December 29, 1989

Subject: Offsite Dose Calculation Manual
Revision 28

The General Office Radiation Protection Staff is transmitting to you this date, Revision 28 of the Offsite Dose Calculation Manual. As this revision affects the manual's generic section, the approval of each station manager has been obtained. Please update your copy No. 50, and discard the affected pages.

REMOVE THESE PAGES		INSERT THESE PAGES	
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3-4	No Rev. #	3-4	Rev. 28
3-5	No Rev. #	3-5	Rev. 28
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3-7	Rev. 1	3-7	Rev. 28
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Table 3.1-1	No Rev. #	Table 3.1-1	Rev. 28
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Table 3.1-30	No Rev. #	Table 3.1-30	Rev. 28

NOTE: As this letter, with it's attachments, contains "LOEP" information, please insert this letter in front of the December 28, 1989.

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Effective Date: 1/1/90

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Enclosure

JUSTIFICATIONS FOR REVISION 28

These changes to the generic section of the Off-Site Dose Calculation Manual are made for the following reasons:

1) Updated Table of Contents to agree with current page numbers.

2) Changed "System Radwaste Engineer" to "System Radiation Protection Manager" to conform with current company titles.

3) Added Mo-99 dose calculation paramaters to manual.

4) Corrected the Cerium cow-milk and goat-milk stable element transfer coefficient from 6.0E-04 to 1.0E-04, and changed affected tables.

5) Added Vegetable/Soil stable element transfer data and associated formulas to manual.

6) Correct several typographical errors in definitions and/or tables.

You may replace the entire section

behind the "General" tab with this

package

OFFSITE DOSE CALCULATION MANUAL

FOR

DUKE POWER NUCLEAR STATIONS

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INTRODUCTION

The Offsite Dose Calculation Manual provides the methodology and parameters to be used in the calculation of off-site doses due to radioactive liquid and gaseous effluents to assure compliance with the dose limitations of the Technical Specifications. These dose limitations assure that:

1) the concentration of radioactive liquid effluents from the site to the unrestricted area will be limited to the concentration levels of 10CFR20, Appendix B, Table II;

2) the exposures to any individual from radioactive liquid effluents will not result in doses greater than the design objectives of 10CFR50, Appendix I;

3) the dose rate at any time at the site boundary from radioactive gaseous effluents will be limited to the annual dose limits of 10CFR20 for unrestricted areas; and

4) the exposure to any individual from radioactive gaseous effluents will not result in doses greater than the design objectives of 10CFR50, Appendix I.

The methodology used to assure compliance with the dose limitations described above shall also be used to prepare the radioactive liquid and gaseous effluent reports required by the Technical Specifications. To assure compliance with 40CFR190 when twice the design objectives of 10CFR50, Appendix I are exceeded, the methodology and parameters to be used in calculating the off-site dose to any individual resulting from the entire fuel cycle except mining and waste management facilities are provided in this Manual.

The Manual also provides the methodology and parameters to be used in the calculation of radioactive liquid and gaseous effluent monitoring instrumentation alarm/trip setpoints to assure compliance with the concentration and dose rate limitations of the Technical Specifications. Changes to the methodology and parameters used in this Manual shall be reviewed by a qualified reviewer(s) and approved by the Station Manager and the System Radiation Protection Manager prior to implementation and shall be audited by the Nuclear Safety Review Board. Changes to this Manual shall be submitted to the Nuclear Regulatory Commission in accordance with plant Technical Specifications.

Normally GASPAR and LADTAP are used for the calculation of offsite doses but this document also describes a method for the calculation of offsite doses when GASPAR and/or LADTAP are not available.

This Manual does not replace any station implementing procedures.

1.0 RELEASE RATE CALCULATIONS

The release rate calculations presented in the following sections are site release limits. Sites containing two or more units shall administratively control releases to assure that the release rate calculations limit releases as stated in the Technical Specifications. Administrative controls could limit the number of releases occurring at one time and/or apportion the release rate between the units.

1.1 LIQUID EFFLUENTS

To comply with Technical Specifications and to assure that the concentration of radioactive liquid effluents from the site to the unrestricted area is limited to the concentrations of 10CFR20, Appendix B, Table II, Column 2, the following release rate calculation shall be performed:

$$f \leq F \cdot \left(\sigma \sum_{i=1}^{n} \frac{C_i}{MPC_i}\right)$$

where:

C_i = The concentration of radionuclide, 'i', in undiluted liquid effluent, in µCi/ml.

MPC_i = the concentration of radionuclide, 'i', from 10CFR20, Appendix B, Table II, Column 2, in µCi/ml.

f = the undiluted effluent flow from the tank, in gpm.

F = the dilution flow from the site discharge structure to unrestricted area receiving waters, in gpm.

σ = recirculation factor at equilibrium; this factor accounts for the fraction of discharged water reused by the station; this factor is one for stations on rivers or lakes where discharged water cannot be reused, and varies for sites where water is recirculated and is specified in the appropriate Appendix.

1.2 GASEOUS EFFLUENTS

In order to comply with the Technical Specifications and to assure that the dose rate, at any time, in the unrestricted area due to radioactive materials released in gaseous effluents from the site is limited to ≤500 mrem/yr to the total body and ≤3000 mrem/yr to the skin for the noble gases and is limited to ≤1500 mrem/yr to any organ for all radioiodine and for all radioactive materials in particulates form and radionuclides other than noble gases with half lives greater than 8 days, the following release rate calculations shall be performed. These calculations, when solved for 'f', i.e. flowrate, are the release rates for noble gases and for radioiodines, particulates and other radionuclides with half-lives greater than 8 days. The most conservative of release rates calculated shall control the release rate.

1.2.1 Noble Gases

$\sum_i K_i \times [(\overline{X/Q})\tilde{Q}_i] < 500$ mrem/yr, and

$\sum_i (L_i + 1.1\, M_i)\, [(\overline{X/Q})\tilde{Q}_i] < 3000$ mrem/yr

where:

K_i = The total body dose factor due to gamma emissions for each identified noble gas radionuclide, in mrem/yr per µCi/m³ from Table 1.2-1.

L_i = The skin dose factor due to beta emissions for each identified noble gas radionuclide, in mrem/yr per µCi/m³ from Table 1.2-1.

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide, in mrad/yr per µCi/m³ from Table 1.2-1 (unit conversion constant of 1.1 mrem/mrad converts air dose to skin dose).

P_i = The dose parameter for radionuclides other than noble gases for the inhalation pathway, in mrem/yr per µCi/m³ and for the food and ground plane pathways in m².(mrem/yr per µCi/sec) from Table 1.2-2. The dose factors are based on the critical individual organ and most restrictive age group (child or infant).

$\tilde{Q}_i$ = The release rate of radionuclides, 'i', in gaseous effluent from all release points at the site, in µCi/sec.

$\overline{X/Q}$ = The highest calculated annual average dispersion parameter for any area at or beyond the unrestricted area boundary.

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

$\tilde{Q}_i = k_1 C_i f + k_2 = 4.72E+2\ C_i f$

where:

C_i = the concentration of radionuclide, 'i', in undiluted gaseous effluent, in µCi/ml.

f = the undiluted effluent flow, in cfm.

k_1 = conversion factor, 2.83E+04 ml/ft³.

k_2 = conversion factor, 6.0E+01 sec/min.

1.2.2 Radioiodines, Particulates, and Others

$\sum_i P_i\, [W\, \tilde{Q}_i] < 1500$ mrem/yr

where the terms are as defined above.

TABLE 1.2-1
(1 of 1)

DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS*

Radionuclide	Total Body Dose Factor K_i (mrem/yr per µCi/m³)	Skin Dose Factor L_i (mrem/yr per µCi/m³)	Gamma Air Dose Factor M_i (mrad/yr per µCi/m³)	Beta Air Dose Factor N_i (mrad/yr per µCi/m³)
Kr-83m	7.56E-02**	---	1.93E+01	2.88E+02
Kr-85m	1.17E+03	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.61E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	5.92E+03	9.73E+03	6.17E+03	1.03E+04
Kr-88	1.47E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.66E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.56E+04	7.29E+03	1.63E+04	7.83E+03
Xe-131m	9.15E+01	4.76E+02	1.56E+02	1.11E+03
Xe-133m	2.51E+02	9.94E+02	3.27E+02	1.48E+03
Xe-133	2.94E+02	3.06E+02	3.53E+02	1.05E+03
Xe-135m	3.12E+03	7.11E+02	3.36E+03	7.39E+02
Xe-135	1.81E+03	1.86E+03	1.92E+03	2.46E+03
Xe-137	1.42E+03	1.22E+04	1.51E+03	1.27E+04
Xe-138	8.83E+03	4.13E+03	9.21E+03	4.75E+03
Ar-41	8.84E+03	2.69E+03	9.30E+03	3.28E+03

*The listed dose factors are for radionuclides that may be detected in gaseous effluents.
**7.56E-02 = 7.56×10^{-2}.

TABLE 1.2-2
(1 of 1)

DOSE PARAMETERS FOR RADIOIODINES AND RADIOACTIVE PARTICULATE, GASEOUS EFFLUENTS*

P(I), DOSE PARAMETERS FOR RADIOIODINES AND RADIOACTIVE PARTICULATES IN GASEOUS EFFLUENTS

	Pathways			Pathways	
Radionuclide	Inhalation (mrem/yr per μCi/m³)	Food and Ground (m^2.mrem/yr per μCi/sec)	Radionuclide	Inhalation (mrem/yr per μCi/m³)	Food and Ground (m^2.mrem/yr per μCi/sec)
H 3	1.125 E+03	2.4E+03	RU 103	6.625 E+05	1.6E+08
Alpha Act	1.100 E+08	1.8E+10	RU 106	1.432 E+07	2.0E+08
CR 51	1.698 E+04	1.1E+07	AG 110M	5.476 E+06	1.5E+10
MN 54	1.576 E+06	1.1E+09	CD 115M	2.920 E+05	5.2E+07
FE 55	1.110 E+05	1.1E+08	SN 123	3.550 E+06	3.7E+09
FE 59	1.269 E+06	7.2E+08	SN 126	1.120 E+07	1.1E+10
CO 58	1.106 E+06	5.8E+08	SB 124	3.240 E+06	1.4E+09
CO 60	7.067 E+06	4.6E+09	SB 125	2.320 E+06	9.1E+08
NI 63	8.214 E+05	3.0E+10	TE 127M	1.408 E+06	1.0E+09
ZN 65	8.399 E+04	1.8E+10	TE 129M	1.761 E+06	1.3E+09
RB 86	1.983 E+05	2.1E+10	CS 134	1.014 E+06	5.6E+10
SR 89	2.157 E+06	1.1E+10	CS 136	1.709 E+05	5.7E+09
SR 90	1.010 E+08	1.0E+11	CS 137	9.065 E+05	5.0E+10
Y 91	2.627 E+06	5.9E+06	BA 140	1.743 E+06	2.6E+08
ZR 95	2.231 E+06	3.5E+08	CE 141	5.439 E+05	3.2E+07
NB 95	6.142 E+05	3.8E+08	CE 144	1.195 E+07	1.6E+08
MO 99	1.354 E+05	3.2E+08	I 131	1.624 E+07	1.0E+12
			I 133	3.848 E+06	9.6E+09

*If SR-90 analysis is performed, use P(I) given in I-131 for unidentified components. If SR-90 and I-131 analyses are performed, use P(I) given in CS-137 for unidentified components. If SR-90, I-131, and CS-137 analyses are performed, use P(I) given in Zn-65 for unidentified components.

Revision 5
9/10/84

2.0 RADIATION MONITORING SETPOINTS

Effluent radiation monitor alarm/trip setpoints shall be determined using the calculations presented in the following sections. The calculations define the relationships between the measured effluent activity, the maximum allowable effluent activity, the effluent flowrate, and the dilution available in the restricted area (as defined for effluent releases in the Technical Specifications) which must be controlled to assure that the instantaneous release rate is not exceeded.

The setpoints shall be determined for those monitors listed in the appropriate tables of the Technical Specifications.

2.1 LIQUID MONITORS

The following equation shall be used to calculate liquid radiation monitor setpoints:

$$\frac{Cf}{F + f} \leq MPC$$

where:

MPC = the effluent concentration limit implementing 10CFR20 for the site, in µCi/ml.

C = the radioactivity concentration in µCi/ml, in the effluent line prior to dilution and subsequent release, which may be the setpoint and, if so, represents a value which, if exceeded, would result in concentrations exceeding the limits of 10CFR20 in the unrestricted area.

f = the flow measured at the radiation monitor location in gpm.

F = the dilution water flow as measured prior to the release point in gpm.

(Note that if no dilution is provided, C ≤ MPC. Also, note that when (F) is large compared to (f), then F + f ≅ F.)

2.2 GAS MONITORS

The following equation shall be used to calculate noble gas radiation monitor setpoints based on Xe-133:

$$K_i(\overline{X/Q})\tilde{Q}_i < 500$$

$$\tilde{Q}_i = 4.72E+2\ C\ f \text{ (See Section 1.2.1)}$$

where:

C = the gross activity in undiluted effluent, in µCi/ml.

f = the flow from the tank or building and varies for various release sources, in cfm.

K_i = from Table 1.2-1 for Xe-133, 2.94E+2 mrem/yr per $\mu Ci/m^3$.

$\overline{X/Q}$ = the highest calculated annual average dispersion parameter for any area at or beyond the unrestricted area boundary for long term releases.

3.0 DOSE CALCULATIONS

3.1 DOSE MODELS FOR MAXIMUM EXPOSED INDIVIDUAL

3.1.1 Liquid Effluents

Of the possible exposure pathways in the aquatic environment, only two contribute significantly to the total dose; these pathways are ingestion of potable water and aquatic foods. The dose contributions, from these pathways, for measured quantities of radioactive materials identified in liquid effluents released to unrestricted areas shall be calculated for the maximum exposed individual in each age group using:

$$D_{a\tau} = \sum_i \left[A_{ai\tau} \sum_{\ell=1}^{m} \Delta t_\ell \, C_{i\ell} \, F_\ell \right]$$

where:

$D_{a\tau}$ = the cumulative dose commitment to the total body or any organ, τ, for an individual of age group, a, from the liquid effluent for the total time period $\sum_{\ell=1}^{m} \Delta t_\ell$, in mrem.

Δt_ℓ = the length of the ℓth time period over which $C_{i\ell}$ and F_ℓ are averaged for all liquid releases, in hours.

$C_{i\ell}$ = the average concentration of radionuclide, 'i', in undiluted liquid effluent during time period Δt_ℓ from any liquid release, in µCi/ml.

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

$$F_\ell = \frac{f\sigma}{F + f}$$

where:

σ = recirculation factor at equilibrium; this factor accounts for the fraction of discharged water reused by the station. This factor is one for stations on rivers or lakes where discharged water cannot be reused and varies for sites where water is recirculated. It is specified in the appropriate Appendix.

f = liquid radwaste flow, in gpm.

F = dilution flow, in gpm.

$A_{ai\tau}$ = the site related ingestion dose commitment factor for an individual of age group, a, to the total body or any organ, 'τ', for each identified principal gamma and beta emitter, mrem/hr per µCi/ml.

$$A_{ai\tau} = 1.14E{+}05 \, (U_{aw}/D_w + U_{af} BF_i) DF_{ai\tau}$$

where:

1.14E5 = 10^6pCi/μCi x 10^3ml/kg ÷ 8760 hr/yr.

U_{aw} = Water consumption by age group, ℓ/yr.

infant	330
child	510
teen	510
adult	730

D_w = Dilution factor from the near field area to the potable water intake.

U_{af} = fish consumption by age group, kg/yr.

infant	--
child	6.9
teen	16
adult	21

BF_i = Bioaccumulation factor for radionuclide, 'i', in fish, pCi/kg per pCi/l, from Table 3.1-1.

DF_{ait} = Dose conversion factor for radionuclide, 'i', by age group in pre-selected organ, τ, in mrem/pCi, from Tables 3.1-2, 3.1-3, 3.1-4, and 3.1-5, respectively.

Using the above information, A_{ait} values for the adult have been calculated for each site. This information is provided in the Table "X" 4.0-3 where "X" is the appendix for the site in question.

3.1.2 Gaseous Effluents

The dose contributions from measured quantities of radioactive materials identified in gaseous effluent released to unrestricted areas shall be calculated for the maximum exposed individual using the following equations:

3.1.2.1 Noble Gases

For gamma radiation:

$$D_\gamma = 3.17\ E\text{-}8 \sum_{i=1} M_i\ [(\overline{X/Q})\ \tilde{Q}_i]$$

For beta radiation:

$$D_\beta = 3.17\ E\text{-}8 \sum_{i=1} N_i\ [(\overline{X/Q})\ \tilde{Q}_i]$$

where:

3.17E-08 = The inverse of the number of seconds in a year.

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide, in mrad/yr per μCi/m^3 from Table 1.2-1.

N_i = The air dose factor due to beta emissions for each identified noble gas radionuclide, in mrad/yr per µCi/m³ from Table 1.2-1.

$\overline{X/Q}$ = The highest calculated annual average relative concentration for any area at or beyond the unrestricted area boundary.

$\tilde{Q}_i$ = The release of noble gas radionuclides, 'i', in gaseous effluents, in µCi.

3.1.2.2 Radioiodines, Particulates, and Others

These calculations apply to all radioiodines, radioactive materials in particulate form and radionuclides other than noble gases with half-lives greater than 8 days:

$$D = 3.17\ E\text{-}8 \sum_i R_i\ [W\tilde{Q}_i]$$

where:

3.17E-08 = The inverse of the number of seconds in a year.

$\tilde{Q}_i$ = The release of radioiodines, radioactive materials in particulate form and radionuclides other than noble gases in gaseous effluents, 'i', in µCi. Releases shall be cumulative over the calendar quarter or year as appropriate.

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

$W = (\overline{X/Q})$ for the inhalation pathway, in sec/m³.

$W = (\overline{D/Q})$ for the food and ground plane pathways, in meters^{-2}.

R_i = The dose factor for each identified radionuclide, 'i', in m².(mrem/yr) per µCi/sec or mrem/yr per µCi/m³, for each pathway. (Tables 3.1-12 → 3.1-30)

where:

Inhalation Pathway Factor, $R_i^I\ [X/Q]$

$$R_i^I\ [X/Q] = K'(BR)_a\ (DFA_i)_a \text{ (mrem/yr per µCi/m}^3\text{)}$$

where:

K' = a constant of unit conversion, 10^6 pCi/µCi.

$(BR)_a$ = the breathing rate of the receptor of age group (a), in m³/yr.

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

Age Group (a)	Breathing Rate (m^3/yr)
Infant	1400
Child	3700
Teen	8000
Adult	8000

$(DFA_i)_a$ = the maximum organ inhalation dose factor the receptor of age group (a) for the ith radionuclide, in mrem/pCi. The total body is considered as an organ in the selection of $(DFA_i)_a$. See Tables 3.1-6, 3.1-7, 3.1-8, and 3.1-9.

Inhalation dose factors $(DFA_i)_a$ for the various age groups are given in Tables 3.1-6, 3.1-7, 3.1-8, and 3.1-9 (taken from Regulatory Guide 1.109 (Rev.1)).

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

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

where:

K' = a constant of unit conversion, 10^6 pCi/μCi.

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

λ_i = the decay constant for the ith radionuclide, sec^{-1}.

t = the exposure time, 4.73×10^8 sec (15 years).

DFG_i = the ground plane dose conversion factor for the ith radionuclide (mrem/hr per pCi/m^2).

SF = the shielding factor (dimensionless), 0.7 (Regulatory Guide 1.109 (Rev. 1)).

Ground plane dose conversion factors, DFG, are found in Table 3.1-10.

Grass-Cow-Milk Pathway Factor, R_i^C [D/Q]

$$R_i^C [D/Q] = K' E Q_F(U_{ap}) F_m(DFL_i)_a \left\{ \frac{(r)}{(\lambda_i + \lambda_w)} \times \left[\frac{f_p f_s}{Y_p} (1-\exp(-(\lambda_i + \lambda_w)t_{ep})) \right.\right.$$

$$\left.\left. + \frac{(1-f_p f_s)}{Y_s} (1-\exp(-(\lambda_i + \lambda_w)t_{es})) \exp(-\lambda_i t_h)\right] + \frac{B_{iv}}{P\lambda_i} (1-\exp(-\lambda_i t_b))\right\} \exp(-\lambda_i t_f)$$

$(m^2 \cdot \text{mrem/yr per } \mu\text{Ci/sec})$

where:

K' = a constant of unit conversion, 10^6 pCi/μCi.

Q_F = the cow's consumption rate, in kg/day (wet weight), (Regulatory Guide 1.109 (Rev. 1)). (Milk cow = 50, Beef Cattle = 50, Goats = 6).

U_{ap} = the receptor's milk consumption rate for age (a), in liters/yr.

U_{ap} (liters/yr)
- Infant 330
- Child 330
- Teen 400
- Adult 310 (Regulatory Guide 1.109 (Rev. 1))

Y_p = the agricultural productivity by unit area of pasture feed grass, in kg/m^2, 0.7.

Y_s = the agricultural productivity by unit area of stored feed, in kg/m^2, 2.0.

F_m = the stable element transfer coefficients, in days/liter, Table 3.1-11.

r = fraction of deposited activity retained on cow's feed grass, r = 1 for radioiodine and r = 0.2 for particulates (Regulatory Guide 1.109).

$(DFL_i)_a$ = the maximum organ ingestion dose factor for the ith radionuclide for the receptor in age group 'a', in mrem/pCi. See Tables 3.1-2, 3.1-3, 3.1-4, and 3.1-5.

λ_i = the decay constant for the ith radionuclide, in sec^{-1}.

λ_w = the decay constant for removal of activity on leaf and plant surfaces by weathering, 5.73×10^{-7} sec^{-1} (corresponding to a 14 day half-life).

t_f = the transport time from pasture to cow, to milk, to receptor, in sec, 1.73×10^5 (2 days).

t_h = the transport time from pasture, to harvest, to cow, to milk, to receptor, in sec, 7.78×10^6 (90 days).

f_p = fraction of the year that the cow is on pasture (dimensionless), 1.0.

f_s = fraction of the cow feed that is pasture grass while the cow is on pasture (dimensionless), 1.0.

E = an adjustment fraction which accounts for the fraction of radionuclides in elemental form which contribute dose for this pathway, E = 0.5 for radioiodine, E = 1.0 for all others.

t_{ep} = period of pasture grass exposure during growing season, in seconds, 2.59E+06 (corresponding to 30 days, Regulatory Guide 1.109).

t_{es} = period of stored feed crop/vegetation exposure during growing season, in seconds, 5.18E+06 (corresponding to 60 days, Regulatory Guide 1.109).

B_{iv} = concentration factor for uptake of radionuclide i from soil by edible parts of crops, in pCi/Kg (wet weight) per pCi/Kg dry soil (Regulatory Guide 1.109). See Table 3.1-11.

P = the effective "surface density" for soil, in kg (dry soil)/m^2, 240 (Regulatory Guide 1.109).

t_b = period of long-term buildup for activity in soil, in seconds, 4.73E8 (corresponding to 15 years, Regulatory Guide 1.109).

The concentration of tritium in milk is based on the airborne concentration rather than the deposition. Therefore, the R_i^C is based on [χ/Q]:

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

where:

K''' = a constant of unit conversion, 10^3 gm/kg.

H = absolute humidity of the atmosphere, 8 gm/m^3, (Regulatory Guide 1.109)

0.75 = the fraction of total feed that is water.

0.5 = the ratio of the specific activity of the feed grass water to the atmospheric water.

Grass-Cow-Meat Pathway Factor, R_i^M [D/Q]

The integrated concentration in meat follows in a similar manner to the development for the milk pathway, therefore:

$$R_i^M [D/Q] = K' E Q_F(U_{ap}) F_f(DFL_i)_a \left[\frac{(r)}{(\lambda_i + \lambda_w)} x \left[\frac{f_p f_s}{Y_p} (1-\exp(-(\lambda_i + \lambda_w)t_{ep})) \right.\right.$$

$$\left.\left. + \frac{(1-f_p f_s)}{Y_s} (1-\exp(-(\lambda_i + \lambda_w)t_{es})) \times \exp(-\lambda_i t_h)\right] + \frac{B_{iv}}{P\lambda_i} (1-\exp(-\lambda_i t_b))\right] x$$

$$\exp(-\lambda_i t_f) \ (m^2 \cdot \text{mrem/yr per } \mu\text{Ci/sec})$$

where:

F_f = the stable element transfer coefficients, in days/kg, Table 3.1.11.

U_{ap} = the receptor's meat consumption rate for age (a), in kg/yr.

U_{ap} (kg/yr) - Infant 0
- Child 41
- Teen 65
- Adult 110 Taken from Regulatory Guide 1.109 (Rev. 1).

t_f = the transport time from pasture to cow, to meat, to receptor, in sec, 1.73×10^6 (20 days).

t_h = the transport time from crop field to receptor, in sec, 7.78×10^6 (90 days).

The concentration of tritium in meat is based on its airborne concentration rather than the deposition. Therefore, the R_i^M is based on [X/Q]:

$$R_i^M[X/Q] = K'K''' F_f Q_F U_{ap} (DFL_i)_a \ [0.75(0.5/H)] \ (\text{mrem/yr per } \mu\text{Ci/m}^3)$$

where all terms are defined above.

Vegetation Pathway Factor, $R_i^V[D/Q]$

The integrated concentration in vegetation consumed by man follows the expression developed in the derivation of the milk factor. Man is considered to consume two types of vegetation (fresh and stored) that differs only in the time period between harvest and consumption, therefore:

$$R_i^V = K' \ E \ (DFL_i)_a \ \left[\frac{(r)}{Y_v(\lambda_i+\lambda_w)} \ (1-\exp(-(\lambda_i+\lambda_w)t_e)) + \frac{B_{iv}}{P\lambda_i} \ (1-\exp(-\lambda_i t_b)) \right] x$$

$$\left[U_a^L f_L e^{-\lambda_i t_L} + U_a^s f_g e^{-\lambda_i t_h} \right]$$

$$(\text{m}^2 \cdot \text{mrem/yr per } \mu\text{Ci/sec})$$

where:

K' = a constant of unit conversion, 10^6 pCi/μCi.

U_a^L = the consumption rate of fresh leafy vegetation by the receptor in age group (a), in kg/yr.

U_a^L = (kg/hr) - Infant 0
- Child 26
- Teen 42
- Adult 64

U_a^S = the consumption rate of stored vegetation by the receptor in age group (a), in kg/yr.

- Child 520
- Teen 630
- Adult 520

f_L = the fraction of the annual intake of fresh leafy vegetation grown locally, (1.0).

f_g = the fraction of the annual intake of stored vegetation grown locally, (0.76).

t_L = the average time between harvest of leafy vegetation and its consumption, in seconds, 8.6×10^4 (1 day).

t_h = the average time between harvest of stored vegetation and its consumption, in seconds, 5.18×10^6 (60 days).

Y_v = the vegetation area density, 2.0 kg/m^2.

and all other factors are previously defined.

The concentration of tritium in vegetation is based on the airborne concentration rather than the deposition. Therefore, the R_i^V is based on [X/Q]:

$$R_i^V[X/Q] = K'K''' \left[U_a^L f_L + U_a^S f_g\right](DFL_i)_a \quad [0.75(0.5/H)] \text{ (mrem/yr per } \mu Ci/m^3).$$

All terms defined previously.

3.1.3 Direct Radiation

Direct radiation is that radiation from confined sources and does not include any external component from radioactive effluents. The point kernel method has been used to calculate offsite dose rates from radioactive materials stored in the refueling water storage tanks, reactor makeup water storage tanks, and temporary on-site radwaste storage tanks. Dose calculations using this method performed for Duke Nuclear Stations indicate direct radiation doses are much less than 0.01 mrem/yr. and, therefore, makes a negligible contribution to individual dose. Direct radiation doses will not be calculated routinely.

3.2 SIMPLIFIED DOSE PROJECTIONS

To estimate the cumulative dose contributions to the maximum exposed individual for 31 day dose projection calculations, the calculations presented in

Section 3.1 can be simplified. The simplified calculations would be for an individual in the critical population using only data for the critical pathway and critical radionuclide(s). Critical populations, critical pathways, and critical radionuclides have been determined for each Duke Nuclear Station from the dose calculations performed to evaluate compliance with Appendix I to 10CFR50.

Simplified 31-day dose projection calculations are presented in the section on site specific information.

3.3 FUEL CYCLE CALCULATIONS

In accordance with the requirements of 40CFR190, the annual dose commitment to any member of the general public shall be calculated to assure that doses are limited to 25 millirems to the total body or any organ with the exception of the thyroid which is limited to 75 millirems. In accordance with the requirements of the Technical Specifications, the annual dose commitment shall also be calculated any time that one of the quarterly dose limits of the Technical Specifications is exceeded; these annual dose commitments may not just be calculated for the calendar year.

The "Uranium fuel cycle" is defined in 40CFR Part 190.02(b) as:

> "Uranium fuel cycle means the operations of milling or uranium ore, chemical conversion of uranium, isotopic enrichment of uranium, fabrication of uranium fuel, generation of electricity by a light-water-cooled nuclear power plant using uranium fuel, and reprocessing of spent uranium fuel, to the extent that these directly support the production of electrical power for public use utilizing nuclear energy, but excludes mining operations, operations at waste disposal sites, transportation of any radioactive material in support of these operations, and the reuse of recovered non-uranium special nuclear and by-product materials from the cycle."

Based on this definition of the fuel cycle and the information in 10CFR51 Table S-3 and WASH-1248, the radiological impact of the following operations has been assessed for Duke Nuclear Stations:

3.3.1 Milling

No milling operations occur within fifty miles of any Duke Nuclear Station. The increment of dose from milling operations to any individual within fifty miles of any Duke Nuclear Station is negligible.

3.3.2 Conversion

No uranium hexafluoride production occurs within fifty miles of any Duke Nuclear Station. The increment of dose from UF_6 production to any individual within fifty miles of any Duke Nuclear Station is negligible.

3.3.3 Enrichment

No uranium enrichment operations occur within fifty miles of any Duke Nuclear Station. The increment of dose from enrichment operations to any individual within fifty miles of any Duke Nuclear Station is negligible.

3.3.4 Fuel Fabrication

No fuel fabrication operations occur within fifty miles of any Duke Nuclear Station. The increment of dose from fabrication operations to any individual within fifty miles of any Duke Nuclear Station is negligible.

3.3.5 Nuclear Power Production

The production of electricity for public use using light-water-cooled nuclear power stations results in increments of dose to individuals within fifty miles of any station due to liquid and gaseous effluent releases and direct radiation or skyshine. The increments of dose resulting from liquid and gaseous effluent releases will be calculated using the methodology presented in Sections 3.1.1 and 3.1.2. The dose from direct radiation, skyshine, and radiation from the station storage facilities has been estimated using conservative assumptions (see Section 3.1.3).

In certain situations more than one nuclear power station site may contribute to the doses to be considered in making fuel cycle dose assessments in accordance with 40CFR190. Situations involving more than one station will be presented in the section on site specific information.

3.3.6 Fuel Reprocessing

No fuel reprocessing operations occur within fifty miles of any Duke Nuclear Station. The increment of dose from reprocessing operations to any individual within fifty miles of any Duke Nuclear Station is negligible.

To summarize, only dose increments from nuclear power production operations (Section 3.3.5) need be considered in calculations to demonstrate compliance with the requirements of 40CFR190.

TABLE 3.1-1*
(1 of 1)
BIOACCUMULATION FACTORS TO BE USED IN THE ABSENCE OF SITE-SPECIFIC DATA
(pCi/kg per pCi/liter)

ELEMENT	FRESHWATER FISH	FRESHWATER INVERTEBRATE
H	9.0E-01	9.0E-01
Na	1.0E+02	2.0E 02
Cr	2.0E 02	2.0E 03
Mn	4.0E 02	9.0E 04
Fe	1.0E 02	3.2E 03
Co	5.0E 01	2.0E 02
Ni	1.0E 02	1.0E 02
Cu	5.0E 01	4.0E 02
Zn	2.0E 03	1.0E 04
Br	4.2E 02	3.3E 02
Rb	2.0E 03	1.0E 03
Sr	3.0E 01	1.0E 02
Y	2.5E 01	1.0E 03
Zr	3.3E 00	6.7E 00
Nb	3.0E 04	1.0E 02
Mo	1.0E 01	1.0E 01
Tc	1.5E 01	5.0E 00
Ru	1.0E 01	3.0E 02
Rh	1.0E 01	3.0E 02
Te	4.0E 02	6.1E 03
I	1.5E 01	5.0E 00
Cs	2.0E 03	1.0E 03
Ba	4.0E 00	2.0E 02
La	2.5E 01	1.0E 03
Ce	1.0E 00	1.0E 03
Pr	2.5E 01	1.0E 03
Nd	2.5E 01	1.0E 03
W	1.2E 03	1.0E 01
Np	1.0E 01	4.0E 02

* Table taken from Regulatory Guide 1.109 (Rev.1)

TABLE 3.1-1
(1 of 1)

TABLE 3.1-2*
(1 of 3)
INGESTION DOSE FACTORS FOR ADULTS
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07
NA 24	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06
CR 51	NO DATA	NO DATA	2.66E-09	1.59E-09	5.86E-10	3.53E-09	6.69E-07
MN 54	NO DATA	4.57E-06	8.72E-07	NO DATA	1.36E-06	NO DATA	1.40E-05
MN 56	NO DATA	1.15E-07	2.04E-08	NO DATA	1.46E-07	NO DATA	3.67E-06
FE 55	2.75E-06	1.90E-06	4.43E-07	NO DATA	NO DATA	1.06E-06	1.09E-06
FE 59	4.34E-06	1.02E-05	3.91E-06	NO DATA	NO DATA	2.85E-06	3.40E-05
CO 58	NO DATA	7.45E-07	1.67E-06	NO DATA	NO DATA	NO DATA	1.51E-05
CO 60	NO DATA	2.14E-06	4.72E-06	NO DATA	NO DATA	NO DATA	4.02E-05
NI 63	1.30E-04	9.01E-06	4.36E-06	NO DATA	NO DATA	NO DATA	1.88E-06
NI 65	5.28E-07	6.86E-08	3.13E-08	NO DATA	NO DATA	NO DATA	1.74E-06
CU 64	NO DATA	8.33E-08	3.91E-08	NO DATA	2.10E-07	NO DATA	7.10E-06
ZN 65	4.84E-06	1.54E-05	6.96E-06	NO DATA	1.03E-05	NO DATA	9.70E-06
ZN 69	1.03E-08	1.97E-08	1.37E-09	NO DATA	1.28E-08	NO DATA	2.96E-09
BR 83	NO DATA	NO DATA	4.02E-08	NO DATA	NO DATA	NO DATA	5.79E-08
BR 84	NO DATA	NO DATA	5.21E-08	NO DATA	NO DATA	NO DATA	4.09E-13
BR 85	NO DATA	NO DATA	2.14E-09	NO DATA	NO DATA	NO DATA	LT E-24
RB 86	NO DATA	2.11E-05	9.83E-06	NO DATA	NO DATA	NO DATA	4.1[illegible]E-06
RB 88	NO DATA	6.05E-08	3.21E-08	NO DATA	NO DATA	NO DATA	8.36E-19
RB 89	NO DATA	4.01E-08	2.82E-08	NO DATA	NO DATA	NO DATA	2.33E-21
SR 89	3.08E-04	NO DATA	8.84E-06	NO DATA	NO DATA	NO DATA	4.94E-05
SR 90	7.58E-03	NO DATA	1.86E-03	NO DATA	NO DATA	NO DATA	2.19E-04
SR 91	5.67E-06	NO DATA	2.29E-07	NO DATA	NO DATA	NO DATA	2.70E-05
SR 92	2.15E-06	NO DATA	9.30E-08	NO DATA	NO DATA	NO DATA	4.26E-05
Y 90	9.62E-09	NO DATA	2.58E-10	NO DATA	NO DATA	NO DATA	1.02E-04
Y 91M	9.09E-11	NO DATA	3.52E-12	NO DATA	NO DATA	NO DATA	2.67E-10
Y 91	1.41E-07	NO DATA	3.77E-09	NO DATA	NO DATA	NO DATA	7.76E-05
Y 92	8.45E-10	NO DATA	2.47E-11	NO DATA	NO DATA	NO DATA	1.48E-05
Y 93	2.68E-09	NO DATA	7.40E-11	NO DATA	NO DATA	NO DATA	8.50E-05
ZR 95	3.04E-08	9.75E-09	6.60E-09	NO DATA	1.53E-08	NO DATA	3.09E-05
ZR 97	1.68E-09	3.39E-10	1.55E-10	NO DATA	5.12E-10	NO DATA	1.05E-04

*Table taken from Regulatory Guide 1.109 (Rev. 1)

TABLE 3.1-2
(2 of 3)
INGESTION DOSE FACTORS FOR ADULTS
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
NB 95	6.22E-09	3.46E-09	1.86E-09	NO DATA	3.42E-09	NO DATA	2.10E-05
MO 99	NO DATA	4.31E-06	8.20E-07	NO DATA	9.76E-06	NO DATA	9.99E-06
TC 99M	2.47E-10	6.98E-10	8.89E-09	NO DATA	1.06E-08	3.42E-10	4.13E-07
TC 101	2.54E-10	3.66E-10	3.59E-09	NO DATA	6.59E-09	1.87E-10	1.10E-21
RU 103	1.85E-07	NO DATA	7.97E-08	NO DATA	7.06E-07	NO DATA	2.16E-05
RU 105	1.54E-08	NO DATA	6.08E-09	NO DATA	1.99E-07	NO DATA	9.42E-06
RU 106	2.75E-06	NO DATA	3.48E-07	NO DATA	5.31E-06	NO DATA	1.78E-04
AG 110M	1.60E-07	1.48E-07	8.79E-08	NO DATA	2.91E-07	NO DATA	6.04E-05
TE 125M	2.68E-06	9.71E-07	3.59E-07	8.06E-07	1.09E-05	NO DATA	1.07E-05
TE 127M	6.77E-06	2.42E-06	8.25E-07	1.73E-06	2.75E-06	NO DATA	2.27E-05
TE 127	1.10E-07	3.95E-08	2.38E-08	8.15E-08	4.48E-07	NO DATA	8.68E-06
TE 129M	1.15E-05	4.29E-06	1.82E-06	3.95E-06	4.80E-05	NO DATA	5.79E-05
TE 129	3.14E-08	1.18E-08	7.65E-09	2.41E-08	1.32E-07	NO DATA	2.37E-08
TE 131M	1.73E-06	8.46E-07	7.05E-07	1.34E-06	8.57E-06	NO DATA	8.40E-05
TE 131	1.97E-08	8.23E-09	6.22E-09	1.62E-08	8.63E-08	NO DATA	2.79E-09
TE 132	2.52E-06	1.63E-06	1.53E-06	1.80E-06	1.57E-05	NO DATA	7.71E-05
I 130	7.56E-07	2.23E-06	8.80E-07	1.89E-04	3.48E-06	NO DATA	1.92E-06
I 131	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	NO DATA	1.57E-06
I 132	2.03E-07	5.43E-07	1.90E-07	1.90E-05	6.65E-07	NO DATA	1.02E-07
I 133	1.42E-06	2.47E-06	7.53E-07	3.63E-04	4.31E-06	NO DATA	2.22E-06
I 134	1.06E-07	2.88E-07	1.03E-07	4.99E-06	4.58E-07	NO DATA	2.51E-10
I 135	4.43E-07	1.16E-06	4.28E-07	7.65E-05	1.86E-06	NO DATA	1.31E-06
CS 134	6.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E-06
CS 136	6.51E-06	2.57E-05	1.85E-05	NO DATA	1.43E-05	1.96E-06	2.92E-06
CS 137	7.97E-05	1.09E-04	7.14E-05	NO DATA	3.70E-05	1.23E-05	2.11E-06
CS 138	5.52E-08	1.09E-07	5.40E-08	NO DATA	8.01E-08	7.91E-09	4.65E-13
BA 139	9.70E-08	6.91E-11	2.84E-09	NO DATA	6.46E-11	3.92E-11	1.72E-07
BA 140	2.03E-05	2.55E-08	1.33E-06	NO DATA	8.67E-09	1.46E-08	4.18E-05
BA 141	4.71E-08	3.56E-11	1.59E-09	NO DATA	3.31E-11	2.02E-11	2.22E-17
BA 142	2.13E-08	2.19E-11	1.34E-09	NO DATA	1.85E-11	1.24E-11	3.00E-26
LA 140	2.50E-09	1.26E-09	3.33E-10	NO DATA	NO DATA	NO DATA	9.25E-05
LA 142	1.28E-10	5.82E-11	1.45E-11	NO DATA	NO DATA	NO DATA	4.25E-07
CE 141	9.36E-09	6.33E-09	7.18E-10	NO DATA	2.94E-09	NO DATA	2.42E-05

TABLE 3.1-2
(3 of 3)
INGESTION DOSE FACTORS FOR ADULTS
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
CE 143	1.65E-09	1.22E-06	1.35E-10	NO DATA	5.37E-10	NO DATA	4.56E-05
CE 144	4.88E-07	2.04E-07	2.62E-08	NO DATA	1.21E-07	NO DATA	1.65E-04
PR 143	9.20E-09	3.69E-09	4.56E-10	NO DATA	2.13E-09	NO DATA	4.03E-05
PR 144	3.01E-11	1.25E-11	1.53E-12	NO DATA	7.05E-12	NO DATA	4.33E-18
ND 147	6.29E-09	7.27E-09	4.35E-10	NO DATA	4.25E-09	NO DATA	3.49E-05
W 187	1.03E-07	8.61E-08	3.01E-08	NO DATA	NO DATA	NO DATA	2.82E-05
NP 239	1.19E-09	1.17E-10	6.45E-11	NO DATA	3.65E-10	NO DATA	2.40E-05

TABLE 3.1-3*
(1 of 3)
INGESTION DOSE FACTORS FOR TEENAGER
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07
NA 24	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06
CR 51	NO DATA	NO DATA	3.60E-09	2.00E-09	7.89E-10	5.14E-09	6.05E-07
MN 54	NO DATA	5.90E-06	1.17E-06	NO DATA	1.76E-06	NO DATA	1.21E-05
MN 56	NO DATA	1.58E-07	2.81E-08	NO DATA	2.00E-07	NO DATA	1.04E-05
FE 55	3.78E-06	2.68E-06	6.25E-07	NO DATA	NO DATA	1.70E-06	1.16E-06
FE 59	5.87E-06	1.37E-05	5.29E-06	NO DATA	NO DATA	4.32E-06	3.24E-05
CO 58	NO DATA	9.72E-07	2.24E-06	NO DATA	NO DATA	NO DATA	1.34E-05
CO 60	NO DATA	2.81E-06	6.33E-06	NO DATA	NO DATA	NO DATA	3.66E-05
NI 63	1.77E-04	1.25E-05	6.00E-06	NO DATA	NO DATA	NO DATA	1.99E-06
NI 65	7.49E-07	9.57E-08	4.36E-08	NO DATA	NO DATA	NO DATA	5.19E-07
CU 64	NO DATA	1.15E-07	5.41E-08	NO DATA	2.91E-07	NO DATA	8.92E-06
ZN 65	5.76E-06	2.00E-05	9.33E-06	NO DATA	1.28E-05	NO DATA	8.47E-06
ZN 69	1.47E-08	2.80E-08	1.96E-09	NO DATA	1.83E-08	NO DATA	5.16E-08
BR 83	NO DATA	NO DATA	5.74E-08	NO DATA	NO DATA	NO DATA	LT E-24
BR 84	NO DATA	NO DATA	7.22E-08	NO DATA	NO DATA	NO DATA	LT E-24
BR 85	NO DATA	NO DATA	3.05E-09	NO DATA	NO DATA	NO DATA	LT E-24
RB 86	NO DATA	2.98E-05	1.40E-05	NO DATA	NO DATA	NO DATA	4.41E-06
SB 88	NO DATA	8.52E-08	4.54E-08	NO DATA	NO DATA	NO DATA	7.90E-15
RB 89	NO DATA	5.50E-08	3.89E-08	NO DATA	NO DATA	NO DATA	8.43E-17
SR 89	4.40E-04	NO DATA	1.26E-05	NO DATA	NO DATA	NO DATA	5.24E-05
SR 90	8.80E-03	NO DATA	2.05E-03	NO DATA	NO DATA	NO DATA	2.33E-04
SR 91	8.07E-06	NO DATA	3.21E-07	NO DATA	NO DATA	NO DATA	3.56E-05
SR 92	3.05E-06	NO DATA	1.30E-07	NO DATA	NO DATA	NO DATA	7.77E-05
Y 90	1.37E-08	NO DATA	3.69E-10	NO DATA	NO DATA	NO DATA	1.13E-04
Y 91M	1.29E-10	NO DATA	4.93E-12	NO DATA	NO DATA	NO DATA	6.09E-09
Y 91	2.01E-07	NO DATA	5.39E-09	NO DATA	NO DATA	NO DATA	8.24E-05
Y 92	1.21E-09	NO DATA	3.50E-11	NO DATA	NO DATA	NO DATA	3.32E-05

*Taken from Regulatory Guide 1.109 (Rev. 1)

TABLE 3.1-3
(2 of 3)
INGESTION DOSE FACTORS FOR TEENAGER
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	3.83E-09	NO DATA	1.05E-10	NO DATA	NO DATA	NO DATA	1.17E-04
ZR 95	4.12E-08	1.30E-08	8.94E-09	NO DATA	1.91E-08	NO DATA	3.00E-05
ZR 97	2.37E-09	4.69E-10	2.16E-10	NO DATA	7.11E-10	NO DATA	1.27E-04
NB 95	8.22E-09	4.56E-09	2.51E-09	NO DATA	4.42E-09	NO DATA	1.95E-05
MO 99	NO DATA	6.03E-06	1.15E-06	NO DATA	1.38E-05	NO DATA	1.08E-05
TC 99M	3.32E-10	9.26E-10	1.20E-08	NO DATA	1.38E-08	5.14E-10	6.08E-07
TC 101	3.60E-10	5.12E-10	5.03E-09	NO DATA	9.26E-09	3.12E-10	8.75E-18
RU 103	2.55E-07	NO DATA	1.09E-07	NO DATA	8.99E-07	NO DATA	2.13E-05
RU 105	2.18E-08	NO DATA	8.46E-09	NO DATA	2.75E-07	NO DATA	1.76E-05
RU 106	3.92E-06	NO DATA	4.94E-07	NO DATA	7.56E-06	NO DATA	1.88E-04
AG 110M	2.05E-07	1.94E-07	1.18E-07	NO DATA	3.70E-07	NO DATA	5.45E-05
TE 125M	3.83E-06	1.38E-06	5.12E-07	1.07E-06	NO DATA	NO DATA	1.13E-05
TE 127M	9.67E-06	3.43E-06	1.15E-06	2.30E-06	3.92E-05	NO DATA	2.41E-05
TE 127	1.58E-07	5.60E-08	3.40E-08	1.09E-07	6.40E-07	NO DATA	1.22E-05
TE 129M	1.63E-05	6.05E-06	2.58E-06	5.26E-06	6.82E-05	NO DATA	6.12E-05
TE 129	4.48E-08	1.67E-08	1.09E-08	3.20E-08	1.88E-07	NO DATA	2.45E-07
TE 131M	2.44E-06	1.17E-06	9.76E-07	1.70E-06	1.22E-05	NO DATA	9.39E-05
TE 131	2.79E-08	1.15E-08	8.72E-09	2.15E-08	1.22E-07	NO DATA	2.29E-09
TE 132	3.49E-06	2.21E-06	2.08E-06	2.33E-06	2.12E-05	NO DATA	7.00E-05
I 130	1.03E-06	2.98E-06	1.19E-06	2.43E-04	4.59E-06	NO DATA	2.29E-06
I 131	5.85E-06	8.19E-06	4.40E-06	2.39E-03	1.41E-05	NO DATA	1.62E-06
I 132	2.79E-07	7.30E-07	2.62E-07	2.46E-05	1.15E-06	NO DATA	3.18E-07
I 133	2.01E-06	3.41E-06	1.04E-06	4.76E-04	3.98E-06	NO DATA	1.58E-06
I 134	1.46E-07	3.87E-07	1.39E-07	6.45E-06	6.10E-07	NO DATA	5.10E-09
I 135	6.10E-07	1.57E-06	5.82E-07	1.01E-04	2.48E-06	NO DATA	1.74E-06
CS 134	8.37E-05	1.97E-04	9.14E-05	NO DATA	6.26E-05	2.39E-05	2.45E-06
CS 136	8.59E-06	3.38E-05	2.27E-05	NO DATA	1.84E-05	2.90E-06	2.72E-06
CS 137	1.12E-04	1.49E-04	5.19E-05	NO DATA	5.07E-05	1.97E-05	2.12E-06
CS 138	7.76E-08	1.49E-07	7.45E-08	NO DATA	1.10E-07	1.28E-08	6.76E-11
BA 139	1.39E-07	9.78E-11	4.05E-09	NO DATA	9.22E-11	6.74E-11	1.24E-06

TABLE 3.1-3
(3 of 3)
INGESTION DOSE FACTORS FOR TEENAGER
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA 140	2.84E-05	3.48E-08	1.83E-06	NO DATA	1.18E-08	2.34E-08	4.38E-05
BA 141	6.71E-08	5.01E-11	2.24E-08	NO DATA	4.65E-11	3.43E-11	1.43E-13
BA 142	2.99E-08	2.99E-11	1.84E-09	NO DATA	2.53E-11	1.99E-11	9.18E-20
LA 140	3.48E-09	1.71E-09	4.55E-10	NO DATA	NO DATA	NO DATA	9.82E-05
LA 142	1.79E-10	7.95E-11	1.98E-11	NO DATA	NO DATA	NO DATA	2.42E-06
CE 141	1.33E-08	8.88E-09	1.02E-09	NO DATA	4.18E-09	NO DATA	2.54E-05
CE 143	2.35E-09	1.71E-06	1.91E-10	NO DATA	7.67E-10	NO DATA	5.14E-05
CE 144	6.96E-07	2.88E-07	3.74E-08	NO DATA	1.72E-07	NO DATA	1.75E-04
PR 143	1.31E-08	5.23E-09	6.52E-10	NO DATA	3.04E-09	NO DATA	4.31E-05
PR 144	4.30E-11	1.76E-11	2.18E-12	NO DATA	1.01E-11	NO DATA	4.74E-14
ND 147	9.38E-09	1.02E-08	6.11E-10	NO DATA	5.99E-09	NO DATA	3.68E-05
W 187	1.46E-07	1.19E-07	4.17E-08	NO DATA	NO DATA	NO DATA	3.22E-05
NP 239	1.76E-09	1.66E-10	9.22E-11	NO DATA	5.21E-10	NO DATA	2.67E-05

TABLE 3.1-4*
(1 of 3)
INGESTION DOSE FACTORS FOR CHILD
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07
NA 24	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06
CR 51	NO DATA	NO DATA	8.90E-09	4.94E-09	1.35E-09	9.02E-09	4.72E-07
MN 54	NO DATA	1.07E-05	2.85E-06	NO DATA	3.00E-06	NO DATA	8.98E-06
MN 56	NO DATA	3.34E-07	7.54E-08	NO DATA	4.04E-07	NO DATA	4.84E-05
FE 55	1.15E-05	6.10E-06	1.89E-06	NO DATA	NO DATA	3.45E-06	1.13E-06
FE 59	1.65E-05	2.67E-05	1.33E-05	NO DATA	NO DATA	7.74E-06	2.78E-05
CO 58	NO DATA	1.80E-06	5.51E-06	NO DATA	NO DATA	NO DATA	1.05E-05
CO 60	NO DATA	5.29E-06	1.56E-05	NO DATA	NO DATA	NO DATA	2.93E-05
NI 63	5.38E-04	2.88E-05	1.83E-05	NO DATA	NO DATA	NO DATA	1.94E-06
NI 65	2.22E-06	2.09E-07	1.22E-07	NO DATA	NO DATA	NO DATA	2.56E-05
CU 64	NO DATA	2.45E-07	1.48E-07	NO DATA	5.92E-07	NO DATA	1.15E-05
ZN 65	1.37E-05	3.65E-05	2.27E-05	NO DATA	2.30E-05	NO DATA	6.41E-06
ZN 69	4.38E-08	6.33E-08	5.85E-09	NO DATA	3.84E-08	NO DATA	3.99E-06
BR 83	NO DATA	NO DATA	1.71E-07	NO DATA	NO DATA	NO DATA	LT E-24
BR 84	NO DATA	NO DATA	1.98E-07	NO DATA	NO DATA	NO DATA	LT E-24
BR 85	NO DATA	NO DATA	9.12E-09	NO DATA	NO DATA	NO DATA	LT E-24
RB 86	NO DATA	6.70E-05	4.12E-05	NO DATA	NO DATA	NO DATA	4.31E-06
RB 88	NO DATA	1.90E-07	1.32E-07	NO DATA	NO DATA	NO DATA	9.32E-09
RB 89	NO DATA	1.17E-07	1.04E-07	NO DATA	NO DATA	NO DATA	1.02E-09
SR 89	1.32E-03	NO DATA	3.77E-05	NO DATA	NO DATA	NO DATA	5.11E-05
SR 90	1.70E-02	NO DATA	4.31E-03	NO DATA	NO DATA	NO DATA	2.99E-04
SR 91	2.40E-05	NO DATA	9.03E-07	NO DATA	NO DATA	NO DATA	5.30E-05
SR 92	9.03E-06	NO DATA	3.62E-07	NO DATA	NO DATA	NO DATA	1.71E-04
Y 90	4.11E-08	NO DATA	1.10E-09	NO DATA	NO DATA	NO DATA	1.17E-04
Y 91M	3.82E-10	NO DATA	1.39E-11	NO DATA	NO DATA	NO DATA	7.48E-07
Y 91	6.02E-07	NO DATA	1.61E-08	NO DATA	NO DATA	NO DATA	8.02E-05
Y 92	3.60E-09	NO DATA	1.03E-10	NO DATA	NO DATA	NO DATA	1.04E-04

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

TABLE 3.1-4
(2 of 3)
INGESTION DOSE FACTORS FOR CHILD
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	1.14E-08	NO DATA	3.13E-10	NO DATA	NO DATA	NO DATA	1.70E-04
ZR 95	1.16E-07	2.55E-08	2.27E-08	NO DATA	3.65E-08	NO DATA	2.66E-05
ZR 97	6.99E-09	1.01E-09	5.96E-10	NO DATA	1.45E-09	NO DATA	1.53E-04
NB 95	2.25E-08	8.76E-09	6.26E-09	NO DATA	8.23E-09	NO DATA	1.62E-05
MO 99	NO DATA	1.33E-05	3.29E-06	NO DATA	2.84E-05	NO DATA	1.10E-05
TC 99M	9.23E-10	1.81E-09	3.00E-08	NO DATA	2.63E-08	9.19E-10	1.03E-06
TC 101	1.07E-09	1.12E-09	1.42E-08	NO DATA	1.91E-08	5.92E-10	3.56E-09
RU 103	7.31E-07	NO DATA	2.81E-07	NO DATA	1.84E-06	NO DATA	1.89E-05
RU 105	6.45E-08	NO DATA	2.34E-08	NO DATA	5.67E-07	NO DATA	4.21E-05
RU 106	1.17E-05	NO DATA	1.46E-06	NO DATA	1.58E-05	NO DATA	1.82E-04
AG 110M	5.39E-07	3.84E-07	2.91E-07	NO DATA	6.78E-07	NO DATA	4.33E-05
TE 125M	1.14E-05	3.09E-06	1.52E-06	3.20E-06	NO DATA	NO DATA	1.10E-05
TE 127M	2.89E-05	7.78E-06	3.43E-06	6.91E-06	8.24E-05	NO DATA	2.34E-05
TE 127	4.71E-07	1.27E-07	1.01E-07	3.26E-07	1.34E-06	NO DATA	1.84E-05
TE 129M	4.87E-05	1.36E-05	7.56E-06	1.57E-05	1.43E-04	NO DATA	5.94E-05
TE 129	1.34E-07	3.74E-08	3.18E-08	9.56E-08	3.92E-07	NO DATA	8.34E-06
TE 131M	7.20E-06	2.49E-06	2.65E-06	5.12E-06	2.41E-05	NO DATA	1.01E-04
TE 131	8.30E-08	2.53E-08	2.47E-08	6.35E-08	2.51E-07	NO DATA	4.36E-07
TE 132	1.01E-05	4.47E-06	5.40E-06	6.51E-06	4.13E-05	NO DATA	4.50E-05
I 130	2.92E-06	5.90E-06	3.04E-06	6.50E-04	8.62E-06	NO DATA	2.76E-06
I 131	1.72E-05	1.73E-05	9.83E-06	5.72E-03	3.84E-05	NO DATA	1.54E-06
I 132	8.00E-07	1.47E-06	6.76E-07	6.82E-05	2.25E-06	NO DATA	1.73E-06
I 133	5.92E-06	7.32E-06	2.77E-06	1.36E-03	1.22E-05	NO DATA	2.95E-06
I 134	4.19E-07	7.78E-07	3.58E-07	1.79E-05	1.19E-06	NO DATA	5.16E-07
I 135	1.75E-06	3.15E-06	1.49E-06	2.79E-04	4.63E-06	NO DATA	2.40E-06
CS 134	2.34E-04	3.84E-04	8.10E-05	NO DATA	1.19E-04	4.27E-05	2.07E-06
CS 136	2.35E-05	6.46E-05	4.18E-05	NO DATA	3.44E-05	5.13E-06	2.27E-06
CS 137	3.27E-04	3.13E-04	4.62E-05	NO DATA	1.02E-04	3.67E-05	1.96E-06
CS 138	2.29E-07	3.17E-07	2.01E-07	NO DATA	2.23E-07	2.40E-08	1.46E-07
BA 139	4.14E-07	2.21E-10	1.20E-08	NO DATA	1.93E-10	1.30E-10	2.39E-05

TABLE 3.1-4
(3 of 3)
INGESTION DOSE FACTORS FOR CHILD
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA 140	8.31E-05	7.28E-08	4.85E-06	NO DATA	2.37E-08	4.34E-08	4.21E-05
BA 141	2.00E-07	1.12E-10	6.51E-09	NO DATA	9.69E-11	6.58E-10	1.14E-07
BA 142	8.74E-08	6.29E-11	4.88E-09	NO DATA	5.09E-11	3.70E-11	1.14E-09
LA 140	1.01E-08	3.53E-09	1.19E-09	NO DATA	NO DATA	NO DATA	9.84E-05
LA 142	5.24E-10	1.67E-10	5.23E-11	NO DATA	NO DATA	NO DATA	3.31E-05
CE 141	3.97E-08	1.98E-08	2.94E-09	NO DATA	8.68E-09	NO DATA	2.47E-05
CE 143	6.99E-09	3.79E-06	5.49E-10	NO DATA	1.59E-09	NO DATA	5.55E-05
CE 144	2.08E-06	6.52E-07	1.11E-07	NO DATA	3.61E-07	NO DATA	1.70E-04
PR 143	3.93E-08	1.18E-08	1.95E-09	NO DATA	6.39E-09	NO DATA	4.24E-05
PR 144	1.29E-10	3.99E-11	6.49E-12	NO DATA	2.11E-11	NO DATA	8.59E-08
ND 147	2.79E-08	2.26E-08	1.75E-09	NO DATA	1.24E-08	NO DATA	3.58E-05
W 187	4.29E-07	2.54E-07	1.14E-07	NO DATA	NO DATA	NO DATA	3.57E-05
NP 239	5.25E-09	3.77E-10	2.65E-10	NO DATA	1.09E-09	NO DATA	2.79E-05

TABLE 3.1-5*
(1 of 3)
INGESTION DOSE FACTORS FOR INFANT
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07
NA 24	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05
CR 51	NO DATA	NO DATA	1.41E-08	9.20E-09	2.01E-09	1.79E-08	4.11E-07
MN 54	NO DATA	1.99E-05	4.51E-06	NO DATA	4.41E-06	NO DATA	7.31E-06
MN 56	NO DATA	8.18E-07	1.41E-07	NO DATA	7.03E-07	NO DATA	7.43E-05
FE 55	1.39E-05	8.98E-06	2.40E-06	NO DATA	NO DATA	4.39E-06	1.14E-06
FE 59	3.08E-05	5.38E-05	2.12E-05	NO DATA	NO DATA	1.59E-05	2.57E-05
CO 58	NO DATA	3.60E-06	8.98E-06	NO DATA	NO DATA	NO DATA	8.97E-06
CO 60	NO DATA	1.08E-05	2.55E-05	NO DATA	NO DATA	NO DATA	2.57E-05
NI 63	6.34E-04	3.92E-05	2.20E-05	NO DATA	NO DATA	NO DATA	1.95E-06
NI 65	4.70E-06	5.32E-07	2.42E-07	NO DATA	NO DATA	NO DATA	4.05E-05
CU 64	NO DATA	6.09E-07	2.82E-07	NO DATA	1.03E-06	NO DATA	1.25E-05
ZN 65	1.84E-05	6.31E-05	2.91E-05	NO DATA	3.06E-05	NO DATA	5.33E-05
ZN 69	9.33E-08	1.68E-07	1.25E-08	NO DATA	6.98E-08	NO DATA	1.37E-05
BR 83	NO DATA	NO DATA	3.63E-07	NO DATA	NO DATA	NO DATA	LT E-24
BR 84	NO DATA	NO DATA	3.82E-07	NO DATA	NO DATA	NO DATA	LT E-24
BR 85	NO DATA	NO DATA	1.94E-08	NO DATA	NO DATA	NO DATA	LT E-24
RB 86	NO DATA	1.70E-04	8.40E-05	NO DATA	NO DATA	NO DATA	4.35E-06
RB 88	NO DATA	4.98E-07	2.73E-07	NO DATA	NO DATA	NO DATA	4.85E-07
RB 89	NO DATA	2.86E-07	1.97E-07	NO DATA	NO DATA	NO DATA	9.74E-08
SR 89	2.51E-03	NO DATA	7.20E-05	NO DATA	NO DATA	NO DATA	5.16E-05
SR 90	1.85E-02	NO DATA	4.71E-03	NO DATA	NO DATA	NO DATA	2.31E-04
SR 91	5.00E-05	NO DATA	1.81E-06	NO DATA	NO DATA	NO DATA	5.92E-05
SR 92	1.92E-05	NO DATA	7.13E-07	NO DATA	NO DATA	NO DATA	2.07E-04
Y 90	8.69E-08	NO DATA	2.33E-09	NO DATA	NO DATA	NO DATA	1.20E-04
Y 91M	8.10E-10	NO DATA	2.76E-11	NO DATA	NO DATA	NO DATA	2.70E-06
Y 91	1.13E-06	NO DATA	3.01E-08	NO DATA	NO DATA	NO DATA	8.10E-05
Y 92	7.65E-09	NO DATA	2.15E-10	NO DATA	NO DATA	NO DATA	1.46E-04

*Taken from Regulatory Guide 1.109 (Rev. 1)

TABLE 3.1-5
(2 of 3)
INGESTION DOSE FACTORS FOR INFANT
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	2.43E-08	NO DATA	6.62E-10	NO DATA	NO DATA	NO DATA	1.92E-04
ZR 95	2.06E-07	5.02E-08	3.56E-08	NO DATA	5.41E-08	NO DATA	2.50E-05
ZR 97	1.48E-08	2.54E-09	1.16E-09	NO DATA	2.56E-09	NO DATA	1.62E-04
NB 95	4.20E-08	1.73E-08	1.00E-08	NO DATA	1.24E-08	NO DATA	1.46E-05
MO 99	NO DATA	3.40E-05	6.63E-06	NO DATA	5.08E-05	NO DATA	1.12E-05
TC 99M	1.92E-09	3.96E-09	5.10E-08	NO DATA	4.26E-08	2.07E-09	1.15E-06
TC 101	2.27E-09	2.86E-09	2.83E-08	NO DATA	3.40E-08	1.56E-09	4.86E-07
RU 103	1.48E-06	NO DATA	4.95E-07	NO DATA	3.08E-06	NO DATA	1.80E-05
RU 105	1.36E-07	NO DATA	4.58E-08	NO DATA	1.00E-06	NO DATA	5.41E-05
RU 106	2.41E-05	NO DATA	3.01E-06	NO DATA	2.85E-05	NO DATA	1.83E-04
AG 110M	9.96E-07	7.27E-07	4.81E-07	NO DATA	1.04E-06	NO DATA	3.77E-05
TE 125M	2.33E-05	7.79E-06	3.15E-06	7.84E-06	NO DATA	NO DATA	1.11E-05
TE 127M	5.85E-05	1.94E-05	7.08E-06	1.69E-05	1.44E-04	NO DATA	2.36E-05
TE 127	1.00E-06	3.35E-07	2.15E-07	8.14E-07	2.44E-06	NO DATA	2.10E-05
TE 129M	1.00E-04	3.43E-05	1.54E-05	3.84E-05	2.50E-04	NO DATA	5.97E-05
TE 129	2.84E-07	9.79E-08	6.63E-08	2.38E-07	7.07E-07	NO DATA	2.27E-05
TE 131M	1.52E-05	6.12E-06	5.05E-06	1.24E-05	4.21E-05	NO DATA	1.03E-04
TE 131	1.76E-07	6.50E-08	4.94E-08	1.57E-07	4.50E-07	NO DATA	7.11E-06
TE 132	2.08E-05	1.03E-05	9.61E-06	1.52E-05	6.44E-05	NO DATA	3.81E-05
I 130	6.00E-06	1.32E-05	5.30E-06	1.48E-03	1.45E-05	NO DATA	2.83E-06
I 131	3.59E-05	4.23E-05	1.86E-05	1.39E-02	4.94E-05	NO DATA	1.51E-06
I 132	1.66E-06	3.37E-06	1.20E-06	1.58E-04	3.76E-07	NO DATA	2.73E-06
I 133	1.25E-05	1.82E-05	5.33E-06	3.31E-03	2.14E-05	NO DATA	3.08E-06
I 134	8.69E-07	1.78E-06	6.33E-07	4.15E-05	1.99E-06	NO DATA	1.84E-06
I 135	3.64E-06	7.24E-06	2.64E-06	6.49E-04	8.07E-06	NO DATA	2.62E-06
CS 134	3.77E-04	7.03E-04	7.10E-05	NO DATA	1.81E-04	7.42E-05	1.91E-06
CS 136	4.59E-05	1.35E-04	5.04E-05	NO DATA	5.38E-05	1.10E-05	2.05E-06
CS 137	5.22E-04	6.11E-04	4.33E-05	NO DATA	1.64E-04	6.64E-05	1.91E-06
CS 138	4.81E-07	7.82E-07	3.79E-07	NO DATA	3.90E-07	6.09E-08	1.25E-06
BA 139	8.81E-07	5.84E-10	2.55E-08	NO DATA	3.51E-10	3.54E-10	5.58E-05

TABLE 3.1-5
(3 of 3)
INGESTION DOSE FACTORS FOR INFANT
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA 140	1.71E-04	1.71E-07	8.81E-06	NO DATA	4.06E-08	1.05E-07	4.20E-05
BA 141	4.25E-07	2.91E-10	1.34E-08	NO DATA	1.75E-10	1.77E-10	5.19E-06
BA 142	1.84E-07	1.53E-10	9.06E-09	NO DATA	8.81E-11	9.26E-11	7.59E-07
LA 140	2.11E-08	8.32E-09	2.14E-09	NO DATA	NO DATA	NO DATA	9.77E-05
LA 142	1.10E-09	4.04E-10	9.67E-11	NO DATA	NO DATA	NO DATA	6.86E-05
CE 141	7.87E-08	4.80E-08	5.65E-09	NO DATA	1.48E-08	NO DATA	2.48E-05
CE 143	1.48E-08	9.82E-06	1.12E-09	NO DATA	2.86E-09	NO DATA	5.73E-05
CE 144	2.98E-06	1.22E-06	1.67E-07	NO DATA	4.93E-07	NO DATA	1.71E-04
PR 143	8.13E-08	3.04E-08	4.03E-09	NO DATA	1.13E-08	NO DATA	4.29E-05
PR 144	2.74E-10	1.06E-10	1.38E-11	NO DATA	3.84E-11	NO DATA	4.93E-06
ND 147	5.53E-08	5.68E-08	3.48E-09	NO DATA	2.19E-08	NO DATA	3.60E-05
W 187	9.03E-07	6.28E-07	2.17E-07	NO DATA	NO DATA	NO DATA	3.69E-05
NP 239	1.11E-08	9.93E-10	5.61E-10	NO DATA	1.98E-09	NO DATA	2.87E-05

TABLE 3.1-6*
(1 of 1)
INHALATION DOSE FACTORS FOR ADULTS
(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
CR 51	NO DATA	NO DATA	1.25E-08	7.44E-09	2.85E-09	1.80E-06	4.15E-07
MN 54	NO DATA	4.95E-06	7.87E-07	NO DATA	1.23E-06	1.75E-04	9.67E-06
FE 55	3.07E-06	2.12E-06	4.93E-07	NO DATA	NO DATA	9.01E-06	7.54E-07
FE 59	1.47E-06	3.47E-06	1.32E-06	NO DATA	NO DATA	1.27E-04	2.35E-05
CO 58	NO DATA	1.98E-07	2.59E-07	NO DATA	NO DATA	1.16E-04	1.33E-05
CO 60	NO DATA	1.44E-06	1.85E-06	NO DATA	NO DATA	7.46E-04	3.56E-05
ZN 65	4.05E-06	1.29E-05	5.82E-06	NO DATA	8.62E-06	1.08E-04	6.68E-06
SR 89	3.80E-05	NO DATA	1.09E-06	NO DATA	NO DATA	1.75E-04	4.37E-05
SR 90	1.24E-02	NO DATA	7.62E-04	NO DATA	NO DATA	1.20E-03	9.02E-05
ZR 95	1.34E-05	4.30E-06	2.91E-06	NO DATA	6.77E-06	2.21E-04	1.88E-05
MO 99	NO DATA	1.51E-08	2.87E-09	NO DATA	3.64E-08	1.14E-05	3.10E-05
SB 124	3.90E-06	7.36E-08	1.55E-06	9.44E-09	NO DATA	3.10E-04	5.08E-05
I 131	3.15E-06	4.47E-06	2.56E-06	1.49E-03	7.66E-06	NO DATA	7.85E-07
I 133	1.08E-06	1.85E-06	5.65E-07	2.69E-04	3.23E-06	NO DATA	1.11E-06
CS 134	4.66E-05	1.06E-04	9.10E-05	NO DATA	3.59E-05	1.22E-05	1.30E-06
CS 136	4.88E-06	1.83E-05	1.38E-05	NO DATA	1.07E-05	1.50E-06	1.46E-06
CS 137	5.98E-05	7.76E-05	5.35E-05	NO DATA	2.78E-05	9.40E-06	1.05E-06
BA 140	4.88E-06	6.13E-09	3.21E-07	NO DATA	2.09E-09	1.59E-04	2.73E-05
CE 141	2.49E-06	1.69E-06	1.91E-07	NO DATA	7.83E-07	4.52E-05	1.50E-05
CE 144	4.29E-04	1.79E-04	2.30E-05	NO DATA	1.06E-04	9.72E-04	1.02E-04

*Table taken from NUREG-0597

TABLE 3.1-7*
(1 of 1)
INHALATION DOSE FACTORS FOR TEENAGER
(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07
CR 51	NO DATA	NO DATA	1.69E-08	9.37E-09	3.84E-09	2.62E-06	3.75E-07
MN 54	NO DATA	6.39E-06	1.05E-06	NO DATA	1.59E-06	2.48E-04	8.35E-06
FE 55	4.18E-06	2.98E-06	6.93E-07	NO DATA	NO DATA	1.55E-05	7.99E-07
FE 59	1.99E-06	4.62E-06	1.79E-06	NO DATA	NO DATA	1.91E-04	2.23E-05
CO 58	NO DATA	2.59E-07	3.47E-07	NO DATA	NO DATA	1.68E-04	1.19E-05
CO 60	NO DATA	1.89E-06	2.48E-06	NO DATA	NO DATA	1.09E-03	3.24E-05
ZN 65	4.82E-06	1.67E-05	7.80E-06	NO DATA	1.08E-05	1.55E-04	5.83E-06
SR 89	5.43E-05	NO DATA	1.56E-06	NO DATA	NO DATA	3.02E-04	4.64E-05
SR 90	1.35E-02	NO DATA	8.35E-04	NO DATA	NO DATA	2.06E-03	9.56E-05
ZR 95	1.82E-05	5.73E-06	3.94E-06	NO DATA	8.42E-06	3.36E-04	1.86E-05
MO 99	NO DATA	2.11E-08	4.03E-09	NO DATA	5.14E-08	1.92E-05	3.36E-05
SB 124	5.38E-06	9.92E-08	2.10E-06	1.22E-08	NO DATA	4.81E-04	4.98E-05
I 131	4.43E-06	6.14E-06	3.30E-06	1.83E-03	1.05E-05	NO DATA	8.11E-07
I 133	1.52E-06	2.56E-06	7.78E-07	3.65E-04	4.49E-06	NO DATA	1.29E-06
CS 134	6.28E-05	1.41E-04	6.86E-05	NO DATA	4.69E-05	1.83E-05	1.22E-06
CS 136	6.44E-06	2.42E-05	1.71E-05	NO DATA	1.38E-05	2.22E-06	1.36E-06
CS 137	8.38E-05	1.06E-04	3.89E-05	NO DATA	3.80E-05	1.51E-05	1.06E-06
BA 140	6.84E-06	8.38E-09	4.40E-07	NO DATA	2.85E-09	2.54E-04	2.86E-05
CE 141	3.55E-06	2.37E-06	2.71E-07	NO DATA	1.11E-06	7.67E-05	1.58E-05
CE 144	6.11E-04	2.53E-04	3.28E-05	NO DATA	1.51E-04	1.67E-03	1.08E-04

*Table taken from NUREG-0597

TABLE 3.1-8*
(1 of 1)
INHALATION DOSE FACTORS FOR CHILD
(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07
CR 51	NO DATA	NO DATA	4.17E-08	2.31E-08	6.57E-09	4.59E-09	2.93E-07
MN 54	NO DATA	1.16E-05	2.57E-06	NO DATA	2.71E-06	4.26E-04	6.19E-06
FE 55	1.28E-05	6.80E-06	2.10E-06	NO DATA	NO DATA	3.00E-05	7.75E-07
FE 59	5.59E-06	9.04E-06	4.51E-06	NO DATA	NO DATA	3.43E-04	1.91E-05
CO 58	NO DATA	4.79E-07	8.55E-07	NO DATA	NO DATA	2.99E-04	9.29E-06
CO 60	NO DATA	3.55E-06	6.12E-06	NO DATA	NO DATA	1.91E-03	2.60E-05
ZN 65	1.15E-05	3.06E-05	1.90E-05	NO DATA	1.93E-05	2.69E-04	4.41E-06
SR 89	1.62E-04	NO DATA	4.66E-06	NO DATA	NO DATA	5.83E-04	4.52E-05
SR 90	2.73E-02	NO DATA	1.74E-03	NO DATA	NO DATA	3.99E-03	9.28E-05
ZR 95	5.13E-05	1.13E-05	1.00E-05	NO DATA	1.16E-05	6.03E-04	1.65E-05
MO 99	NO DATA	4.66E-08	1.15E-08	NO DATA	1.06E-07	3.66E-05	3.42E-05
SB 124	1.55E-05	2.00E-07	5.41E-06	3.41E-08	NO DATA	8.76E-04	4.43E-05
I 131	1.30E-05	1.30E-05	7.37E-06	4.39E-03	2.13E-05	NO DATA	7.68E-07
I 133	4.48E-06	5.49E-06	2.08E-06	1.04E-03	9.13E-06	NO DATA	1.48E-06
CS 134	1.76E-04	2.74E-04	6.07E-05	NO DATA	8.93E-05	3.27E-05	1.04E-06
CS 136	1.76E-05	4.62E-05	3.14E-05	NO DATA	2.58E-05	3.93E-06	1.13E-06
CS 137	2.45E-04	2.23E-04	3.47E-05	NO DATA	7.63E-05	2.81E-05	9.78E-07
BA 140	2.00E-05	1.75E-08	1.17E-06	NO DATA	5.71E-09	4.71E-04	2.75E-05
CE 141	1.06E-05	5.28E-06	7.83E-07	NO DATA	2.31E-06	1.47E-04	1.53E-05
CE 144	1.83E-03	5.72E-04	9.77E-05	NO DATA	3.17E-04	3.23E-03	1.05E-04

*Table taken From NUREG-0597.

TABLE 3.1-9*
(1 of 1)
INHALATION DOSE FACTORS FOR INFANT
(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	4.62E-07	4.62E-07	4.62E-07	4.62E-07	4.62E-07	4.62E-07
CR 51	NO DATA	NO DATA	6.39E-08	4.11E-08	9.45E-09	9.17E-06	2.55E-07
MN 54	NO DATA	1.81E-05	3.56E-06	NO DATA	3.56E-06	7.14E-04	5.04E-06
FE 55	1.41E-05	8.39E-06	2.38E-06	NO DATA	NO DATA	6.21E-05	7.82E-07
FE 59	9.69E-06	1.68E-05	6.77E-06	NO DATA	NO DATA	7.25E-04	1.77E-05
CO 58	NO DATA	8.71E-07	1.30E-06	NO DATA	NO DATA	5.55E-04	7.95E-06
CO 60	NO DATA	5.73E-06	8.41E-06	NO DATA	NO DATA	3.22E-03	2.28E-05
ZN 65	1.38E-05	4.47E-05	2.22E-05	NO DATA	2.32E-05	4.62E-04	3.67E-05
SR 89	2.84E-04	NO DATA	8.15E-06	NO DATA	NO DATA	1.45E-03	4.57E-05
SR 90	2.92E-02	NO DATA	1.85E-03	NO DATA	NO DATA	8.03E-03	9.36E-05
ZR 95	8.24E-05	1.99E-05	1.45E-05	NO DATA	2.22E-05	1.25E-03	1.55E-05
MO 99	NO DATA	1.18E-07	2.31E-08	NO DATA	1.89E-07	9.63E-05	3.48E-05
SB 124	2.71E-05	3.97E-07	8.56E-06	7.18E-08	NO DATA	1.89E-03	4.22E-05
I 131	2.71E-05	3.17E-05	1.40E-05	1.06E-02	3.70E-05	NO DATA	7.56E-07
I 133	9.46E-06	1.37E-05	4.00E-06	2.54E-03	1.60E-05	NO DATA	1.54E-06
CS 134	2.83E-04	5.02E-04	5.32E-05	NO DATA	1.36E-04	5.69E-05	9.53E-07
CS 136	3.45E-05	9.61E-05	3.78E-05	NO DATA	4.03E-05	8.40E-06	1.02E-06
CS 137	3.92E-04	4.37E-04	3.25E-05	NO DATA	1.23E-04	5.09E-05	9.53E-07
BA 140	4.00E-05	4.00E-08	2.07E-06	NO DATA	9.59E-09	1.14E-03	2.74E-05
CE 141	1.98E-05	1.19E-05	1.42E-06	NO DATA	3.75E-06	3.69E-04	1.54E-05
CE 144	2.28E-03	8.65E-04	1.26E-04	NO DATA	3.84E-04	7.03E-03	1.06E-04

*Table taken from NUREG-0597.

TABLE 3.1-10*
(1 of 2)
EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND

(mrem/hr per pCi/m^2)

Element	Total Body	Skin
H-3	0.0	0.0
Na-24	2.50E-08	2.90E-08
Cr-51	2.20E-10	2.60E-10
Mn-54	5.80E-09	6.80E-09
Mn-56	1.10E-08	1.30E-08
Fe-55	0.0	0.0
Fe-59	8.00E-09	9.40E-09
Co-58	7.00E-09	8.20E-09
Co-60	1.70E-08	2.00E-08
Ni-63	0.0	0.0
Ni-65	3.70E-09	4.30E-09
Cu-64	1.50E-09	1.70E-09
Zn-65	4.00E-09	4.60E-09
Zn-69	0.0	0.0
Br-83	6.40E-11	9.30E-11
Br-84	1.20E-08	1.40E-08
Br-85	0.0	0.0
Rb-86	6.30E-10	7.20E-10
Rb-88	3.50E-09	4.00E-09
Rb-89	1.50E-08	1.80E-08
Sr-89	5.60E-13	6.50E-13
Sr-91	7.10E-09	8.30E-09
Sr-92	9.00E-09	1.00E-08
Y-90	2.20E-12	2.60E-12
Y-91M	3.80E-09	4.40E-09
Y-91	2.40E-11	2.70E-11
Y-92	1.60E-09	1.90E-09
Y-93	5.70E-10	7.80E-10
Zr-95	5.00E-09	5.80E-09
Zr-97	5.50E-09	6.40E-09
Nb-95	5.10E-09	6.00E-09
Mo-99	1.90E-09	2.20E-09
Tc-99M	9.60E-10	1.10E-09
Tc-101	2.70E-09	3.00E-09
Ru-103	3.60E-09	4.20E-09
Ru-105	4.50E-09	5.10E-09
Ru-106	1.50E-09	1.80E-09
Ag-110M	1.80E-08	2.10E-08
Te-125M	3.50E-11	4.80E-11
Te-127M	1.10E-12	1.30E-12
Te-127	1.00E-11	1.10E-11
Te-129M	7.70E-10	9.00E-10
Te-129	7.10E-10	8.40E-10

*Taken from Regulatory Guide 1.109 (Rev. 1)

TABLE 3.1-10 (cont'd)
(2 of 2)
EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND

(mrem/hr per pCi/m^2)

Element	Total Body	Skin
Te-131M	8.40E-09	9.90E-09
Te-131	2.20E-09	2.60E-06
Te-132	1.70E-09	2.00E-09
I-130	1.40E-08	1.70E-08
I-131	2.80E-09	3.40E-09
I-132	1.70E-08	2.00E-08
I-133	3.70E-09	4.50E-09
I-134	1.60E-08	1.90E-08
I-135	1.20E-08	1.40E-08
Cs-134	1.20E-08	1.40E-08
Cs-136	1.50E-08	1.70E-08
Cs-137	4.20E-09	4.90E-09
Cs-138	2.10E-08	2.40E-08
Ba-139	2.40E-09	2.70E-09
Ba-140	2.10E-09	2.40E-09
Ba-141	4.30E-09	4.90E-09
Ba-142	7.90E-09	9.00E-09
La-140	1.50E-08	1.70E-08
La-142	1.50E-08	1.80E-08
Ce-141	5.50E-10	6.20E-10
Ce-143	2.20E-09	2.50E-09
Ce-144	3.20E-10	3.70E-10
Pr-143	0.0	0.0
Pr-144	2.00E-10	2.30E-10
Nd-147	1.00E-09	1.20E-09
W-187	3.10E-09	3.60E-09
Np-239	9.50E-10	1.10E-09

TABLE 3.1-11*
(1 of 1)
STABLE ELEMENT TRANSFER DATA

Element	B_{iv} Veg/Soil	F_m(Cow) Milk (d/ℓ)	F_f Meat (d/kg)
H	4.8E+00	1.0E-02**	1.2E-02
Na	5.2E-02	4.0E-02	3.0E-02
Cr	2.5E-04	2.2E-03	2.4E-03
Mn	2.9E-02	2.5E-04	8.0E-04
Fe	6.6E-04	1.2E-03**	4.0E-02
Co	9.4E-03	1.0E-03	1.3E-02
Ni	1.9E-02	6.7E-03	5.3E-02
Cu	1.2E-01	1.4E-02**	8.0E-03
Zn	4.0E-01	3.9E-02	3.0E-02
Rb	1.3E-01	3.0E-02	3.1E-02
Sr	1.7E-02	8.0E-04**	6.0E-04
Y	2.6E-03	1.0E-05	4.6E-03
Zr	1.7E-04	5.0E-06	3.4E-02
Nb	9.4E-03	2.5E-03	2.8E-01
Mo	1.2E-01	7.5E-03	8.0E-03
Tc	2.5E-01	2.5E-02	4.0E-01
Ru	5.0E-02	1.0E-06	4.0E-01
Rh	1.3E+01	1.0E-02	1.5E-03
Ag	1.5E-01	5.0E-02	1.7E-02
Te	1.3E+00	1.0E-03	7.7E-02
I	2.0E-02	6.0E-03**	2.9E-03
Cs	1.0E-02	1.2E-02**	4.0E-03
Ba	5.0E-03	4.0E-04	3.2E-03
La	2.5E-03	5.0E-06	2.0E-04
Ce	2.5E-03	1.0E-04	1.2E-03
Pr	2.5E-03	5.0E-06	4.7E-03
Nd	2.4E-03	5.0E-06	3.3E-03
W	1.8E-02	5.0E-04	1.3E-03
Np	2.5E-03	5.0E-06	2.0E-04

*Taken from Regulatory Guide 1.109 (Rev. 1)

**Nuclide Transfer parameters for Goat's milk

Element	Fm (d/l)
H	0.17
Fe	1.30E-04
Cu	0.013
Sr	0.014
I	0.06
Cs	0.30

TABLE 3.1-12
(1 of 1)
R_i VALUES - GROUND PATHWAY - ALL AGES

NUCLIDE	T.BODY	SKIN
H 3	NO DATA	NO DATA
CR 51	4.65E+06	5.49E+06
MN 54	1.38E+09	1.62E+09
FE 55	NO DATA	NO DATA
FE 59	2.72E+08	3.20E+08
CO 58	3.79E+08	4.44E+08
CO 60	2.15E+10	2.53E+10
ZN 65	7.44E+08	8.56E+08
SR 89	2.16E+04	2.50E+04
SR 90	NO DATA	NO DATA
ZR 95	2.51E+08	2.91+08
MO 99	4.63E+06	4.00E+06
SB 124	5.98E+08	6.91E+08
I 131	8.59E+06	1.04E+07
I 133	1.22E+06	1.49E+06
CS 134	6.82E+09	7.96E+09
CS 136	1.50E+08	1.70E+08
CS 137	1.03E+10	1.20E+10
BA 140	2.05E+07	2.34E+07
CE 141	1.36E+07	1.54E+07
CE 144	6.92E+07	8.01E+07

TABLE 3.1-13
(1 of 1)
R_i VALUES - VEGETABLE PATHWAY - ADULT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	2.28E+03	2.28E+03	2.28E+03	2.28E+03	2.28E+03	2.28E+03
CR 51	0.0	0.0	4.58E+04	2.74E+04	1.01E+04	6.07E+04	1.15E+07
MN 54	0.0	3.07E+08	5.86E+07	0.0	9.14E+07	0.0	9.41E+08
FE 55	1.99E+08	1.38E+08	3.21E+07	0.0	0.0	7.68E+07	7.90E+07
FE 59	1.23E+08	2.90E+08	1.11E+08	0.0	0.0	8.09E+07	9.66E+08
CO 58	0.0	2.99E+07	6.71E+07	0.0	0.0	0.0	6.07E+08
CO 60	0.0	1.66E+08	3.67E+08	0.0	0.0	0.0	3.12E+09
ZN 65	4.00E+08	1.27E+09	5.76E+08	0.0	8.52E+08	0.0	8.02E+08
SR 89	9.75E+09	0.0	2.80E+08	0.0	0.0	0.0	1.56E+09
SR 90	6.70E+11	0.0	1.64E+11	0.0	0.0	0.0	1.94E+10
ZR 95	1.16E+06	3.73E+05	2.52E+05	0.0	5.85E+05	0.0	1.18E+09
MO 99	0.0	6.20E+06	1.18E+06	0.0	1.40E+07	0.0	1.44E+07
SB 124	1.01E+08	1.91E+06	4.01E+07	2.45E+05	0.0	7.88E+07	2.87E+09
I 131	4.03E+07	5.76E+07	3.30E+07	1.89E+10	9.88E+07	0.0	1.52E+07
I 133	1.04E+06	1.80E+06	5.50E+05	2.65E+08	3.15E+06	0.0	1.62E+06
CS 134	4.54E+09	1.08E+10	8.83E+09	0.0	3.49E+09	1.16E+09	1.89E+08
CS 136	4.23E+07	1.67E+08	1.20E+08	0.0	9.30E+07	1.27E+07	1.90E+07
CS 137	6.63E+09	9.07E+09	5.94E+09	0.0	3.08E+09	1.02E+09	1.76E+08
BA 140	1.28E+08	1.61E+05	8.40E+06	0.0	5.47E+04	9.22E+04	2.64E+08
CE 141	1.94E+05	1.31E+05	1.49E+04	0.0	6.09E+04	0.0	5.02E+08
CE 144	3.15E+07	1.31E+07	1.69E+06	0.0	7.80E+06	0.0	1.06E+10

TABLE 3.1-14
(1 of 1)
R_i VALUES - VEGETABLE PATHWAY - TEENAGER

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	2.61E+03	2.61E+03	2.61E+03	2.61E+03	2.61E+03	2.61E+03
CR 51	0.0	0.0	6.08E+04	3.38E+04	1.33E+04	8.68E+04	1.02E+07
MN 54	0.0	4.46E+08	8.85E+07	0.0	1.33E+08	0.0	9.15E+08
FE 55	3.10E+08	2.20E+08	5.13E+07	0.0	0.0	1.39E+08	9.51E+07
FE 59	1.75E+08	4.09E+08	1.58E+08	0.0	0.0	1.29E+08	9.68E+08
CO 58	0.0	4.25E+07	9.79E+07	0.0	0.0	0.0	5.86E+08
CO 60	0.0	2.47E+08	5.57E+08	0.0	0.0	0.0	3.22E+09
ZN 65	5.35E+08	1.86E+09	8.66E+08	0.0	1.19E+09	0.0	7.86E+08
SR 89	1.48E+10	0.0	4.24E+08	0.0	0.0	0.0	1.76E+09
SR 90	8.32E+11	0.0	2.05E+11	0.0	0.0	0.0	2.34E+10
ZR 95	1.70E+06	5.38E+05	3.70E+05	0.0	7.90E+05	0.0	1.24E+09
MO 99	0.0	5.69E+06	1.09E+06	0.0	1.30E+07	0.0	1.02E+07
SB 124	1.51E+08	2.78E+06	5.88E+07	3.42E+05	0.0	1.32E+08	3.04E+09
I 131	3.83E+07	5.37E+07	2.88E+07	1.57E+10	9.24E+07	0.0	1.06E+07
I 133	9.63E+05	1.63E+06	4.98E+05	2.28E+08	2.87E+06	0.0	1.24E+06
CS 134	6.90E+09	1.62E+10	7.54E+09	0.0	5.16E+09	1.97E+09	2.02E+08
CS 136	4.33E+07	1.71E+08	1.15E+08	0.0	9.28E+07	1.46E+07	1.37E+07
CS 137	1.06E+10	1.41E+10	4.90E+09	0.0	4.78E+09	1.86E+09	2.00E+08
BA 140	1.38E+08	1.69E+05	8.88E+06	0.0	5.72E+04	1.14E+05	2.12E+08
CE 141	2.78E+05	1.86E+05	2.13E+04	0.0	8.75E+04	0.0	5.32E+08
CE 144	5.04E+07	2.09E+07	2.71E+06	0.0	1.25E+07	0.0	1.27E+10

TABLE 3.1-15
(1 of 1)
R_i VALUES - VEGETABLE PATHWAY - CHILD

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	4.04E+03	4.04E+03	4.04E+03	4.04E+03	4.04E+03	4.04E+03
CR 51	0.0	0.0	1.15E+05	6.40E+04	1.75E+04	1.17E+05	6.12E+06
MN 54	0.0	6.53E+08	1.74E+08	0.0	1.83E+08	0.0	5.48E+08
FE 55	7.62E+08	4.04E+08	1.25E+08	0.0	0.0	2.29E+08	7.49E+07
FE 59	3.88E+08	6.29E+08	3.13E+08	0.0	0.0	1.82E+08	6.54E+08
CO 58	0.0	6.27E+07	1.92E+08	0.0	0.0	0.0	3.66E+08
CO 60	0.0	3.76E+08	1.11E+09	0.0	0.0	0.0	2.08E+09
ZN 65	1.02E+09	2.73E+09	1.70E+09	0.0	1.72E+09	0.0	4.80E+08
SR 89	3.52E+10	0.0	1.00E+09	0.0	0.0	0.0	1.36E+09
SR 90	1.38E+12	0.0	3.49E+11	0.0	0.0	0.0	1.86E+10
ZR 95	3.82E+06	8.40E+05	7.48E+05	0.0	1.20E+06	0.0	8.77E+08
MO 99	0.0	7.77E+06	1.92E+06	0.0	1.66E+07	0.0	6.43E+06
SB 124	3.44E+08	4.46E+06	1.20E+08	7.59E+05	0.0	1.91E+08	2.15E+09
I 131	7.13E+07	7.17E+07	4.08E+07	2.37E+10	1.18E+08	0.0	6.39E+06
I 133	1.76E+06	2.17E+06	8.22E+05	4.03E+08	3.62E+06	0.0	8.75E+05
CS 134	1.56E+10	2.56E+10	5.40E+09	0.0	7.93E+09	2.85E+09	1.38E+08
CS 136	8.16E+07	2.24E+08	1.45E+08	0.0	1.19E+08	1.78E+07	7.88E+06
CS 137	2.49E+10	2.39E+10	3.52E+09	0.0	7.78E+09	2.80E+09	1.50E+08
BA 140	2.76E+08	2.42E+05	1.61E+07	0.0	7.87E+04	1.44E+05	1.40E+08
CE 141	6.45E+05	3.22E+05	4.78E+04	0.0	1.41E+05	0.0	4.02E+08
CE 144	1.22E+08	3.81E+07	6.48E+06	0.0	2.11E+07	0.0	9.93E+09

TABLE 3.1-16
(1 of 1)
R_i VALUES - MEAT PATHWAY - ADULT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	3.27E+02	3.27E+02	3.27E+02	3.27E+02	3.27E+02	3.27E+02
CR 51	0.0	0.0	5.86E+03	3.50E+03	1.29E+03	7.77E+03	1.47E+06
MN 54	0.0	6.83E+06	1.30E+06	0.0	2.03E+06	0.0	2.09E+07
FE 55	2.13E+08	1.47E+08	3.43E+07	0.0	0.0	8.20E+07	8.44E+07
FE 59	2.12E+08	4.99E+08	1.91E+08	0.0	0.0	1.39E+08	1.66E+09
CO 58	0.0	1.41E+07	3.17E+07	0.0	0.0	0.0	2.87E+08
CO 60	0.0	5.56E+07	1.23E+08	0.0	0.0	0.0	1.04E+09
ZN 65	3.01E+08	9.57E+08	4.32E+08	0.0	6.40E+08	0.0	6.03E+08
SR 89	2.39E+08	0.0	6.86E+06	0.0	0.0	0.0	3.83E+07
SR 90	9.67E+09	0.0	2.37E+09	0.0	0.0	0.0	2.79E+08
ZR 95	1.47E+06	4.72E+05	3.20E+05	0.0	7.41E+05	0.0	1.50E+09
MO 99	0.0	9.38E+04	1.78E+04	0.0	2.12E+05	0.0	2.17E+05
SB 124	1.55E+07	2.93E+05	6.15E+06	3.76E+04	0.0	1.21E+07	4.40E+08
I 131	4.92E+06	7.03E+06	4.03E+06	2.30E+09	1.21E+07	0.0	1.86E+06
I 133	1.69E-01	2.94E-01	8.97E-02	4.32E+01	5.14E-01	0.0	2.65E-01
CS 134	4.83E+08	1.15E+09	9.39E+08	0.0	3.72E+08	1.23E+08	2.01E+07
CS 136	1.06E+07	4.20E+07	3.03E+07	0.0	2.34E+07	3.21E+06	4.78E+06
CS 137	6.58E+08	9.00E+08	5.89E+08	0.0	3.05E+08	1.02E+08	1.74E+07
BA 140	2.56E+07	3.22E+04	1.68E+06	0.0	1.09E+04	1.84E+04	5.27E+07
CE 141	1.15E+04	7.79E+03	8.84E+02	0.0	3.62E+03	0.0	2.98E+07
CE 144	1.07E+06	4.49E+05	5.76E+04	0.0	2.66E+05	0.0	3.63E+08

TABLE 3.1-17
(1 of 1)
R_i VALUES - MEAT PATHWAY - TEENAGER

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02	1.95E+02
CR 51	0.0	0.0	4.68E+03	2.60E+03	1.03E+03	6.69E+03	7.87E+05
MN 54	0.0	5.21E+06	1.03E+06	0.0	1.55E+06	0.0	1.07E+07
FE 55	1.73E+08	1.23E+08	2.86E+07	0.0	0.0	7.78E+07	5.31E+07
FE 59	1.70E+08	3.96E+08	1.53E+08	0.0	0.0	1.25E+08	9.36E+08
CO 58	0.0	1.09E+07	2.51E+07	0.0	0.0	0.0	1.50E+08
CO 60	0.0	4.31E+07	9.72E+07	0.0	0.0	0.0	5.62E+08
ZN 65	2.11E+08	7.34E+08	3.43E+08	0.0	4.70E+08	0.0	3.11E+08
SR 89	2.02E+08	0.0	5.78E+06	0.0	0.0	0.0	2.40E+07
SR 90	6.26E+09	0.0	1.55E+09	0.0	0.0	0.0	1.76E+08
ZR 95	1.18E+06	3.72E+05	2.56E+05	0.0	5.47E+05	0.0	8.58E+08
MO 99	0.0	7.75E+04	1.48E+04	0.0	1.77E+05	0.0	1.39E+05
SB 124	1.27E+07	2.33E+05	4.94E+06	2.87E+04	0.0	1.11E+07	2.55E+08
I 131	4.09E+06	5.72E+06	3.07E+06	1.67E+09	9.85E+06	0.0	1.13E+06
I 133	1.42E-01	2.40E-01	7.32E-02	3.35E+01	4.21E-01	0.0	1.82E-01
CS 134	3.84E+08	9.04E+08	4.19E+08	0.0	2.87E+08	1.10E+08	1.12E+07
CS 136	8.30E+06	3.27E+07	2.19E+07	0.0	1.78E+07	2.80E+06	2.63E+06
CS 137	5.46E+08	7.27E+08	2.53E+08	0.0	2.47E+08	9.61E+07	1.03E+07
BA 140	2.12E+07	2.59E+04	1.36E+06	0.0	8.79E+03	1.74E+04	3.26E+07
CE 141	9.67E+03	6.46E+03	7.42E+02	0.0	3.04E+03	0.0	1.85E+07
CE 144	9.04E+05	3.74E+05	4.86E+04	0.0	2.24E+05	0.0	2.27E+08

TABLE 3.1-18
(1 of 1)
R_i VALUES - MEAT PATHWAY - CHILD

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	2.36E+02	2.36E+02	2.36E+02	2.36E+02	2.36E+02	2.36E+02
CR 51	0.0	0.0	7.31E+03	4.06E+03	1.11E+03	7.40E+03	3.87E+05
MN 54	0.0	5.96E+06	1.59E+06	0.0	1.67E+06	0.0	5.00E+06
FE 55	3.32E+08	1.76E+08	5.45E+07	0.0	0.0	9.95E+07	3.26E+07
FE 59	3.01E+08	4.86E+08	2.42E+08	0.0	0.0	1.41E+08	5.06E+08
CO 58	0.0	1.27E+07	3.90E+07	0.0	0.0	0.0	7.43E+07
CO 60	0.0	5.12E+07	1.51E+08	0.0	0.0	0.0	2.84E+08
ZN 65	3.17E+08	8.45E+08	5.26E+08	0.0	5.33E+08	0.0	1.48E+08
SR 89	3.82E+08	0.0	1.09E+07	0.0	0.0	0.0	1.48E+07
SR 90	8.08E+09	0.0	2.05E+09	0.0	0.0	0.0	1.09E+08
ZR 95	2.09E+06	4.60E+05	4.10E+05	0.0	6.59E+05	0.0	4.80E+08
MO 99	0.0	1.08E+05	2.67E+04	0.0	2.30E+05	0.0	8.92E+04
SB 124	2.29E+07	2.97E+05	8.03E+06	5.06E+04	0.0	1.27E+07	1.43E+08
I 131	7.58E+06	7.62E+06	4.33E+06	2.52E+09	1.25E+07	0.0	6.78E+05
I 133	2.63E-01	3.25E-01	1.23E-01	6.04E+01	5.42E-01	0.0	1.31E-01
CS 134	6.77E+08	1.11E+09	2.34E+08	0.0	3.44E+08	1.24E+08	5.99E+06
CS 136	1.43E+07	3.94E+07	2.55E+07	0.0	2.10E+07	3.13E+06	1.38E+06
CS 137	1.01E+09	9.63E+08	1.42E+08	0.0	3.14E+08	1.13E+08	6.03E+06
BA 140	3.91E+07	3.42E+04	2.28E+06	0.0	1.11E+04	2.04E+04	1.98E+07
CE 141	1.82E+04	9.08E+03	1.35E+03	0.0	3.98E+03	0.0	1.13E+07
CE 144	1.70E+06	5.34E+05	9.10E+04	0.0	2.96E+05	0.0	1.39E+08

TABLE 3.1-19
(1 of 1)
R_i VALUES - COW MILK PATHWAY - ADULT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	7.69E+02	7.69E+02	7.69E+02	7.69E+02	7.69E+02	7.69E+02
CR 51	0.0	0.0	2.38E+04	1.42E+04	5.24E+03	3.15E+04	5.98E+06
MN 54	0.0	6.26E+06	1.19E+06	0.0	1.86E+06	0.0	1.92E+07
FE 55	1.82E+07	1.26E+07	2.94E+06	0.0	0.0	7.03E+06	7.22E+06
FE 59	2.37E+07	5.58E+07	2.14E+07	0.0	0.0	1.56E+07	1.86E+08
CO 58	0.0	3.66E+06	8.19E+06	0.0	0.0	0.0	7.41E+07
CO 60	0.0	1.21E+07	2.68E+07	0.0	0.0	0.0	2.28E+08
ZN 65	1.16E+09	3.69E+09	1.67E+09	0.0	2.47E+09	0.0	2.32E+09
SR 89	1.15E+09	0.0	3.30E+07	0.0	0.0	0.0	1.84E+08
SR 90	3.64E+10	0.0	8.93E+09	0.0	0.0	0.0	1.05E+09
ZR 95	7.38E+02	2.37E+02	1.60E+02	0.0	3.71E+02	0.0	7.50E+05
MO 99	0.0	2.32E+07	4.42E+06	0.0	5.25E+07	0.0	5.38E+07
SB 124	2.02E+07	3.81E+05	7.99E+06	4.89E+04	0.0	1.57E+07	5.72E+08
I 131	1.36E+08	1.94E+08	1.11E+08	6.36E+10	3.32E+08	0.0	5.12E+07
I 133	1.80E+06	3.13E+06	9.55E+05	4.61E+08	5.47E+06	0.0	2.82E+06
CS 134	4.15E+09	9.88E+09	8.08E+09	0.0	3.20E+09	1.06E+09	1.73E+08
CS 136	2.33E+08	9.22E+08	6.63E+08	0.0	5.13E+08	7.03E+07	1.05E+08
CS 137	5.57E+09	7.62E+09	4.99E+09	0.0	2.59E+09	8.59E+08	1.47E+08
BA 140	2.39E+07	3.01E+04	1.57E+06	0.0	1.02E+04	1.72E+04	4.93E+07
CE 141	3.99E+03	2.70E+03	3.06E+02	0.0	1.25E+03	0.0	1.03E+07
CE 144	2.64E+05	1.10E+05	1.42E+04	0.0	6.55E+04	0.0	8.93E+07

TABLE 3.1-20
(1 of 1)
R_i VALUES - COW MILK PATHWAY - TEENAGER

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.00E+03	1.00E+03	1.00E+03	1.00E+03	1.00E+03	1.00E+03
CR 51	0.0	0.0	4.15E+04	2.31E+04	9.10E+03	5.93E+04	6.98E+06
MN 54	0.0	1.04E+07	2.07E+06	0.0	3.11E+06	0.0	2.14E+07
FE 55	3.23E+07	2.29E+07	5.34E+06	0.0	0.0	1.45E+07	9.92E+06
FE 59	4.14E+07	9.67E+07	3.73E+07	0.0	0.0	3.05E+07	2.29E+08
CO 58	0.0	6.15E+06	1.42E+07	0.0	0.0	0.0	8.48E+07
CO 60	0.0	2.06E+07	4.63E+07	0.0	0.0	0.0	2.68E+08
ZN 65	1.78E+09	6.18E+09	2.88E+09	0.0	3.96E+09	0.0	2.62E+09
SR 89	2.12E+09	0.0	6.07E+07	0.0	0.0	0.0	2.53E+08
SR 90	5.14E+10	0.0	1.27E+10	0.0	0.0	0.0	1.44E+09
ZR 95	1.29E+03	4.07E+02	2.80E+02	0.0	5.98E+02	0.0	9.39E+05
MO 99	0.0	4.19E+07	7.99E+06	0.0	9.59E+07	0.0	7.50E+07
SB 124	3.60E+07	6.62E+05	1.40E+07	8.16E+04	0.0	3.14E+07	7.25E+08
I 131	2.46E+08	3.44E+08	1.85E+08	1.01E+11	5.93E+08	0.0	6.81E+07
I 133	3.29E+06	5.58E+06	1.70E+06	7.79E+08	9.79E+06	0.0	4.22E+06
CS 134	7.21E+09	1.70E+10	7.87E+09	0.0	5.39E+09	2.06E+09	2.11E+08
CS 136	3.97E+08	1.56E+09	1.05E+09	0.0	8.51E+08	1.34E+08	1.26E+08
CS 137	1.01E+10	1.34E+10	4.68E+09	0.0	4.57E+09	1.78E+09	1.91E+08
BA 140	4.32E+07	5.30E+04	2.78E+06	0.0	1.80E+04	3.56E+04	6.67E+07
CE 141	7.31E+03	4.88E+03	5.61E+02	0.0	2.30E+03	0.0	1.40E+07
CE 144	4.86E+05	2.01E+05	2.61E+04	0.0	1.20E+05	0.0	1.22E+08

TABLE 3.1-21
(1 of 1)
R_i VALUES - COW MILK PATHWAY - CHILD

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.58E+03	1.58E+03	1.58E+03	1.58E+03	1.58E+03	1.58E+03
CR 51	0.0	0.0	3.47E+04	4.70E+04	1.28E+04	8.58E+04	4.49E+06
MN 54	0.0	1.56E+07	4.16E+06	0.0	4.38E+06	0.0	1.31E+07
FE 55	8.11E+07	4.30E+07	1.33E+07	0.0	0.0	2.43E+07	7.97E+06
FE 59	9.61E+07	1.55E+08	7.74E+07	0.0	0.0	4.51E+07	1.62E+08
CO 58	0.0	9.40E+06	2.88E+07	0.0	0.0	0.0	5.48E+07
CO 60	0.0	3.19E+07	9.41E+07	0.0	0.0	0.0	1.77E+08
ZN 65	3.49E+09	9.31E+09	5.79E+09	0.0	5.87E+09	0.0	1.63E+09
SR 89	5.25E+09	0.0	1.50E+08	0.0	0.0	0.0	2.03E+08
SR 90	8.69E+10	0.0	2.20E+10	0.0	0.0	0.0	1.17E+09
ZR 95	3.00E+03	6.59E+02	5.86E+02	0.0	9.43E+02	0.0	6.87E+05
MO 99	0.0	7.62E+07	1.89E+07	0.0	1.63E+08	0.0	6.30E+07
SB 124	8.51E+07	1.10E+06	2.98E+07	1.88E+05	0.0	4.72E+07	5.32E+08
I 131	5.97E+08	6.00E+08	3.41E+08	1.98E+11	9.85E+08	0.0	5.34E+07
I 133	8.00E+06	9.89E+06	3.74E+06	1.84E+09	1.65E+07	0.0	3.98E+06
CS 134	1.66E+10	2.73E+10	5.75E+09	0.0	8.45E+09	3.03E+09	1.47E+08
CS 136	8.97E+08	2.47E+09	1.60E+09	0.0	1.31E+09	1.96E+08	8.67E+07
CS 137	2.43E+10	2.33E+10	3.44E+09	0.0	7.59E+09	2.73E+09	1.46E+08
BA 140	1.04E+08	9.14E+04	6.09E+06	0.0	2.98E+04	5.45E+04	5.29E+07
CE 141	1.80E+04	8.98E+03	1.33E+03	0.0	3.94E+03	0.0	1.12E+07
CE 144	1.20E+06	3.76E+05	6.40E+04	0.0	2.08E+05	0.0	9.80E+07

TABLE 3.1-22
(1 of 1)
R_i VALUES - COW MILK PATHWAY - INFANT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	2.40E+03	2.40E+03	2.40E+03	2.40E+03	2.40E+03	2.40E+03
CR 51	0.0	0.0	1.34E+05	8.75E+04	1.91E+04	1.70E+05	3.91E+06
MN 54	0.0	2.90E+07	6.58E+06	0.0	6.43E+06	0.0	1.07E+07
FE 55	9.81E+07	6.34E+07	1.69E+07	0.0	0.0	3.10E+07	8.04E+06
FE 59	1.79E+08	3.13E+08	1.23E+08	0.0	0.0	9.26E+07	1.50E+08
CO 58	0.0	1.88E+07	4.69E+07	0.0	0.0	0.0	4.69E+07
CO 60	0.0	6.52E+07	1.54E+08	0.0	0.0	0.0	1.55E+08
ZN 65	4.69E+09	1.61E+10	7.42E+09	0.0	7.80E+09	0.0	1.36E+10
SR 89	9.98E+09	0.0	2.86E+08	0.0	0.0	0.0	2.05E+08
SR 90	9.45E+10	0.0	2.41E+10	0.0	0.0	0.0	1.18E+09
ZR 95	5.32E+03	1.30E+03	9.20E+02	0.0	1.40E+03	0.0	6.46E+05
MO 99	0.0	1.95E+08	2.08E+07	0.0	2.91E+08	0.0	6.42E+07
SB 124	1.64E+08	2.41E+06	5.08E+07	4.35E+05	0.0	1.03E+08	5.06E+08
I 131	1.25E+09	1.47E+09	6.45E+08	4.82E+11	1.71E+09	0.0	5.24E+07
I 133	1.69E+07	2.46E+07	7.20E+06	4.47E+09	2.89E+07	0.0	4.16E+06
CS 134	2.68E+10	4.99E+10	5.04E+09	0.0	1.29E+10	5.27E+09	1.36E+08
CS 136	1.75E+09	5.15E+09	1.92E+09	0.0	2.05E+09	4.20E+08	7.83E+07
CS 137	3.88E+10	4.54E+10	3.22E+09	0.0	1.22E+10	4.94E+09	1.42E+08
BA 140	2.15E+08	2.15E+05	1.11E+07	0.0	5.10E+04	1.32E+05	5.27E+07
CE 141	3.57E+04	2.18E+04	2.56E+03	0.0	6.71E+03	0.0	1.12E+07
CE 144	1.72E+06	7.03E+05	9.62E+04	0.0	2.84E+05	0.0	9.85E+07

TABLE 3.1-23
(1 of 1)
R_i VALUES - GOAT MILK PATHWAY - ADULT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.57E+03	1.57E+03	1.57E+03	1.57E+03	1.57E+03	1.57E+03
CR 51	0.0	0.0	2.85E+03	1.71E+03	6.28E+02	3.79E+03	7.17E+05
MN 54	0.0	7.51E+05	1.43E+05	0.0	2.24E+05	0.0	2.30E+06
FE 55	2.37E+06	1.64E+06	3.82E+05	0.0	0.0	9.13E+05	9.39E+05
FE 59	3.09E+06	7.25E+06	2.78E+06	0.0	0.0	2.03E+06	2.42E+07
CO 58	0.0	4.39E+05	9.83E+05	0.0	0.0	0.0	8.89E+06
CO 60	0.0	1.46E+06	3.21E+06	0.0	0.0	0.0	2.73E+07
ZN 65	1.39E+08	4.43E+08	2.00E+08	0.0	2.96E+08	0.0	2.79E+08
SR 89	2.42E+09	0.0	6.93E+07	0.0	0.0	0.0	3.87E+08
SR 90	7.64E+10	0.0	1.87E+10	0.0	0.0	0.0	2.21E+09
ZR 95	8.85E+01	2.84E+01	1.92E+01	0.0	4.46E+01	0.0	9.00E+04
MO 99	0.0	2.78E+06	5.30E+05	0.0	6.31E+06	0.0	6.45E+06
SB 124	2.42E+06	4.57E+04	9.59E+05	5.87E+03	0.0	1.88E+06	6.87E+07
I 131	1.63E+08	2.33E+08	1.33E+08	7.63E+10	3.99E+08	0.0	6.14E+07
I 133	2.16E+06	3.76E+06	1.15E+06	5.53E+08	6.56E+06	0.0	3.38E+06
CS 134	1.25E+10	2.96E+10	2.42E+10	0.0	9.59E+09	3.18E+09	5.19E+08
CS 136	7.00E+08	2.76E+09	1.99E+09	0.0	1.54E+09	2.11E+08	3.14E+08
CS 137	1.67E+10	2.28E+10	1.50E+10	0.0	7.76E+09	2.58E+09	4.42E+08
BA 140	2.87E+06	3.61E+03	1.88E+05	0.0	1.23E+03	2.07E+03	5.92E+06
CE 141	4.79E+02	3.24E+02	3.67E+01	0.0	1.50E+02	0.0	1.24E+06
CE 144	3.17E+04	1.33E+04	1.70E+03	0.0	7.86E+03	0.0	1.07E+07

TABLE 3.1-24
(1 of 1)
R_i VALUES - GOAT MILK PATHWAY - TEENAGER

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	204E+03	2.04E+03	2.04E+03	2.04E+03	2.04E+03	2.04E+03
CR 51	0.0	0.0	4.98E+03	2.77E+03	1.09E+03	7.11E+03	8.37E+05
MN 54	0.0	1.25E+06	2.48E+05	0.0	3.73E+05	0.0	2.57E+06
FE 55	4.20E+06	2.98E+06	6.95E+05	0.0	0.0	1.89E+06	1.29E+06
FE 59	5.39E+06	1.26E+07	4.85E+06	0.0	0.0	3.96E+06	2.97E+07
CO 58	0.0	7.39E+05	1.70E+06	0.0	0.0	0.0	1.02E+07
CO 60	0.0	2.47E+06	5.56E+06	0.0	0.0	0.0	3.21E+07
ZN 65	2.14E+08	7.42E+08	3.46E+08	0.0	4.75E+08	0.0	3.14E+08
SR 89	4.45E+09	0.0	1.28E+08	0.0	0.0	0.0	5.30E+08
SR 90	1.08E+11	0.0	2.67E+10	0.0	0.0	0.0	3.03E+09
ZR 95	1.55E+02	4.88E+01	3.36E+01	0.0	7.18E+01	0.0	1.13E+05
MO 99	0.0	5.03E+06	9.59E+05	0.0	1.15E+07	0.0	9.00E+06
SB 124	4.31E+06	7.95E+04	1.68E+06	9.79E+03	0.0	3.77E+06	8.70E+07
I 131	2.95E+08	4.13E+08	2.22E+08	1.21E+11	7.12E+08	0.0	8.18E+07
I 133	3.95E+06	6.70E+06	2.04E+06	9.35E+08	1.17E+07	0.0	5.07E+06
CS 134	2.16E+10	5.09E+10	2.36E+10	0.0	1.62E+10	6.17E+09	6.33E+08
CS 136	1.19E+09	4.69E+09	3.15E+09	0.0	2.55E+09	4.03E+08	3.78E+08
CS 137	3.03E+10	4.03E+10	1.40E+10	0.0	1.37E+10	5.33E+09	5.73E+08
BA 140	5.19E+06	6.35E+03	3.34E+05	0.0	2.15E+03	4.27E+03	8.00E+06
CE 141	8.77E+02	5.86E+02	6.73E+01	0.0	2.76E+02	0.0	1.68E+06
CE 144	5.83E+04	2.41E+04	3.14E+03	0.0	1.44E+04	0.0	1.47E+07

TABLE 3.1-25
(1 of 1)
R_i VALUES - GOAT MILK PATHWAY - CHILD

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	3.23E+03	3.23E+03	3.23E+03	3.23E+03	3.23E+03	3.23E+03
CR 51	0.0	0.0	1.02E+04	5.64E+03	1.54E+03	1.03E+04	5.39E+05
MN 54	0.0	1.87E+06	4.99E+05	0.0	5.25E+05	0.0	1.57E+06
FE 55	1.05E+07	5.59E+06	1.73E+06	0.0	0.0	3.16E+06	1.04E+06
FE 59	1.25E+07	2.02E+07	1.01E+07	0.0	0.0	5.86E+06	2.10E+07
CO 58	0.0	1.13E+06	3.45E+06	0.0	0.0	0.0	6.58E+06
CO 60	0.0	3.83E+06	1.13E+07	0.0	0.0	0.0	2.12E+07
ZN 65	4.19E+08	1.12E+09	6.95E+08	0.0	7.04E+08	0.0	1.96E+08
SR 89	1.10E+10	0.0	3.15E+08	0.0	0.0	0.0	4.27E+08
SR 90	1.82E+11	0.0	4.62E+10	0.0	0.0	0.0	2.46E+09
ZR 95	3.60E+02	7.91E+01	7.04E+01	0.0	1.13E+02	0.0	8.25E+04
MO 99	0.0	9.15E+06	2.26E+06	0.0	1.95E+07	0.0	7.57E+06
SB 124	1.02E+07	1.32E+05	3.58E+06	2.25E+04	0.0	5.67E+06	6.38E+07
I 131	7.16E+08	7.20E+08	4.09E+08	2.38E+11	1.18E+09	0.0	6.41E+07
I 133	9.59E+06	1.19E+07	4.49E+06	2.20E+09	1.98E+07	0.0	4.78E+06
CS 134	4.99E+10	8.18E+10	1.73E+10	0.0	2.54E+10	9.10E+09	4.41E+08
CS 136	2.69E+09	7.40E+09	4.79E+09	0.0	3.94E+09	5.88E+08	2.60E+08
CS 137	7.30E+10	6.98E+10	1.03E+10	0.0	2.28E+10	8.19E+09	4.37E+08
BA 140	1.25E+07	1.10E+04	7.31E+05	0.0	3.57E+03	6.54E+03	6.34E+06
CE 141	2.16E+03	1.08E+03	1.60E+02	0.0	4.72E+02	0.0	1.34E+06
CE 144	1.44E+05	4.51E+04	7.68E+03	0.0	2.50E+04	0.0	1.18E+07

TABLE 3.1-26
(1 of 1)
R_i VALUES - GOAT MILK PATHWAY - INFANT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	4.90E+03	4.90E+03	4.90E+03	4.90E+03	4.90E+03	4.90E+03
CR 51	0.0	0.0	1.61E+04	1.05E+04	2.29E+03	2.04E+04	4.69E+05
MN 54	0.0	3.48E+06	7.89E+05	0.0	7.72E+05	0.0	1.28E+06
FE 55	1.27E+07	8.24E+06	2.20E+06	0.0	0.0	4.03E+06	1.05E+06
FE 59	2.33E+07	4.07E+07	1.60E+07	0.0	0.0	1.20E+07	1.95E+07
CO 58	0.0	2.26E+06	5.63E+06	0.0	0.0	0.0	5.62E+06
CO 60	0.0	7.82E+06	1.85E+07	0.0	0.0	0.0	1.86E+07
ZN 65	5.63E+08	1.93E+09	8.91E+08	0.0	9.36E+08	0.0	1.63E+09
SR 89	2.10E+10	0.0	6.01E+08	0.0	0.0	0.0	4.31E+08
SR 90	1.98E+11	0.0	5.05E+10	0.0	0.0	0.0	2.48E+09
ZR 95	6.39E+02	1.56E+02	1.10E+02	0.0	1.68E+02	0.0	7.75E+04
MO 99	0.0	2.34E+07	4.56E+06	0.0	3.49E+07	0.0	7.70E+06
SB 124	1.97E+07	2.90E+05	6.10E+06	5.22E+04	0.0	1.23E+07	6.07E+07
I 131	1.49E+09	1.76E+09	7.74E+08	5.79E+11	2.06E+09	0.0	6.29E+07
I 133	2.03E+07	2.95E+07	8.64E+06	5.36E+09	3.47E+07	0.0	4.99E+06
CS 134	8.03E+10	1.50E+11	1.51E+10	0.0	3.86E+10	1.58E+10	4.07E+08
CS 136	5.26E+09	1.55E+10	5.77E+09	0.0	6.16E+09	1.26E+09	2.35E+08
CS 137	1.16E+11	1.36E+11	9.66E+09	0.0	3.66E+10	1.48E+10	4.26E+08
BA 140	2.58E+07	2.58E+04	1.33E+06	0.0	6.12E+03	1.58E+04	6.33E+06
CE 141	4.28E+03	2.61E+03	3.07E+02	0.0	8.05E+02	0.0	1.35E+06
CE 144	2.06E+05	8.44E+04	1.15E+04	0.0	3.41E+04	0.0	1.18E+07

TABLE 3.1-26
(1 of 1)

TABLE 3.1-27
(1 of 1)
R_i VALUES - INHALATION PATHWAY - ADULT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03
CR 51	0.0	0.0	9.99E+01	5.94E+01	2.28E+01	5.94E+04	3.32E+03
MN 54	0.0	3.95E+04	6.29E+03	0.0	9.83E+03	1.40E+06	7.72E+04
FE 55	2.45E+04	1.69E+04	3.94E+03	0.0	0.0	7.20E+04	6.02E+03
FE 59	1.17E+04	2.77E+04	1.05E+04	0.0	0.0	1.01E+06	1.88E+05
CO 58	0.0	1.58E+03	2.07E+03	0.0	0.0	9.27E+05	1.06E+05
CO 60	0.0	1.15E+04	1.48E+04	0.0	0.0	5.96E+06	2.84E+05
ZN 65	3.24E+04	1.03E+05	4.65E+04	0.0	6.89E+04	8.63E+05	5.34E+04
SR 89	3.04E+05	0.0	8.71E+03	0.0	0.0	1.40E+06	3.49E+05
SR 90	9.91E+07	0.0	6.09E+06	0.0	0.0	9.59E+06	7.21E+05
ZR 95	1.07E+05	3.44E+04	2.32E+04	0.0	5.41E+04	1.77E+06	1.50E+05
MO 99	0.0	1.21E+02	2.30E+01	0.0	2.92E+02	9.13E+04	2.48E+05
SB 124	3.12E+04	5.88E+02	1.24E+04	7.54E+01	0.0	2.48E+06	4.06E+05
I 131	2.52E+04	3.57E+04	2.05E+04	1.19E+07	6.12E+04	0.0	6.27E+03
I 133	8.63E+03	1.48E+04	4.51E+03	2.15E+06	2.58E+04	0.0	8.87E+03
CS 134	3.72E+05	8.47E+05	7.27E+05	0.0	2.87E+05	9.75E+04	1.04E+04
CS 136	3.90E+04	1.46E+05	1.10E+05	0.0	8.55E+04	1.20E+04	1.17E+04
CS 137	4.78E+05	6.20E+05	4.27E+05	0.0	2.22E+05	7.51E+04	8.39E+03
BA 140	3.90E+04	4.90E+01	2.56E+03	0.0	1.67E+01	1.27E+06	2.18E+05
CE 141	1.99E+04	1.35E+04	1.53E+03	0.0	6.25E+03	3.61E+05	1.20E+05
CE 144	3.43E+06	1.43E+06	1.84E+05	0.0	8.47E+05	7.76E+06	8.15E+05

TABLE 3.1-27
(1 of 1)

TABLE 3.1-28
(1 of 1)
R_i VALUES - INHALATION PATHWAY - TEENAGER

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03
CR 51	0.0	0.0	1.35E+02	7.49E+01	3.07E+01	2.09E+04	3.00E+03
MN 54	0.0	5.10E+04	8.39E+03	0.0	1.27E+04	1.98E+06	6.67E+04
FE 55	3.34E+04	2.38E+04	5.34E+03	0.0	0.0	1.24E+05	6.38E+03
FE 59	1.59E+04	3.69E+04	1.43E+04	0.0	0.0	1.53E+06	1.78E+05
CO 58	0.0	2.07E+03	2.77E+03	0.0	0.0	1.34E+06	9.51E+04
CO 60	0.0	1.51E+04	1.98E+04	0.0	0.0	8.71E+06	2.59E+05
ZN 65	3.85E+04	1.33E+05	6.23E+04	0.0	8.63E+04	1.24E+06	4.66E+04
SR 89	4.34E+05	0.0	1.25E+04	0.0	0.0	2.41E+06	3.71E+05
SR 90	1.08E+08	0.0	6.67E+06	0.0	0.0	1.65E+07	7.64E+05
ZR 95	1.45E+05	4.58E+04	3.15E+04	0.0	6.73E+04	2.68E+06	1.49E+05
MO 99	0.0	1.69E+02	3.23E+01	0.0	4.12E+02	1.54E+05	2.69E+05
SB 124	4.30E+04	7.92E+02	1.68E+04	9.75E+01	0.0	3.84E+06	3.98E+05
I 131	3.54E+04	4.90E+04	2.64E+04	1.46E+07	8.39E+04	0.0	6.48E+03
I 133	1.21E+04	2.05E+04	6.21E+03	2.92E+06	3.59E+04	0.0	1.03E+04
CS 134	5.02E+05	1.13E+06	5.48E+05	0.0	3.75E+05	1.46E+05	9.75E+03
CS 136	5.14E+04	1.93E+05	1.37E+05	0.0	1.10E+05	1.77E+04	1.09E+04
CS 137	6.69E+05	8.47E+05	3.11E+05	0.0	3.04E+05	1.21E+05	8.47E+03
BA 140	5.46E+04	6.69E+01	3.51E+03	0.0	2.28E+01	2.03E+06	2.28E+05
CE 141	2.84E+04	1.89E+04	2.16E+03	0.0	8.87E+03	6.13E+05	1.26E+05
CE 144	4.88E+06	2.02E+06	2.62E+05	0.0	1.21E+06	1.33E+07	8.63E+05

TABLE 3.1-29
(1 of 1)
R_i VALUES - INHALATION PATHWAY - CHILD

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03
CR 51	0.0	0.0	1.54E+02	8.53E+01	2.43E+01	1.70E+04	1.08E+03
MN 54	0.0	4.29E+04	9.50E+03	0.0	1.00E+04	1.57E+06	2.29E+04
FE 55	4.73E+04	2.51E+04	7.76E+03	0.0	0.0	1.11E+05	2.86E+03
FE 59	2.07E+04	3.34E+04	1.67E+04	0.0	0.0	1.27E+06	7.06E+04
CO 58	0.0	1.77E+03	3.16E+03	0.0	0.0	1.10E+06	3.43E+04
CO 60	0.0	1.31E+04	2.26E+04	0.0	0.0	7.06E+06	9.61E+04
ZN 65	4.25E+04	1.13E+05	7.02E+04	0.0	7.13E+04	9.94E+05	1.63E+04
SR 89	5.99E+05	0.0	1.72E+04	0.0	0.0	2.15E+06	1.67E+05
SR 90	1.01E+08	0.0	6.43E+06	0.0	0.0	1.47E+07	3.43E+05
ZR 95	1.90E+05	4.17E+04	3.69E+04	0.0	5.95E+04	2.23E+06	6.10E+04
MO 99	0.0	1.73E+02	4.26E+01	0.0	3.93E+02	1.36E+05	1.27E+05
SB 124	5.73E+04	7.39E+02	2.00E+04	1.26E+02	0.0	3.24E+06	1.64E+05
I 131	4.80E+04	4.80E+04	2.72E+04	1.62E+07	7.87E+04	0.0	2.84E+03
I 133	1.66E+04	2.03E+04	7.68E+03	3.84E+06	3.37E+04	0.0	5.47E+03
CS 134	6.50E+05	1.01E+06	2.24E+05	0.0	3.30E+05	1.21E+05	3.84E+03
CS 136	6.50E+04	1.71E+05	1.16E+05	0.0	9.53E+04	1.45E+04	4.17E+03
CS 137	9.05E+05	8.24E+05	1.28E+05	0.0	2.82E+05	1.04E+05	3.61E+03
BA 140	7.39E+04	6.47E+01	4.32E+03	0.0	2.11E+01	1.74E+06	1.02E+05
CE 141	3.92E+04	1.95E+04	2.89E+03	0.0	8.53E+03	5.43E+05	5.65E+04
CE 144	6.76E+06	2.11E+06	3.61E+05	0.0	1.17E+06	1.19E+07	3.88E+05

TABLE 3.1-29
(1 of 1)

TABLE 3.1-30
(1 of 1)
R_i VALUES - INHALATION PATHWAY - INFANT

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.0	6.46E+02	6.46E+02	6.46E+02	6.46E+02	6.46E+02	6.46E+02
CR 51	0.0	0.0	8.93E+01	5.75E+01	1.32E+01	1.28E+04	3.56E+02
MN 54	0.0	2.53E+04	4.98E+03	0.0	4.98E+03	9.98E+05	7.05E+03
FE 55	1.97E+04	1.17E+04	3.33E+03	0.0	0.0	8.68E+04	1.09E+03
FE 59	1.35E+04	2.35E+04	9.46E+03	0.0	0.0	1.01E+06	2.47E+04
CO 58	0.0	1.22E+03	1.82E+03	0.0	0.0	7.76E+05	1.11E+04
CO 60	0.0	8.01E+03	1.18E+04	0.0	0.0	4.50E+06	3.19E+04
ZN 65	1.93E+04	6.25E+04	3.10E+04	0.0	3.24E+04	6.46E+05	5.13E+04
SR 89	3.97E+05	0.0	1.14E+04	0.0	0.0	2.03E+06	6.39E+04
SR 90	4.08E+07	0.0	2.59E+06	0.0	0.0	1.12E+07	1.31E+05
ZR 95	1.15E+05	2.78E+04	2.03E+04	0.0	3.10E+04	1.75E+06	2.17E+04
MO 99	0.0	1.65E+02	3.24E+01	0.0	2.65E+02	1.35E+05	4.88E+04
SB 124	3.79E+04	5.55E+02	1.20E+04	1.00E+02	0.0	2.64E+06	5.90E+04
I 131	3.79E+04	4.43E+04	1.96E+04	1.48E+07	5.17E+04	0.0	1.06E+03
I 133	1.32E+04	1.92E+04	5.59E+03	3.55E+06	2.24E+04	0.0	2.15E+03
CS 134	3.96E+05	7.02E+05	7.44E+04	0.0	1.90E+05	7.95E+04	1.33E+03
CS 136	4.82E+04	1.34E+05	5.28E+04	0.0	5.63E+04	1.17E+04	1.43E+03
CS 137	5.48E+05	6.11E+05	4.54E+04	0.0	1.72E+05	7.12E+04	1.33E+03
BA 140	5.59E+04	5.59E+01	2.89E+03	0.0	1.34E+01	1.59E+06	3.83E+04
CE 141	2.77E+04	1.66E+04	1.99E+03	0.0	5.24E+03	5.16E+05	2.15E+04
CE 144	3.19E+06	1.21E+06	1.76E+05	0.0	5.37E+05	9.83E+06	1.48E+05