegetation grown locally
U_a^S	Stored veg consumption rate adult (kg/yr)
f_s	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 (gm/m^3)

4.2.3.4 Ingestion Milk

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

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

$R_{a(pnm)i}[D/Q]$ Milk Ingestion Pathway Dose Factor
[(m^2 mrem/yr)/(μCi/sec)]

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

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

Q_F Feed Consumption [Kg/da]

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

U_{am} Milk Consumption Rate [l/yr]

Milk consumption rate for age group a.

F_m Stable Element Transfer Coefficient for Milk [da/l]

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

f_p Pasture Time Fraction [dimensionless]

Fraction of year that animal is on pasture.

f_s Pasture Grass Fraction [dimensionless]

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

Y_P Agricultural Productivity Yield - Pasture Grass [kg/m^2]

The agricultural productivity by unit area of pasture feed grass.

Y_S Agricultural Productivity Yield - Stored Feed [kg/m^2]

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:

$$R_{a(H-3)(milk)j}[\chi/Q] = K'K''F_m\,Q_F U_{am} DFL_{a(H-3)j}[0.75(0.5/H)] \qquad (4\text{-}14)$$

$R_{a(H-3)(milk)j}[\chi/Q]$ Tritium Milk Ingestion Pathway Dose Factor [(mrem/yr)/(Ci/m3)]

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/m3]

0.75 Water Fraction [dimensionless]

The fraction of total feed that is water.

0.5 Specific Activity Ratio [dimensionless]

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:

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

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^3)

4.2.3.5 Ingestion: Meat

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

$$R_{a(\text{Meat})i}[D/Q] = K'\frac{Q_F(U_{ap})}{\lambda_i+\lambda_w}F_i(r)(DFL_{ai})\left[\frac{f_p f_e}{Y_p}+\frac{(1-f_p f_e)e^{-\lambda_i t_h}}{Y_s}\right]e^{-\lambda_i t_f} \qquad \textbf{(4-15)}$$

$R_{a(\text{Meat})i}[D/Q]$ Meat Ingestion Pathway Dose Factor
[(m^2 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, the meat dose factor is calculated using (D/Q).

U_{af} Meat Consumption Rate [kg/yr]

Meat consumption rate for age group a.

F_f 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 II Table 1-4.

t_h Environmental Transport Time - Stored Feed [sec]

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

t_f 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:

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

$R_{a(H-3)(Meat)j}[\chi/Q]$ Tritium Meat Ingestion Pathway Dose Factor (mrem/yr)/(µci/m3)]

Site-specific tritium meat ingestion dose factor for age group a and organ j. The tritium meat dose is calculated using χ/Q.

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

H Absolute Atmospheric Humidity [gm/m3]

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.

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:

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

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_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^3)

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**3)	Radius (meters)	D/Q (1/m**2)	Radius (meters)	X/Q (sec/m**3)	D/Q (1/m**2)
N	1875.	1.9[illegible]E-07	1875.	1.9[illegible]E-09	1875.	8.6[illegible]E-07	4.4[illegible]E-09
NNE	1829.	1.6[illegible]E-07	1829.	1.9[illegible]E-09	1829.	7.5[illegible]E-07	4.2[illegible]E-09
NE	1585.	1.5[illegible]E-07	1585.	1.8[illegible]E-09	1585.	7.8[illegible]E-07	4.3[illegible]E-09
ENE	1234.	1.3[illegible]E-07	1234.	1.7[illegible]E-09	1234.	8.0[illegible]E-07	5.0[illegible]E-09
E	1227.	1.4[illegible]E-07	1227.	2.3[illegible]E-09	1227.	1.1[illegible]E-06	6.2[illegible]E-09
ESE	991.	2.5[illegible]E-07	991.	3.5[illegible]E-09	991.	1.4[illegible]E-06	9.0[illegible]E-09
SE	1006.	3.0[illegible]E-07	1006.	3.5[illegible]E-09	1006.	2.4[illegible]E-06	1.1[illegible]E-08
SSE	800.	4.4[illegible]E-07	800.	3.7[illegible]E-09	800.	4.1[illegible]E-06	1.4[illegible]E-08
S	945.	2.3[illegible]E-07	945.	2.7[illegible]E-09	945.	1.9[illegible]E-06	9.3[illegible]E-09
SSW	975.	1.4[illegible]E-07	975.	1.9[illegible]E-09	975.	1.3[illegible]E-06	6.6[illegible]E-09
SW	1067.	1.1[illegible]E-07	1067.	1.7[illegible]E-09	1067.	9.2[illegible]E-07	5.3[illegible]E-09
WSW	1212.	1.1[illegible]E-07	1212.	1.9[illegible]E-09	1212.	7.6[illegible]E-07	5.0[illegible]E-09
W	1189.	1.7[illegible]E-07	1189.	1.8[illegible]E-09	1189.	9.3[illegible]E-07	5.3[illegible]E-09
WNW	1227.	1.8[illegible]E-07	1227.	1.8[illegible]E-09	1227.	6.9[illegible]E-07	3.7[illegible]E-09
NW	1128.	1.4[illegible]E-07	1128.	1.7[illegible]E-09	1128.	8.8[illegible]E-07	4.9[illegible]E-09
NNW	1044.	3.0[illegible]E-07	1044.	3.2[illegible]E-09	1044.	1.4[illegible]E-06	8.8[illegible]E-09

Byron Site Meteorological Data 1/76 - 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.

χ/Q is used for beta skin, and inhalation dose pathways. See Sections 4.2.1, 4.2.2 and 4.2.3.2.

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 χ/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**3)	Radius (meters)	D/Q (1/m**2)	Radius (meters)	X/Q (sec/m**3)	D/Q (1/m**2)
N	777.	6.3578-07	777.	7.8048-09	777.	3.2988-06	1.8528-08
NNE	538.	8.7788-07	538.	1.0648-08	538.	5.0848-06	1.1928-08
NE	538.	8.0888-07	538.	7.7988-09	538.	4.3978-06	1.4448-08
ENE	476.	9.3618-07	476.	9.0478-09	476.	4.8144-06	2.3468-08
E	448.	8.6988-07	448.	7.9988-09	448.	5.3978-06	1.9988-08
ESE	488.	7.3778-07	488.	8.9638-09	488.	5.4348-06	1.1448-08
SE	427.	1.1268-06	427.	1.8638-08	427.	1.0848-05	1.3988-08
SSE	418.	1.3468-06	418.	8.7648-09	418.	1.3978-05	6.8648-08
S	295.	1.4418-06	295.	1.1718-08	295.	1.3978-05	5.7878-08
SSW	299.	9.3888-07	299.	8.2998-09	299.	9.3768-06	6.1978-08
SW	451.	5.9488-07	451.	5.8698-09	451.	3.4468-06	2.8998-08
WSW	336.	6.0988-07	336.	7.4298-09	336.	4.4978-06	3.0888-08
W	379.	1.0418-06	379.	8.1168-09	379.	6.6978-06	1.2798-08
WNW	365.	7.4948-07	365.	6.8818-09	365.	4.3888-06	2.3788-08
NW	445.	7.3948-07	445.	6.1178-09	445.	4.0688-06	2.1988-08
NNW	458.	6.1288-07	458.	6.1778-09	458.	2.9888-06	1.8748-08

Byron Site Meteorological Data 1/76 - 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 χ/Q or D/Q at or beyond the restricted area boundary (RAB).

Table 4-3
Maximum Offsite Gamma-χ/Q

Downwind Direction	Radius (meters)	Ground Gamma-χ/Q (sec/m**3)	Vent Gamma-χ/Q (sec/m**3)
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
χ/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	χ/Q sec/m^3	D/Q m^{-2}	χ/Q sec/m^3	D/Q m^{-2}
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
χ/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	χ/Q sec/m^3	D/Q m^{-2}	χ/Q sec/m^3	D/Q m^{-2}
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
χ/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	χ/Q sec/m^3	D/Q m^{-2}	χ/Q sec/m^3	D/Q m^{-2}
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

Table 4-7
Ground Plane Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
C-14	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00	0.00 E+00
Na-24	1.20E+07	1.20E+07	1.20E+07	1.20E+07	1.20E+07	1.20E+07	1.20E+07
Cr-51	4.65E+06	4.65E+06	4.65E+06	4.65E+06	4.65E+06	4.65E+06	4.65E+06
Mn-54	1.38E+09	1.38E+09	1.38E+09	1.38E+09	1.38E+09	1.38E+09	1.38E+09
Mn-56	9.03E+05	9.03E+05	9.03E+05	9.03E+05	9.03E+05	9.03E+05	9.03E+05
Fe-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fe-59	2.73E+08	2.73E+08	2.73E+08	2.73E+08	2.73E+08	2.73E+08	2.73E+08
Co-58	3.80E+08	3.80E+08	3.80E+08	3.80E+08	3.80E+08	3.80E+08	3.80E+08
Co-60	2.45E+10	2.45E+10	2.45E+10	2.45E+10	2.45E+10	2.45E+10	2.45E+10
Ni-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ni-65	2.97E+05	2.97E+05	2.97E+05	2.97E+05	2.97E+05	2.97E+05	2.97E+05
Cu-64	6.05E+05	6.05E+05	6.05E+05	6.05E+05	6.05E+05	6.05E+05	6.05E+05
Zn-65	7.46E+08	7.46E+08	7.46E+08	7.46E+08	7.46E+08	7.46E+08	7.46E+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	4.87E+03	4.87E+03	4.87E+03	4.87E+03	4.87E+03	4.87E+03	4.87E+03
Br-84	2.03E+05	2.03E+05	2.03E+05	2.03E+05	2.03E+05	2.03E+05	2.03E+05
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	9.01E+06	9.01E+06	9.01E+06	9.01E+06	9.01E+06	9.01E+06	9.01E+06
Rb-88	3.31E+04	3.31E+04	3.31E+04	3.31E+04	3.31E+04	3.31E+04	3.31E+04
Rb-89	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05	1.23E+05
Sr-89	2.16E+04	2.16E+04	2.16E+04	2.16E+04	2.16E+04	2.16E+04	2.16E+04
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-91	2.14E+06	2.14E+06	2.14E+06	2.14E+06	2.14E+06	2.14E+06	2.14E+06
Sr-92	7.76E+05	7.76E+05	7.76E+05	7.76E+05	7.76E+05	7.76E+05	7.76E+05
Y-90	4.50E+03	4.50E+03	4.50E+03	4.50E+03	4.50E+03	4.50E+03	4.50E+03
Y-91M	1.00E+05	1.00E+05	1.00E+05	1.00E+05	1.00E+05	1.00E+05	1.00E+05
Y-91	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06
Y-92	1.80E+05	1.80E+05	1.80E+05	1.80E+05	1.80E+05	1.80E+05	1.80E+05
Y-93	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05	1.83E+05
Zr-95	2.45E+08	2.45E+08	2.45E+08	2.45E+08	2.45E+08	2.45E+08	2.45E+08
Zr-97	2.96E+06	2.96E+06	2.96E+06	2.96E+06	2.96E+06	2.96E+06	2.96E+06
Nb-95	1.37E+08	1.37E+08	1.37E+08	1.37E+08	1.37E+08	1.37E+08	1.37E+08
Mo-99	3.99E+06	3.99E+06	3.99E+06	3.99E+06	3.99E+06	3.99E+06	3.99E+06
Tc- 99M	1.84E+05	1.84E+05	1.84E+05	1.84E+05	1.84E+05	1.84E+05	1.84E+05
Tc-101	2.03E+04	2.03E+04	2.03E+04	2.03E+04	2.03E+04	2.03E+04	2.03E+04
Ru-103	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08	1.08E+08
Ru-105	6.36E+05	6.36E+05	6.36E+05	6.36E+05	6.36E+05	6.36E+05	6.36E+05
Ru-106	4.22E+08	4.22E+08	4.22E+08	4.22E+08	4.22E+08	4.22E+08	4.22E+08
Ag-110M	3.45E+09	3.45E+09	3.45E+09	3.45E+09	3.45E+09	3.45E+09	3.45E+09

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^2 mrem/yr per µCi/sec.
2) All age groups are assumed to receive the same dose.

Table 4-8
External Dose Factors for Standing on Contaminated Ground
DFG_i (mrem/hr per pCi/ m^2)

Element	Whole Body Dose Factor	Reference	Element	Whole Body Dose Factor	Reference
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[1]	-	Zn-65	4.00E-09	6
Zn-69m	5.08E-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	1.58E-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	8.46E-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[1]	-	Ru-97	2.99E-09	99
Ru-103	3.60E-09	6	Ru-105	4.50E-09	6
Ru/Rh-106	5.76E-09[2]	6, 99	Pd-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[2]	-
Sn-113	1.15E-09	99	Sn-117m	1.96E-08	99
Sn-119m	7.05E-11	99	Sb-117	0.00E+00[2]	-
Sb-122	2.71E-09[1]	-	Sb-124	1.16E-08[1]	-
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_i (mrem/hr per pCi/ m^2)

Element	Whole Body Dose Factor	Reference	Element	Whole Body Dose Factor	Reference
Te-125	0.00E+00[2]	-	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-I-132	3.40E-09[3]	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-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/Ba-137m	1.14E-08[4]	6, 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[2]	-	Ba-139	2.40E-09	6
Ba-La-140	1.71E-08[5]	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[7]	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-149m	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
Gd-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[1]	-	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-193m	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[2]	-	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

1 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.

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

3 Value is the sum of Ru-106 (1.50E-9) and Rh-106 (4.26E-9). The Rh-106 value is from Reference 99 and the Ru-106 value is from Reference 6.

4 Value is the sum of Ce-137 (4.20E-9) and Ba-137m (7.17E-9). The values are from references 6 and 99, respectively.

Table 4-8 (cont.)
External Dose Factors for Standing on Contaminated Ground
DFG_{ij} (mrem/hr per pCi/ m^2)

5 Value is the sum of Te-132 (1.70E-9) and I-132 (1.70E-9).

6 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.

7 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

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
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 $\mu Ci/m^3$.

Table 4-10
Teen Inhalation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
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

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
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 $\mu Ci/m^3$.

Table 4-11
Child Inhalation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
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 $\mu Ci/m^3$.

Table 4-12
Infant Inhalation Dose Factors

Nuclide	Bone	Liver	T Body	Thyroid	Kidney	Lung	GI-LLI
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 $\mu Ci/m^3$.