OFFSITE DOSE CALCULATION MANUAL

for

Kansas Gas and Electric
Wolf Creek Generating Station

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1.0 INTRODUCTION

The Offsite Dose Calculation Manual (ODCM) describes the methodology and parameters to be used in the calculation of offsite doses due to radioactive liquid and gaseous effluents. These dose estimates are used to demonstrate compliance with the Radiological Effluent Technical Specifications as required by 10 CFR 50.36, 10 CFR 20.106, 10 CFR 50 Appendix I, and 40 CFR 190. The ODCM contents are based on "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants (NUREG-0133)," and Regulatory Guide 1.109, Revision 1.

The ODCM provides the methodology to be used in the calculation of liquid and gaseous effluent monitor alarm/trip setpoints to assure compliance with the concentration and dose limitations of the Radiological Effluent Technical Specifications.

The ODCM provides the Radiological Environmental Monitoring Program. The program consists of monitoring stations and sampling programs designed to confirm the dose estimates made under normal or accident conditions, and conform to NRC requiremnts in 20 CFR Part 50.

The ODCM also provides a description of the methods used to calculate offsite doses in the event of an emergency.

2.0 LIQUID EFFLUENTS

2.1 LIQUID EFFLUENT MONITOR SETPOINTS

The alarm/trip setpoints for the liquid effluent radiation monitors are based on the instantaneous concentration limits of 10 CFR 20, Appendix B, Table II, Column 2 applied at the boundary of the restricted area. Specifically, the High Alarm setpoint will correspond to the 10 CFR Part 20 limits at the boundary of the restricted area; the alert alarm setpoint is set one order of magnitude below the High Alarm/Trip setpoint. Since the High Alarm/Trip initiates isolation of the particular system and termination of the release, this setpoint represents assurance that the instantaneous liquid release limit of 10 CFR Part 20 is not exceeded. Auditable records shall be maintained indicating the actual setpoints used at all times.

2.1.1 CONTINUOUS LIQUID EFFLUENT MONITORS

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

Monitor ID	Description
0-BM-RE-52	Steam Generator Blowdown Discharge Monitor
0-LE-RE-59	Turbine Building Drain Monitor

The steam generator blowdown discharge effluent monitor continuously monitors the blowdown discharge pump outlet to detect excess radioactivity due to system demineralizer breakthrough or abnormal primary to secondary leakage. The blowdown discharge monitor's high alarm setpoint initiates closure of the blowdown isolation valves and the blowdown discharge valve. Similarly, the high radiation alarm on the turbine building drain monitor initiates closure of the drain line isolation valve to prevent the release of radioactive effluents.

Monitor setpoints will be conservatively based on I-131, the most restrictive isotope expected to be present. This is particularly appropriate for the turbine building drain line monitor since the most probable source is the secondary steam system which is expected to have negligible activity unless there is a significant primary to secondary leak. Due to changing activities, it will not be possible to select a radionuclide distribution on which to base the monitor setpoint. Additionally, maximum effluent flows and minimum dilution flows will normally be assumed.

The High Alarm/Trip Setpoint will be set to correspond to the I-131 MPC limit at the boundary of the restricted area from 10 CFR Part 20, Appendix B, Table II, Column 2. The alert alarm is set one order of magnitude below the high alarm/trip setpoint. This high alarm/trip setpoint assures the limits of Specification 3.11.1.1 are not exceeded at the boundary of the restricted area.

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

The above continuous liquid effluents are not radioactive effluents until activity has been detected by the liquid effluent monitor, a tritium analysis of the secondary system, or a gross beta analysis of the secondary system. At that time an analysis of the effluent will be made to verify activity in the system effluent.

2.1.1.1 STEAM GENERATOR BLOWDOWN DISCHARGE MONITOR

$$\text{SETPOINT } (\mu\text{Ci/ml}) = MPC_{I-131} \times \frac{F_m + F_B}{F_B}$$

where,

MPC_{I-131} = Maximum Permissible Concentration of I-131, 3.0 E-7 μCi/ml.

F_m = Dilution flow rate.

F_B = Blowdown flow rate.

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

On the event that an alarm is reached, the setpoint will be re-evaluated using the actual dilution flow rate, the actual blowdown flow rate, and the actual isotopic analysis. This evaluation will be used to ensure the limit of Specification 3.11.1.1 was not exceeded. The setpoint will still be based on the MPC of I-131 due to the changing conditions of activity and I-131 being the most restrictive isotope.

2.1.1.2 TURBINE BUILDING DRAIN MONITOR

$$\text{Setpoint } (\mu\text{Ci/ml}) = MPC_{I-131} \times \frac{F_m + F_T}{F_T}$$

where,

MPC_{I-131} = 3.0 E-7 μCi/ml.

F_m = Dilution flow rate.

F_T = Turbine Building drain flow rate.

The setpoint is based on the minimum dilution flow rate, the maximum possible Turbine Building drain flow rate, and the most restrictive isotope expected to be present, I-131.

On the event that an alarm is reached, the release will be evaluated to see if the limit of Specification 3.11.1.1 was exceeded by using the actual dilution flow rate, the actual Turbine Building drain flow rate, and the actual isotopic analysis. The setpoint will still be based on the MPC of I-131 due to the changing conditions of activity and I-131 being the most restrictive isotope.

2.1.2 BATCH RADIOACTIVE LIQUID EFFLUENT MONITOR

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

Monitor ID	Description
O-HF-RE-45	Secondary Liquid Waste System Monitor
O-HB-RE-18	Liquid Radwaste Discharge Monitor

The setpoint is a function of dilution flow rate, tank flow rate, and isotopic composition. A laboratory isotopic analysis is made of each batch prior to discharge. Based on the isotopic analysis and existing flow condition, the setpoint will be calculated and set on the appropriate monitor to ensure the concentration limits of 10 CFR 20, Appendix B, Table II, Column 2 are not exceeded. The setpoints are determined using the following methodology:

1. A sample will be taken from the tank to be discharged and an isotopic analysis performed.

2. A monthly sample will be taken from the lake at the discharge area and an isotopic analysis performed.

$$\text{Setpoint } (\mu\text{Ci/ml}) = \left(\sum_i (P_i)(MPC_i - LC_i)\right)\left(\frac{F + F_W}{F}\right)$$

where,

$$P_i = C_i/C_T$$

where,

P_i = Fraction of the total activity which is the ith isotope.

C_i = Concentration of the ith isotope, μCi/ml.

$C_T = \sum_i C_i$ = Total concentration of sample.

LC_i = Concentration of the ith isotope, μCi/ml already contained in the receiving water at the boundary of the unrestricted area.

MPC_i = Maximum Permissible Concentration of the ith isotope.

F_W = Dilution flow rate.

F = Waste tank discharge rate.

2.2 LIQUID EFFLUENT CONCENTRATION - COMPLIANCE WITH 10 CFR 20

Specification 3.11.1.1 requires that the radioactive material released in liquid effluents to unrestricted areas shall be limited to:

a. The concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases.

b. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} μCi/ml total activity.

To show compliance with this specification, concentrations of actual liquid effluents will be determined by performing an isotopic analysis. The liquid effluent monitors will provide assurance that the liquid concentration limits are not exceeded.

2.3 RADIOACTIVE LIQUID EFFLUENT DOSES - COMPLIANCE WITH 10 CFR 50, Appendix I

Specification 3.11.1.2 requires that the dose to an individual from radioactive materials in liquid effluents released to unrestricted areas shall be limited to:

a. During any calendar quarter to less than or equal to 1.5 mrem to the total body and to less than or equal to 5 mrem to any organ, and

b. During any calendar year to less than or equal to 3 mrem to the total body and to less than or equal to 10 mrem to any organ.

To show compliance with this specification, cumulative dose contributions from actual liquid effluents will be determined using the following methodology:

$$D_T = \sum_i \left(A_{iT} \sum_{L=1}^{m} \Delta t_L \, C_{iL} \, F_L \right)$$

where,

D_T = the cumulative dose commitment to the total body or any organ, T, from the liquid effluent for the total time period $\sum_{L=1}^{m} \Delta t_L$, in mrem.

Δt_L = the length of the Lth time period over which C_{iL} and F_L are averaged for all liquid releases, in hours.

C_{iL} = the average concentration of radionuclide, 'i', in undiluted liquid effluent flow during time period Δt_L, in μCi/ml

F_L = the near field average dilution factor for C_{iL} during any liquid effluent release where:

$$F_L = \frac{f}{(F)K}$$

where:

f = Liquid Radioactive Waste Flow

F = Discharge Structure Exit Flow, the sum of the release and dilution flow.

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

A_{iT} = the site related ingestion dose commitment factor to the total body or any organ, 'T', for each identified principal gamma and beta emitter, mrem/hr per μCi/ml:

$$A_{iT} = 1.14E5\ (U_W/DW + U_F.BF_i)\ DF_i$$

where,

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

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

DF_i = Dose Conversion factor for radionuclide, 'i', in mrem/pCi, from Table A.3-1 thru A.3-4 from Regulatory Guide 1.109 (Rev. 1).

U_W = Water consumption, in kg/yr.

U_F = Fish consumption, in kg/yr.

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

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

3.0 GASEOUS EFFLUENTS

3.1 GASEOUS EFFLUENT MONITOR SETPOINTS

The alarm/trip setpoints for the gaseous effluent radiation monitors are based on the instantaneous concentration limits of 10 CFR Part 20, Appendix B, Table II, Column 1 applied at the boundary of the restricted area. Specifically, the setpoints will be based on maintaining the concentrations of the most significant isotope, expected to be present and detectable, below the maximum permissible concentrations for an unrestricted area. Although the gaseous effluent monitors are also sensitive to radioiodine and particulates accumulated on filters, these channels are not suitable for instantaneous release limits; therefore, the alarm/trip setpoints will be based on Xe-133, which during changing conditions would be the most significant isotope.

3.1.1 CONTINUOUS GASEOUS EFFLUENT MONITORS

The plant has two gaseous effluent release points. The associated monitors are listed below.

Monitor ID	Release Point Description
O-GT-RE-21 A and B	Unit Vent (fuel/auxiliary building, access control area, containment purge, condenser air discharge)
O-GH-RE-10 A and B	Radwaste Building Vent (Radwaste building, waste gas decay tank discharge)

The unit vent monitor has only an alarm function and is used to monitor the normally low activity associated with continuous releases The radwaste building vent serves as both a continuous and batch monitor; this monitor has an alarm function and also functions to isolate the waste gas decay tank discharge.

Since there are two gaseous effluent release points, a fraction of the total MPC will be allocated to each release point. The fraction can be assigned based on the results of the PWR-GALE results (FSAR Table 11.1-2). Neglecting the batch releases, the plant unit vent monitor will be originally allocated 0.7 MPC and the radwaste building exhaust will be allocated 0.3 MPC and will be changed or set as required but limited to 1.0 MPC of Xe-133. Therefore, a particular monitor reaching the fractional MPC setpoint would not necessarily mean the MPC limit at the site boundary is being exceeded; the alarm only indicates that the specific release point is contributing a greater fraction of the MPC limit than was allocated to the associated monitor and will constitute an evaluation of both systems.

The gaseous effluent monitor setpoints will be determined by using the most significant isotope (Xe-133).

$$\text{Setpoint } (\mu\text{Ci/cc}) = \frac{(3\ \text{E-7})\text{AF}}{\text{F} \cdot (\text{X/Q})}$$

where,

3 E-7 = MPC for Xe-133.(most significant isotope)

F = Vent flow, M^3/sec.

X/Q = Atmospheric dispersion factor, 1.5 E-4 sec/m^3, or current X/Q.

AF = Allocation Factor which takes into account the fraction of the MPC allotted to each individual monitor.

The value of the X/Q adopted in the setpoint calculation is based on the worst 2 hour value at the restricted area boundary in a 3 year measurement period.

3.1.2 BATCH GASEOUS EFFLUENT MONITORS

The monitors associated with the batch releases are listed below:

Monitor	Release Point Description
O-GT-RE-22&33	Containment Purge System Monitor (acts to isolate the purge; is not an effluent monitor)
O-GH-RE-10 A and B	Radwaste Building Vent (acts to isolate waste Gas Decay Tank Discharge Line)

Prior to each batch release an isotopic analysis is made of the contained activity to determine the identity and quantity of the principle radionuclides. If necessary, the existing setpoint will be decreased or increased to ensure the concentration limits of 10 CFR Part 20 are not exceeded. Actually, since the primary purpose of the containment purge system monitor is to isolate the purge in the event of accidental release, the setpoints will be maintained at a level which is much more restrictive than is required by 10 CFR 20.

$$\text{Setpoint } (\mu\text{Ci/ml}) = \sum_i \frac{(P_i)(MPC_i))}{(F \cdot (X/Q))}$$

where,

P_i = C_i/C_T = Fraction of the total activity which is the ith isotope.

C_i = Concentration of the ith isotope, μCi/ml.

C_T = $\sum_i C_i$ = Total concentration of sample.

MPC_i = Maximum Permissible Concentration of the ith isotope.

F = Vent flow rate, in m^3/sec.

X/Q = Atmospheric dispersion factor, 1.5 E-4 sec/m^3, or current X/Q.

3.2 GASEOUS EFFLUENT CONCENTRATION/DOSE RATE

- Compliance with 10 CFR 20

The Standard Technical Specification 3.11.2.1 requires that the instantaneous dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to the following values:

a. The dose rate limit for noble gases shall be <500 mrem/yr to the total body and <3000 mrem/yr to the skin, and

b. The dose rate limit for all radioiodines and for all radioactive materials in particulate form and radionuclides other than noble gases with half lives greater than 8 days shall be <1500 mrem/yr to any organ.

Based on the methodology of NUREG-0133;

a. Release rate limit for noble gases:

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

and

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

where:

K_i = Total body dose factor due to gamma emissions for each identified noble gas radionuclide, in mrem/yr per μCi/m^3, from Table A.1-2.

(X/Q) = 1.5 E-4 sec/m^3, the most restrictive X/Q, during a 2 hour period, at the restricted area boundary, (Based upon historical data contained in the FSAR.) or current X/Q.

Q_i = Release rate of radionuclide i from vent, in μCi/sec.

L_i = Skin dose factor due to beta emissions for each identified noble gas radionuclide, in mrem/yr per μCi/m^3, from Table A.1-2.

M_i = Air dose factor due to gamma emissions for each identified noble gas radionuclide, in mrad/yr per μCi/m^3 from Table A.1-2.

1.1 = Conversion constant of air dose to skin dose.

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

$\sum_i (P_{ox(i)} \cdot Q_i)$ <1500 mrem/yr to any organ.

where:

Q_i = The release rate of radionuclides, i, in gaseous effluent from all vent releases, in μCi/sec.

$P_{ox(i)} = P(i)_{IN} \cdot (X/Q) + P_{(i)GR} \cdot (D/Q) + P_{(i)F} \cdot (D/Q)$

See Table A.4-1.

where:

$P_{(i)IN}$ = The dose parameter for radionuclides other than noble gases for the inhalation pathway, in mrem/yr per $\mu Ci/m^3$. See Table A.4-1.

$P_{(i)GR}$ = The dose parameter for radionuclides other than noble gases for the ground plane pathways in (m^2·mrem/yr per μCi/sec). See Table A 4-1.

$P_{(i)F}$ = The dose parameter for radionuclides other than noble gases for food pathways, in (m^2· mrem/yr per μCi/sec). See Table A.4-1.

X/Q = 1.5 E-4 sec/m^3 (most restrictive value for 0-2 hr. release and is used in FSAR). The highest calculated dispersion parameter for estimating the dose to an individual at the unrestricted area boundry in the NNW sector, or current X/Q.

D/Q = The highest calculated annual average relative deposition parameter for estimating the dose to an individual at the restricted area boundary in the N sector, 1.8 E-8 m^{-2} based on the FSAR.

NOTE: When calculating the dose due to tritium, use the X/Q relative concentration (sec/m^3) factor in place of the D/Q average dispersion (m^{-2}) parameter.

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

The following equations for P_i were taken from NUREG 0133:

$P_{(i)IN}$ (Inhalation);

$$P_{(i)IN} = K' \text{ (BR) } DFA_i \text{ (mrem/yr per } \mu Ci/m^3)$$

where:

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

BR = the breathing rate of the infant age group in m^3/yr

DFA_i = the maximum organ inhalation dose factor for the infant age group for the ith radionuclide, in mrem/pCi. The total body is considered as an organ in the selection of DFA_i.

The age group considered is the infant group. The infant's breathing rate is taken as 1400 m^3/yr from Table E-5 of Regulatory Guide 1.109. The inhalation dose factors for the infant, DFA_i are presented in Table E-10 of Regulatory Guide 1.109, in units of mrem/pCi.

Resolution of the units yields:

P_i (Inhalation) = 1.4 X 10^9 DFA_i

See Table A.4-1

$P_{(i)GR}$ (Ground);

$$P_{(i)GR} = K'K''(DFG_i)(1-e^{-\lambda_i t})\ \lambda_i \quad (m^2 \cdot \text{mrem/yr per } \mu\text{Ci/sec})$$

where:

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

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

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

t = the exposure period, 3.15 x 10^7 sec (1 year)

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

The deposition rate onto the ground plane results in a ground plane concentration that is assumed to persist over a year with radiological decay being the only operating removal mechanism for each radionuclide. The ground plane dose conversion factors for the ith radionuclide, DFG_i, are presented in Table E-6 of Regulatory Guide 1.109, in units of mrem/hr per pCi/m^2.

Resolution of units yields:

$$P_i \text{ (Ground)} = 8.76 \times 10^9 \cdot DFG_i \, (1-e^{-\lambda_i t})/\lambda_i$$

See Table A.4-1.

$P_{(i)F}$ (Food);

$$P_{(i)F} = K' r \frac{Q_F}{Y_p} \frac{(U_{ap})}{(\lambda_i + \lambda_w)} F_m DFL_i \, [e^{-\lambda_i t_f}]$$

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

where:

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

Q_F = the cow's consumption rate, in kg/day (wet weight)

U_{ap} = the infant's milk consumption rate, in liters/year

Y_p = the agricultural productivity by unit area, in kg/m^2

F_m = the stable element transfer coefficients, in days/liter

r = fraction of deposited activity retained on cow's feed grass

DFL_i = the maximum organ ingestion dose factor for the ith radionuclide, in sec^{-1}

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-time).

t_f = the transport time from pasture to cow, to milk, to infant, in sec.

A fraction of the airborne deposition is captured by the ground plane vegetation cover. The captured material is removed from the vegetation (grass) by both radiological decay and weathering processes.

The values of Q_F, U_{ap}, and Y_p are provided in Regulatory Guide 1.109, Tables E-3, E-5, and E-15, as 50 kg/day, 330 liters/day, and 0.7 kg/m^2, respectively. The value t_F is provided in Regulatory Guide 1.109, Table E-15, as 2 days (1.73 X 10^5sec). The fraction, R, has a value of 1.0 for radioiodines and 0.2 for particulates, as presented in Regulatory Guide 1.109, Table E-15.

Table E-1 of Regulatory Guide 1.109 provides the stable element transfer coefficients, F_m, and Table E-14 provides the ingestion dose factors, DFL_i, for the infant's organs. The organ with the maximum value of DFL_i is to be used.

Resolution of the units yields:

$$P_i \text{ (Food)} = 2.4 \times 10^{10} \left(\frac{rF_m}{\lambda_i + \lambda_w}\right) DFL_i \left(e^{-\lambda_i t_f}\right)$$

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

See Table A.4-1.

The P_i values for tritium are:

P_i (Inhalation) = 1.4×10^9 DFA_j

P_i (Ground) = 0, due to being a weak beta emitter

P_i (Food) = 2.4×10^3 mrem/yr per μCi/m^3

3.3 GASEOUS EFFLUENT DOSES

- Compliance with 10 CFR 50 Appendix I

3.3.1 NOBLE GASES

Specification 3.11.2.2 requires that the air dose due to noble gases released in gaseous effluents to areas at and beyond the site boundary shall be limited to the following:

a. During any calendar quarter, to $\leq$ 5 mrad for gamma radiation and $\leq$ 10 mrad for beta radiation;

b. During any calendar year, to $\leq$ 10 mrad for gamma radiation and $\leq$ 20 mrad for beta radiation.

To show compliance with this specification, the dose calculations for the actual releases of radioactive noble gases in gaseous effluent will be consistent with the methodology provided in Reg. Guide 1.109, Rev. 1. The following dose calculations will be performed:

a. During any calendar quarter;

For gamma radiation;

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

For beta radiation;

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

b. During any calendar year:

For gamma radiation:

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

For beta radiation:

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

where:

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

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

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

X/Q = 1.5 E-4 sec/m^3. The highest calculated relative concentration for any area at or beyond the unrestricted area boundary for a two hour period, or current X/Q.

Q_i = The average release of noble gas radionuclides, 'i', in gaseous effluents, in μCi.

An average monthly air dose schedule should be setup to ensure section 3.11.2.2 of Wolf Creek Technical Specifications are not exceeded. The average monthly air dose should be as follows:

a. For gamma radiation $\leq$ 1.6 mrad/mo.
For beta radiation $\leq$ 3.3 mrad/mo.

b. For gamma radiation $\leq$ 0.8 mrad/mo.
For beta radiation $\leq$ 1.6 mrad/mo.

If the monthly average air dose for: (a) is exceeded, it should be noted that if the release is continued at the same (or higher) frequencies or activities, Section 3.11.2.2 A of Wolf Creek Technical Specifications will be exceeded.

If the monthly average air dose for: (b) is exceeded, it should be noted that if the release is continued at the same (or higher) frequencies or activities, Section 3.11.2.2 B of Wolf Creek Technical Specifications will be exceeded.

If any of the above monthly average air doses are exceeded, evaluation of the causes of the high air dose should be performed and steps should be taken to reduce the activity or frequency of the release.

3.3.2 RADIOIODINES, PARTICULATES, AND OTHER RADIONUCLIDES

Specification 3.11.2.3 requires that the dose to an individual from iodine-131 and 133, tritium, and all radioactive materials in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:

a. During any calendar quarter to $\leq$ 7.5 mrem; and

b. During any calendar year to $\leq$ 15 mrem.

To show compliance with this specification, the dose calculations for the actual releases of the subject materials are consistent with the methodology provided in Regulation Guide 1.109, Revision 1. The following dose calculation will be performed:

a. $D\ (\text{mrem}) = 3.17\text{E-}8 \sum_i R_i\ (WQ_i) \leq 7.5\ \text{mrem}$

b. $D\ (\text{mrem}) = 3.17\text{E-}8 \sum_i R_i\ (WQ_i) \leq 15\ \text{mrem}$

where:

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

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

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

W = $(^{X}/_{Q})$, 1.5 x 10^{-4} sec/m^3, or current X/Q for the inhalation pathway.

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

R_i = The dose factor for each identified radionuclide, 'i', in mrem/yr per μCi/m^3.

$$R_i = R_i^I [^X/_Q] + R_i^G [^D/_Q] + R_i^C [^D/_Q, ^X/_Q] + R_i^M [^D/_Q, ^X/_Q] + R_i^V [^D/_Q, ^X/_Q]$$

where:

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

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

where:

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

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

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

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 for the receptor of age group (a) for the i th radionuclide, in mrem/pCi. The total body is considered as an organ in the selection of (DFA_i)a. See Tables A.2-1, A.2-2, A.2-3, & A.2-4. From Regulatory Guide 1.109, Tables E-7, E-8, E-9, and E-10.

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

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

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 i th radionuclide, sec^{-1}.

t = The exposure time, 4.73 E8 sec (15 years).

DFG_i = The ground plane dose conversion factor for the ith radionuclide (mrem/yr per pCi/m^2). See Table A.2-5. (Regulatory Guide 1.109, Table E-6).

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

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

$$R_i^C[D/Q] = K'\left(\frac{Q_F(U_{ap})}{\lambda_i + \lambda_w}\right) F_m(r)(DFL_i)_a\ (1/Y_p)\ (e^{-\lambda_i t_f})$$

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

where:

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

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

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

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

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

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

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

$(DFL_i)_a$ = The maximum organ ingestion dose factor for the i th radionuclide for the receptor in age group 'a', in mrem/pCi. See Tables A.3-1, A.3-2, A.3-3, and A.3-4. (Reg. Guide 1.109, Table E-11, E-12, E-13, and E-14)

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 E-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 E5 secs (2 days). (Reg. Guide 1.109, Table E-15).

NOTE: The fraction of the year that the cow is on pasture and the fraction of the cow feed that is pasture grass is assumed to be 1.0, which is the most restrictive case.

The concentration of tritium in milk is based on the airborne concentration rather than the deposition. Therefore, the R^C_i is based on $(^X/Q)$,

$$R^C_i [X/Q] = K'K''' F_m Q_F U_{ap} (DFL_i)_a [0.75 (0.5/H)]$$

(mrem/yr per μCi/m^3)

where:

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

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

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

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

Grass-Cow-Meat Pathway Factor, $R^M_i[D/Q]$

$$R^M_i[D/Q] = K' \left(\frac{Q_F (U_{ap})}{\lambda_i + \lambda_w}\right) F_f (r) (DFL_i)_a (1/Y_p) e^{-\lambda_i t_f}$$

(m^2 · mrem/yr per μCi/sec)

where:

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

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

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

t_f = The transport time from pasture to receptor, in sec., 1.73 E6 (20 days) (Reg Guide 1.109, Table E-15).

The concentration of tritium in meat is based on its airborne concentration rather than the deposition. Therefore, the R^M_i is based on $(^X/_Q)$:

$$R^M_i[X/Q] = K'K'' F_f Q_f U_{ap} (DFL_i)_a [0.75(0.5/H)]$$

(mrem/yr per μCi/m^3)

where:

All terms defined above.

Vegetation Pathway Factor, $R^V_i[D/Q]$

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

$$R^V_i[D/Q] = K' \left[\frac{r}{Y_V(\lambda_i+\lambda_w)}\right](DFL_i)a \left[(U^L_a)(f_L)(e^{-\lambda_i t_L})+(U^S_a)(f_g)(e^{-\lambda_i t_h})\right]$$

(m^2 · mrem/yr per μCi/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. (Reg Guide 1.109, Table E-5).

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

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

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

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

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

t_L = The average time between harvest of leafy vegetation and its consumption, in seconds, 8.6 E4 secs (1 day). Reg. Guide 1.109).

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

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

All other factors previously defined.

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

$$R_i^V[X/Q] = K' K''' [U_a^L f_L + U_a^S f_g] (DFL_i)_a [0.75 (0.5/H)]$$

(mrem/yr per μCi/m^3)

where:

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

An average monthly air dose schedule should be setup to ensure Section 3.11.2.3 of Wolf Creek Technical Specifications are not exceeded. The average monthly air dose due to radioiodines, particulates, and other radionuclides which are included in this section should be as follows:

a. < 2.5 mrem/mo.
b. < 1.25 mrem/mo.

If the monthly average air dose for (a) is exceeded, it should be noted that if the release is continued at the same (or higher) frequencies or activities the quarterly limit of Specification 3.11.2.3 A will be exceeded.

If the monthly average air dose for (b) is exceeded, it should be noted that if the release is continued at the same (or higher) frequencies or activities the yearly limit of Specification 3.11.2.3 B will be exceeded.

If any of the above monthly air doses are exceeded, evaluation of the causes should be performed and steps taken to reduce the activity or frequency of the release.

4.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Table 4.1 gives specific Radiological Environmental sampling pathways, locations and frequencies corresponding to Table 3.12-1 of Wolf Creek Technical Specifications. Maps showing these locations in relation to the Wolf Creek site are shown in Figures 4.1, 4.2 and 4.3; Table 4.2 lists distances and directions from the site to the sampling locations.

TABLE 4.1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
1. AIRBORNE			
Radioiodine and Particulates	Five locations, station numbers 2, 3, 31, 37 and 40 (control) Figure 4.1.	Continuous operation of sampler with sample collection as required by dust loading but at least weekly.	Radioiodine canister. Analyze weekly for for I-131. Analyze for gross beta radioactivity not less than 24 hours following filter change. Perform gamma isotopic analysis on each sample when gross beta activity is greater than 10 times the yearly mean of control samples. Perform gamma isotopic analysis on composite (by location) once per quarter.
2. DIRECT RADIATION	38 TLD locations within 5-mile radius of site (station numbers 1-38 on Figure 4.1) and two offsite locations (stations 39 and 40); two TLD dosimeters at each location.	Quarterly at each location.	Gamma dose quarterly.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
3. WATERBORNE			
a. Surface	One upstream location near the John Redmond Reservoir spillway, one sample from Wolf Creek Cooling Lake.	Monthly grab sample	Monthly gamma isotopic analysis. Quarterly tritium analysis of composite sample.
b. Ground	Three locations at C-10, C-49, D-65, one control location at B-12 (see Figure 4.2).	Quarterly	Quarterly gamma isotopic and tritium analysis.
c. Drinking	Municipal water supplies at Burlington (upstream) and Le Roy (downstream).	Monthly composite*	Monthly gross beta and gamma isotopic analysis. Quarterly tritium analysis of composite sample.
d. Sediment from Shoreline	One sample from discharge cove area of the Wolf Creek Cooling Lake.	Semiannually	Semiannual gamma isotopic analysis.

* Composite sampling shall be performed by collecting an aliquot at intervals not exceeding 2 hours.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
4. INGESTION			
a. Milk	Samples from B-8, F-1, Q-5, and a control sample from S-3 (Hartford); alternate locations are P-2, and C-11 (see Figure 4.3).	Semimonthly when animals are on pasture; monthly at other times.	Gamma isotopic and I-131 analysis of each sample.
b. Fish	One sample from Wolf Creek Cooling Reservoir, similar sample from John Redmond Reservoir spillway as control.	Semiannually	Gamma isotopic analysis on edible portions.
c. Food Products	Broad leaf vegetation samples at site boundary in sector with highest D/Q (location A-1 on Figure 4.3); control at S-4 (Hartford); alternate samples from locations Q-1, R-1, and Q-2 as available.	Monthly during harvest.	Gamma isotopic analysis on edible portions.

TABLE 4.2

SAMPLING LOCATION NUMBERS, DISTANCES (miles) AND DIRECTIONS

TLD and Air Particulate

Location Number	Distance/ Direction	Location Number	Distance/ Direction	Location Number	Distance/ Direction	Location Number	Distance Direction
1	1.4/N	11	1.6/E	21	3.8/S	31	3.0/WNW
2	2.7/N	12	1.8/ESE	22	4.1/SSW	32	2.8/WNW
3	3.0/NNE	13	1.5/SE	23	4.5/SW	33	4.1/WNW
4	3.7/NNE	14	2.6/SE	24	4.1/WSW	34	4.0/NW
5	4.0/NE	15	4.5/ESE	25	3.6/W	35	4.6/NNW
6	4.4/ENE	16	4.2/E	26	2.6/WSW	36	4.2/N
7	1.9/NE	17	3.6/SE	27	2.1/SW	37	2.1/NNW
8	1.6/NNE	18	2.8/SSE	28	2.8/SW	38	1.2/NW
9	2.0/ENE	19	4.0/SSE	29	2.6/SSW	39	13.0/N
10	2.4/ENE	20	3.3/S	30	2.2/W	40	15.0/WNW

Groundwater

B-12	2.2/NE	C-10	2.8/W	C-49	2.9/SW	D-65	3.9/S

Milk and Food Products

A-1	1.4/N	F-1	1.6/ESE	Q-1	1.3/NW	R-1	2.2/NNW
B-8	4.9/NNE	G-1	1.4/SE	Q-2	1.4/NW	S-3	15.0/WNW
C-11	5.2/NE	P-2	2.9/WNW	Q-5	3.6/NW	S-4	15.0/WNW

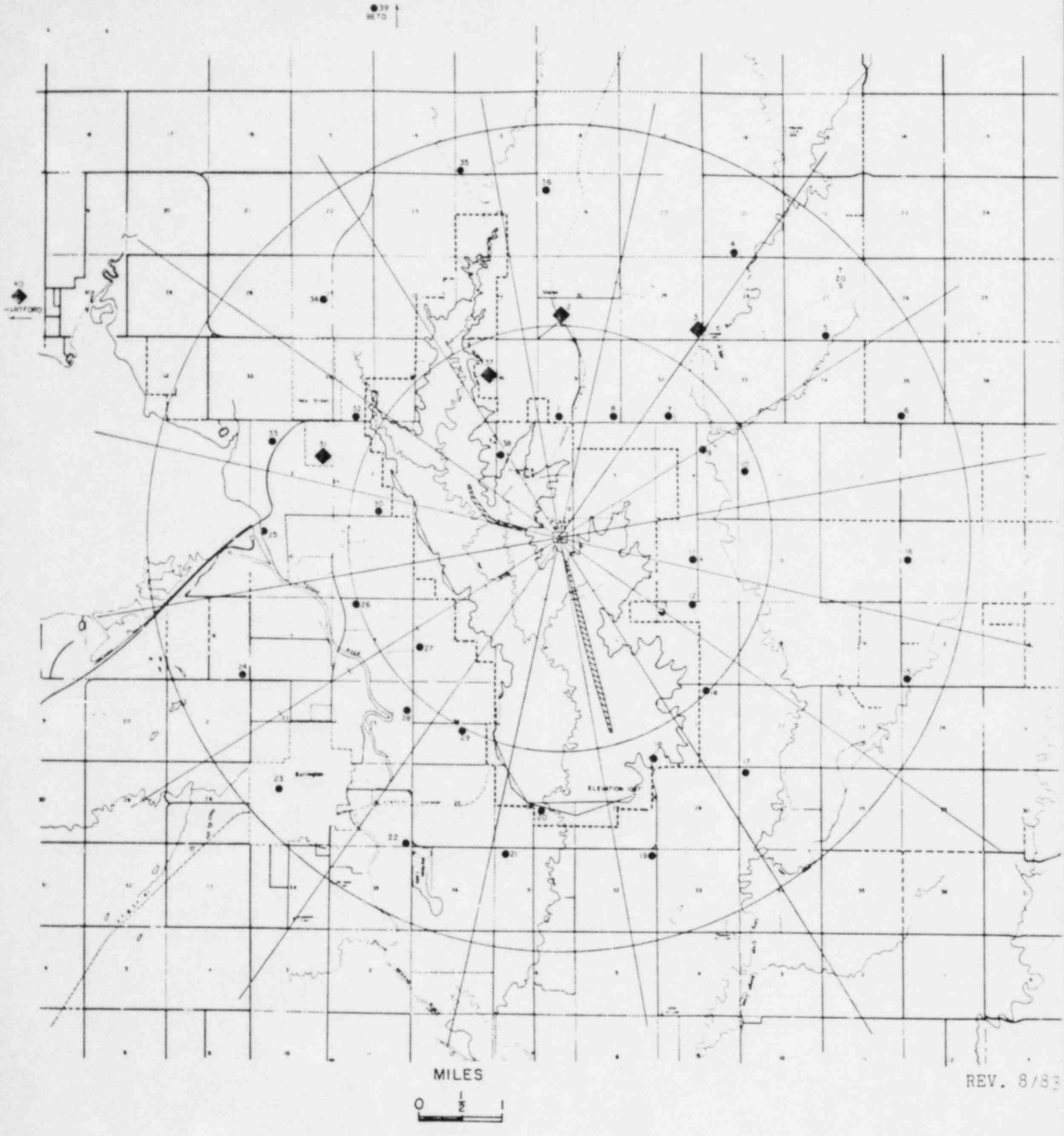


FIGURE 4.1
ATMOSPHERIC SAMPLING

• -TLD

◆ -PARTICULATE IODINE AND TLD

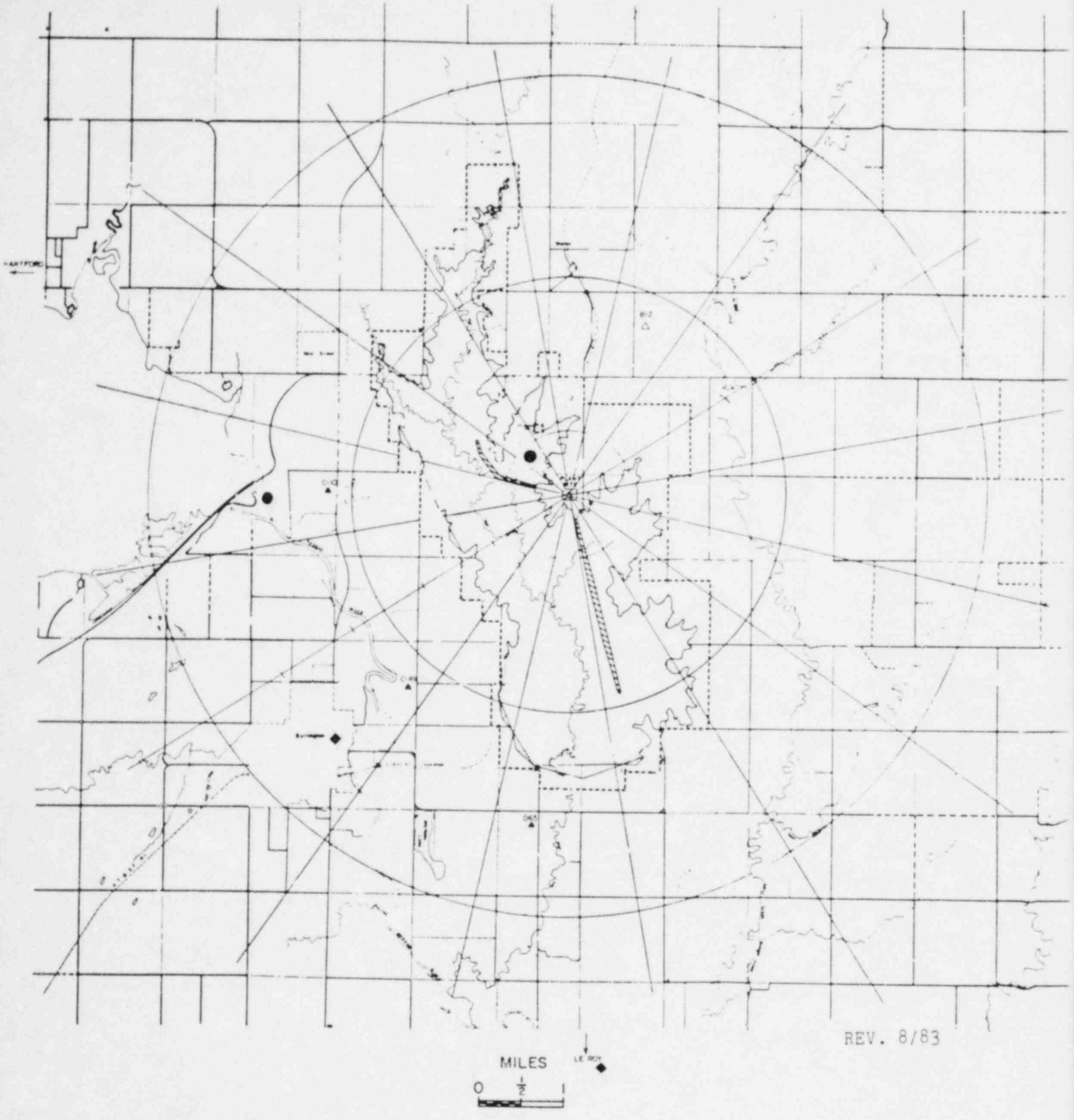


FIGURE 4.2

WATER SAMPLING LOCATIONS

◆ — DRINKING WATER SAMPLE LOCATION

● — SURFACE WATER

▲ — WELL LOCATIONS

△ — CONTROL WELL LOCATIONS

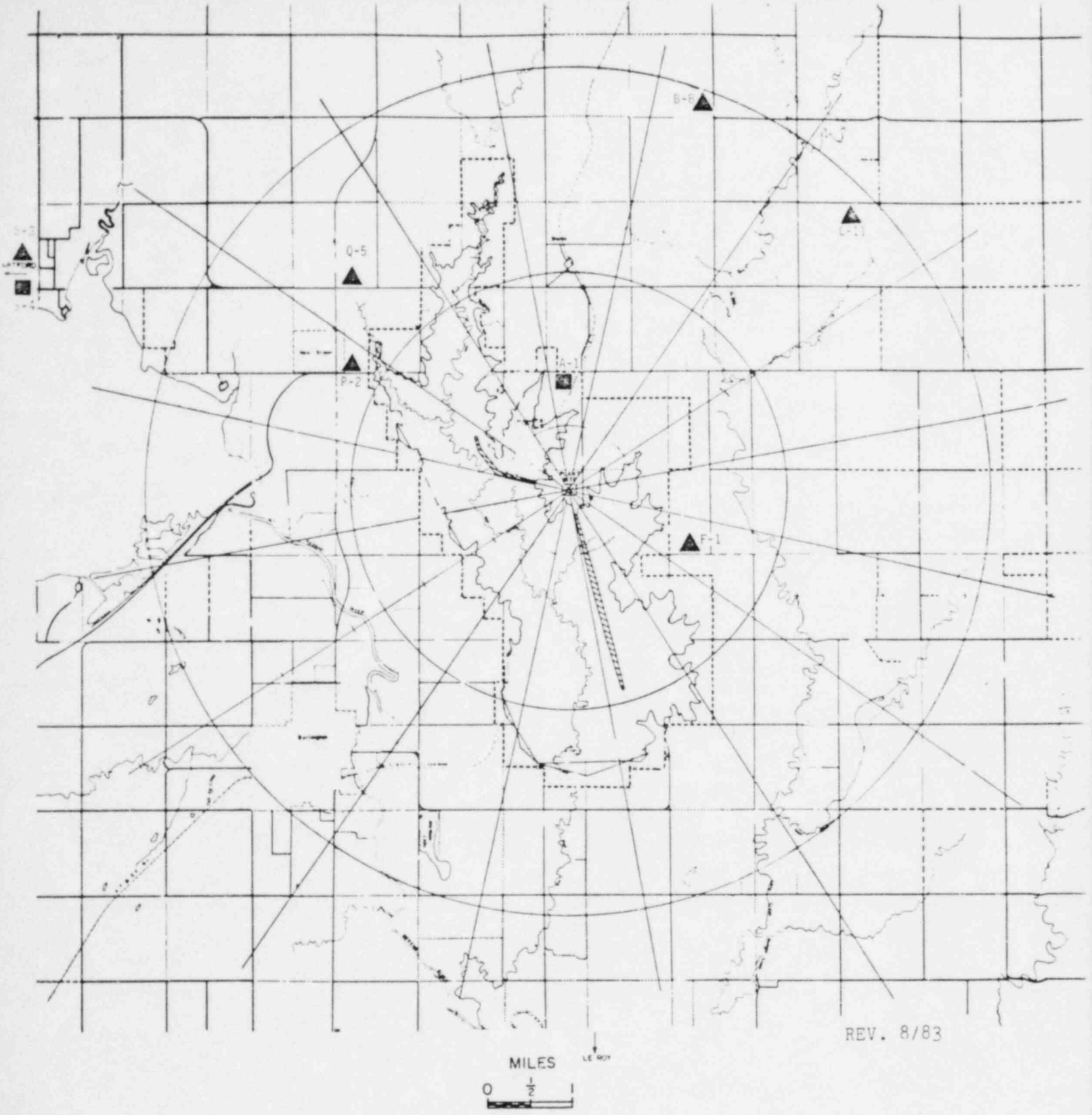
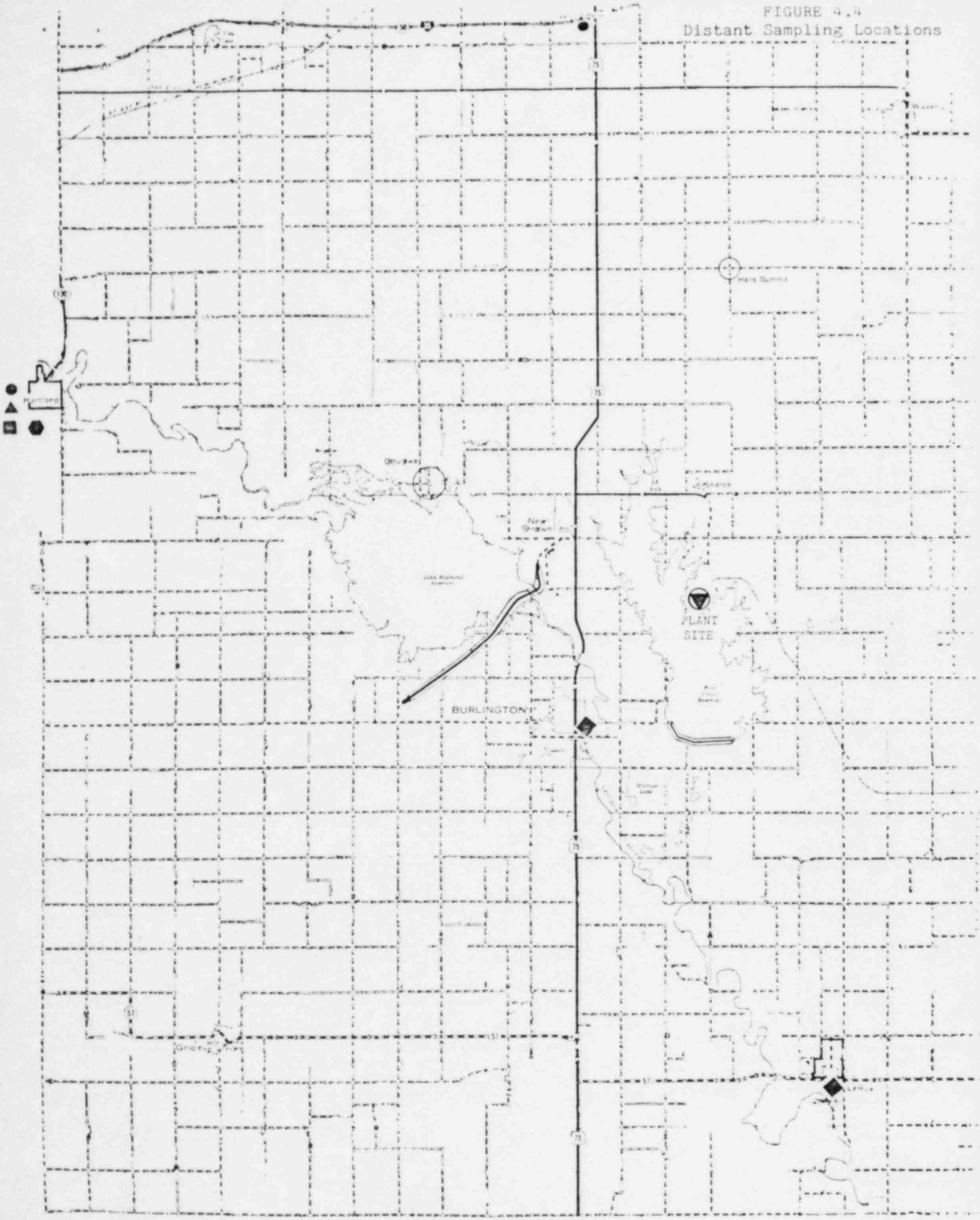


FIGURE 4.3
MILK & VEGETATION SAMPLING LOCATIONS

▲ — MILK SAMPLES

■ — BROADLEAF VEGETATION SAMPLES

FIGURE 4.4
Distant Sampling Locations



● TLD
▲ Air Particulate
■ Milk
⬢ Broadleaf Vegetation
◆ Drinking Water

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APPENDIX A

Dose Conversion Factor Tables

TABLE A.1-1*

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

ELEMENT	FRESHWATER	
	FISH	INVERTEBRATE
H	9.0E-01	9.0E-01
C	4.6E 03	9.1E 03
Na	1.0E 02	2.0E 02
P	1.0E 05	2.0E 04
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

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

TABLE A.1-2

DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS*

Radionuclide	Total Body Dose Factor K_i (mrem/yr per μCi/m^3)	Skin Dose Factor L_i (mrem/yr per μCi/m^3)	Gamma Air Dose Factor M_i (mrad/yr per μCi/m^3)	Beta Air Dose Factor N_i (mrad/yr per μCi/m^3)
Kr-83m	7.56E-02**	---	1.93E+01	2.88E+02
Kr-85m	1.17E+03	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.61E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	5.92E+03	9.73E+03	6.17E+03	1.03E+04
Kr-88	1.47E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.66E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.56E+04	7.29E+03	1.63E+04	7.83E+03
Xe-131m	9.15E+01	4.76E+02	1.56E+02	1.11E+03
Xe-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

* Based on Regulatory Guide 1.109 (Rev. 1).
**7.56E-02 = 7.56 x 10^{-2}

TABLE A.2-1*

INHALATION DOSE FACTORS FOR ADULTS
(MREM PER PCI INHALED)

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

*Taken from Regulatory Guide 1.109 (Rev. 1)

TABLE A.2-1 (cont'd)

INHALATION DOSE FACTORS FOR ADULTS
(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	1.18E-08	NO DATA	3.26E-10	NO DATA	NO DATA	6.06E-06	5.27E-05
ZR 95	1.34E-05	4.30E-06	2.91E-06	NO DATA	6.77E-06	2.21E-04	1.88E-05
ZR 97	1.21E-08	2.45E-09	1.13E-09	NO DATA	3.71E-09	9.84E-06	6.54E-05
NB 95	1.76E-06	9.77E-07	5.26E-07	NO DATA	9.67E-07	6.31E-05	1.30E-05
MO 99	NO DATA	1.51E-08	2.87E-09	NO DATA	3.64E-08	1.14E-05	3.10E-05
TC 99M	1.29E-13	3.64E-13	4.63E-12	NO DATA	5.52E-12	9.55E-08	5.20E-07
TC 101	5.22E-15	7.52E-15	7.38E-14	NO DATA	1.35E-13	4.99E-08	1.36E-21
RU 103	1.91E-07	NO DATA	8.23E-08	NO DATA	7.29E-07	6.31E-05	1.38E-05
RU 105	9.88E-11	NO DATA	3.89E-11	NO DATA	1.27E-10	1.37E-06	6.02E-06
RU 106	8.64E-06	NO DATA	1.09E-06	NO DATA	1.67E-05	1.17E-03	1.14E-04
AG 110M	1.35E-06	1.25E-06	7.43E-07	NO DATA	2.46E-06	5.79E-04	3.78E-05
TE 125M	4.27E-07	1.98E-07	5.84E-08	1.31E-07	1.55E-06	3.92E-05	8.83E-06
TE 127M	1.58E-06	7.21E-07	1.96E-07	4.11E-07	5.72E-06	1.20E-04	1.87E-05
TE 127	1.75E-10	8.03E-11	3.87E-11	1.32E-10	6.37E-10	8.14E-07	7.17E-06
TE 129M	1.22E-06	5.84E-07	1.98E-07	4.30E-07	4.57E-06	1.45E-04	4.79E-05
TE 129	6.22E-12	2.99E-12	1.55E-12	4.87E-12	2.34E-11	2.42E-07	1.96E-08
TE 131M	8.74E-09	5.45E-09	3.63E-09	6.88E-09	3.86E-08	1.82E-05	6.95E-05
TE 131	1.39E-12	7.44E-13	4.49E-13	1.17E-12	5.46E-12	1.74E-07	2.30E-09
TE 132	3.25E-08	2.69E-08	2.02E-08	2.37E-08	1.82E-07	3.60E-05	6.37E-05
I 130	5.72E-07	1.68E-06	6.60E-07	1.42E-04	2.61E-06	NO DATA	9.61E-05
I 131	3.15E-06	4.47E-06	2.56E-06	1.49E-03	7.66E-06	NO DATA	7.85E-07
I 132	1.45E-07	4.07E-07	1.45E-07	1.43E-05	6.48E-07	NO DATA	5.08E-08
I 133	1.08E-06	1.85E-06	5.65E-07	2.69E-04	3.23E-06	NO DATA	1.11E-06
I 134	8.05E-08	2.16E-07	7.69E-08	3.73E-06	3.44E-07	NO DATA	1.26E-10
I 135	3.35E-07	8.73E-07	3.21E-07	5.60E-05	1.39E-06	NO DATA	6.56E-07
CS 134	4.66E-05	1.06E-04	9.10E-05	NO DATA	3.59E-05	1.22E-05	1.30E-06
CS 136	4.88E-06	1.83E-05	1.38E-05	NO DATA	1.07E-05	1.50E-06	1.46E-06
CS 137	5.98E-05	7.76E-05	5.35E-05	NO DATA	2.78E-05	9.40E-06	1.05E-06
CS 138	4.14E-08	7.76E-08	4.05E-08	NO DATA	6.00E-08	6.07E-09	2.33E-13
BA 139	1.17E-10	8.32E-14	3.42E-12	NO DATA	7.78E-14	4.70E-07	1.12E-07

TABLE A.2-1 (cont'd)

INHALATION DOSE FACTORS FOR ADULTS
(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA 140	4.88E-06	6.13E-09	3.21E-07	NO DATA	2.09E-09	1.59E-04	2.73E-05
BA 141	1.25E-11	9.41E-15	4.20E-13	NO DATA	8.75E-15	2.42E-07	1.45E-17
BA 142	3.29E-12	3.38E-15	2.07E-13	NO DATA	2.86E-15	1.49E-07	1.96E-26
LA 140	4.30E-08	2.17E-08	5.73E-09	NO DATA	NO DATA	1.70E-05	5.73E-05
LA 142	8.54E-11	3.88E-11	9.65E-12	NO DATA	NO DATA	7.91E-07	2.64E-07
CE 141	2.49E-06	1.69E-06	1.91E-07	NO DATA	7.83E-07	4.52E-05	1.50E-05
CE 143	2.33E-08	1.72E-08	1.91E-09	NO DATA	7.60E-09	9.97E-06	2.83E-05
CE 144	4.29E-04	1.79E-04	2.30E-05	NO DATA	1.06E-04	9.72E-04	1.02E-04
PR 143	1.17E-06	4.69E-07	5.80E-08	NO DATA	2.70E-07	3.51E-05	2.50E-05
PR 144	3.76E-12	1.56E-12	1.91E-13	NO DATA	8.81E-13	1.27E-07	2.69E-18
ND 147	6.59E-07	7.62E-07	4.56E-08	NO DATA	4.45E-07	2.76E-05	2.16E-05
W 187	1.06E-09	8.85E-10	3.10E-10	NO DATA	NO DATA	3.63E-06	1.94E-05
NP 239	2.87E-08	2.82E-09	1.55E-09	NO DATA	8.75E-09	4.70E-06	1.49E-05

TABLE A.2-2*

INHALATION DOSE FACTORS FOR TEENAGER
(MREM PER PCI INHALED)

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

*Taken from Regulatory Guide 1.109 (Rev. 1)

TABLE A.2-2 (cont'd)

INHALATION DOSE FACTORS FOR TEENAGERS
(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	1.69E-08	NO DATA	4.65E-10	NO DATA	NO DATA	1.04E-05	7.24E-05
ZR 95	1.82E-05	5.73E-06	3.94E-06	NO DATA	8.42E-06	3.36E-04	1.86E-05
ZR 97	1.72E-08	3.40E-09	1.57E-09	NO DATA	5.15E-09	1.62E-05	7.88E-05
NB 95	2.32E-06	1.29E-06	7.08E-07	NO DATA	1.25E-06	9.39E-05	1.21E-05
MO 99	NO DATA	2.11E-08	4.03E-09	NO DATA	5.14E-08	1.92E-05	3.36E-05
TC 99M	1.73E-13	4.83E-13	6.24E-12	NO DATA	7.20E-12	1.44E-07	7.66E-07
TC 101	7.40E-15	1.05E-14	1.03E-13	NO DATA	1.90E-13	8.34E-08	1.09E-16
RU 103	2.63E-07	NO DATA	1.12E-07	NO DATA	9.29E-07	9.79E-05	1.36E-05
RU 105	1.40E-10	NO DATA	5.42E-11	NO DATA	1.76E-10	2.27E-06	1.13E-05
RU 106	1.23E-05	NO DATA	1.55E-06	NO DATA	2.38E-05	2.01E-03	1.20E-04
AG 110M	1.73E-06	1.64E-06	9.99E-07	NO DATA	3.13E-06	8.44E-04	3.41E-05
TE 125M	6.10E-07	2.80E-07	8.34E-08	1.75E-07	NO DATA	6.70E-05	9.38E-06
TE 127M	2.25E-06	1.02E-06	2.73E-07	5.48E-07	8.17E-06	2.07E-04	1.99E-05
TE 127	2.51E-10	1.14E-10	5.52E-11	1.77E-10	9.10E-10	1.40E-06	1.01E-05
TE 129M	1.74E-06	8.23E-07	2.81E-07	5.72E-07	6.49E-06	2.47E-04	5.06E-05
TE 129	8.87E-12	4.22E-12	2.20E-12	6.48E-12	3.32E-11	4.12E-07	2.02E-07
TE 131M	1.23E-08	7.51E-09	5.03E-09	9.06E-09	5.49E-08	2.97E-05	7.76E-05
TE 131	1.97E-12	1.04E-12	6.30E-13	1.55E-12	7.72E-12	2.92E-07	1.89E-09
TE 132	4.50E-08	3.63E-08	2.74E-08	3.07E-08	2.44E-07	5.61E-05	5.79E-05
I 130	7.80E-07	2.24E-06	8.96E-07	1.86E-04	3.44E-06	NO DATA	1.14E-06
I 131	4.43E-06	6.14E-06	3.30E-06	1.83E-03	1.05E-05	NO DATA	8.11E-07
I 132	1.99E-07	5.47E-07	1.97E-07	1.89E-05	8.65E-07	NO DATA	1.59E-07
I 133	1.52E-06	2.56E-06	7.78E-07	3.65E-04	4.49E-06	NO DATA	1.29E-06
I 134	1.11E-07	2.90E-07	1.05E-07	4.94E-06	4.58E-07	NO DATA	2.55E-09
I 135	4.62E-07	1.18E-06	4.36E-07	7.76E-05	1.86E-06	NO DATA	8.69E-07
CS 134	6.28E-05	1.41E-04	6.86E-05	NO DATA	4.69E-05	1.83E-05	1.22E-06
CS 136	6.44E-06	2.42E-05	1.71E-05	NO DATA	1.38E-05	2.22E-06	1.36E-06
CS 137	8.38E-05	1.06E-04	3.89E-05	NO DATA	3.80E-05	1.51E-05	1.06E-06
CS 138	5.82E-08	1.07E-07	5.58E-08	NO DATA	8.28E-08	9.84E-09	3.38E-11
BA 139	1.67E-10	1.18E-13	4.87E-12	NO DATA	1.11E-13	8.08E-07	8.06E-07

TABLE A.2-2 (cont'd)

INHALATION DOSE FACTORS FOR TEENAGERS
(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA 140	6.84E-06	8.38E-09	4.40E-07	NO DATA	2.85E-09	2.54E-04	2.86E-05
BA 141	1.78E-11	1.32E-14	5.93E-13	NO DATA	1.23E-14	4.11E-07	9.33E-14
BA 142	4.62E-12	4.63E-15	2.84E-13	NO DATA	3.92E-15	2.39E-07	5.99E-20
LA 140	5.99E-08	2.95E-08	7.82E-09	NO DATA	NO DATA	2.68E-05	6.09E-05
LA 142	1.20E-10	5.31E-11	1.32E-11	NO DATA	NO DATA	1.27E-06	1.50E-06
CE 141	3.55E-06	2.37E-06	2.71E-07	NO DATA	1.11E-06	7.67E-05	1.58E-05
CE 143	3.32E-08	2.42E-08	2.70E-09	NO DATA	1.08E-08	1.63E-05	3.19E-05
CE 144	6.11E-04	2.53E-04	3.28E-05	NO DATA	1.51E-04	1.67E-03	1.08E-04
PR 143	1.67E-06	6.64E-07	8.28E-08	NO DATA	3.86E-07	6.04E-05	2.67E-05
PR 144	5.37E-12	2.20E-12	2.72E-13	NO DATA	1.26E-12	2.19E-07	2.94E-14
ND 147	9.83E-07	1.07E-06	6.41E-08	NO DATA	6.28E-07	4.65E-05	2.28E-05
W 187	1.50E-09	1.22E-09	4.29E-10	NO DATA	NO DATA	5.92E-06	2.21E-05
NP 239	4.23E-08	3.99E-09	2.21E-09	NO DATA	1.25E-08	8.11E-06	1.65E-05

TABLE A.2-3*

INHALATION DOSE FACTORS FOR CHILD
(MREM PER PCI INHALED)

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

*Taken from Regulatory Guide 1.109 (Rev. 1)

TABLE A.2-3 (cont'd)

INHALATION DOSE FACTORS FOR CHILD
(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	5.04E-08	NO DATA	1.38E-09	NO DATA	NO DATA	2.01E-05	1.05E-04
ZR 95	5.13E-05	1.13E-05	1.00E-05	NO DATA	1.61E-05	6.03E-04	1.65E-05
ZR 97	5.07E-08	7.34E-09	4.32E-09	NO DATA	1.05E-08	3.06E-05	9.49E-05
NB 95	6.35E-06	2.48E-06	1.77E-06	NO DATA	2.33E-06	1.66E-04	1.00E-05
MO 99	NO DATA	4.66E-08	1.15E-08	NO DATA	1.06E-07	3.66E-05	3.42E-05
TC 99M	4.81E-13	9.41E-13	1.56E-11	NO DATA	1.37E-11	2.57E-07	1.30E-06
TC 101	2.19E-14	2.30E-14	2.91E-13	NO DATA	3.92E-13	1.58E-07	4.41E-09
RU 103	7.55E-07	NO DATA	2.90E-07	NO DATA	1.90E-06	1.79E-04	1.21E-05
RU 105	4.13E-10	NO DATA	1.50E-10	NO DATA	3.63E-10	4.30E-06	2.69E-05
RU 106	3.68E-05	NO DATA	4.57E-06	NO DATA	4.97E-05	3.87E-03	1.16E-04
AG 110M	4.56E-06	3.08E-06	2.47E-06	NO DATA	5.74E-06	1.48E-03	2.71E-05
TE 125M	1.82E-06	6.29E-07	2.47E-07	5.20E-07	NO DATA	1.29E-04	9.13E-06
TE 127M	6.72E-06	2.31E-06	8.16E-07	1.64E-06	1.72E-05	4.00E-04	1.93E-05
TE 127	7.49E-10	2.57E-10	1.65E-10	5.30E-10	1.91E-09	2.71E-06	1.52E-05
TE 129M	5.19E-06	1.85E-06	8.22E-07	1.71E-06	1.36E-05	4.76E-04	4.91E-05
TE 129	2.64E-11	9.45E-12	6.44E-12	1.93E-11	6.94E-11	7.93E-07	6.89E-06
TE 131M	3.63E-08	1.60E-08	1.37E-08	2.64E-08	1.08E-07	5.56E-05	8.32E-05
TE 131	5.87E-12	2.28E-12	1.78E-12	4.59E-12	1.59E-11	5.55E-07	3.60E-07
TE 132	1.30E-07	7.36E-08	7.12E-08	8.58E-08	4.79E-07	1.02E-04	3.72E-05
I 130	2.21E-06	4.43E-06	2.28E-06	4.99E-04	6.61E-06	NO DATA	1.38E-06
I 131	1.30E-05	1.30E-05	7.37E-06	4.39E-03	2.13E-05	NO DATA	7.68E-07
I 132	5.72E-07	1.10E-06	5.07E-07	5.23E-05	1.69E-06	NO DATA	8.65E-07
I 133	4.48E-06	5.49E-06	2.08E-06	1.04E-03	9.13E-06	NO DATA	1.48E-06
I 134	3.17E-07	5.84E-07	2.69E-07	1.37E-05	8.92E-07	NO DATA	2.58E-07
I 135	1.33E-06	2.36E-06	1.12E-06	2.14E-04	3.62E-06	NO DATA	1.20E-06
CS 134	1.76E-04	2.74E-04	6.07E-05	NO DATA	8.93E-05	3.27E-05	1.04E-06
CS 136	1.76E-05	4.62E-05	3.14E-05	NO DATA	2.58E-05	3.93E-06	1.13E-06
CS 137	2.45E-04	2.23E-04	3.47E-05	NO DATA	7.63E-05	2.81E-05	9.78E-07
CS 138	1.71E-07	2.27E-07	1.50E-07	NO DATA	1.68E-07	1.84E-08	7.29E-08
BA 139	4.98E-10	2.66E-13	1.45E-11	NO DATA	2.33E-13	1.56E-06	1.56E-05

TABLE A.2-3 (cont'd)

INHALATION DOSE FACTORS FOR CHILD
(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA 140	2.00E-05	1.75E-08	1.17E-06	NO DATA	5.71E-09	4.71E-04	2.75E-05
BA 141	5.29E-11	2.95E-14	1.72E-12	NO DATA	2.56E-14	7.89E-07	7.44E-08
BA 142	1.35E-11	9.73E-15	7.54E-13	NO DATA	7.87E-15	4.44E-07	7.41E-10
LA 140	1.74E-07	6.08E-08	2.04E-08	NO DATA	NO DATA	4.94E-05	6.10E-05
LA 142	3.50E-10	1.11E-10	3.49E-11	NO DATA	NO DATA	2.35E-06	2.05E-05
CE 141	1.06E-05	5.28E-06	7.83E-07	NO DATA	2.31E-06	1.47E-04	1.53E-05
CE 143	9.89E-08	5.37E-08	7.77E-09	NO DATA	2.26E-08	3.12E-05	3.44E-05
CE 144	1.83E-03	5.72E-04	9.77E-05	NO DATA	3.17E-04	3.23E-03	1.05E-04
PR 143	4.99E-06	1.50E-06	2.47E-07	NO DATA	8.11E-07	1.17E-04	2.63E-05
PR 144	1.61E-11	4.99E-12	8.10E-13	NO DATA	2.64E-12	4.23E-07	5.32E-08
ND 147	2.92E-06	2.36E-06	1.84E-07	NO DATA	1.30E-06	8.87E-05	2.22E-05
W 187	4.41E-09	2.61E-09	1.17E-09	NO DATA	NO DATA	1.11E-05	2.46E-05
NP 239	1.26E-07	9.04E-09	6.35E-09	NO DATA	2.63E-08	1.57E-05	1.73E-05

TABLE A.2-4*

INHALATION DOSE FACTORS FOR INFANT
(MREM PER PCI INHALED)

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

*Taken from Regulatory Guide 1.109 (Rev. 1)

TABLE A.2-1 (cont'd)

INHALATION DOSE FACTORS FOR INFANT
(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	1.07E-07	NO DATA	2.91E-09	NO DATA	NO DATA	5.46E-05	1.19E-04
ZR 95	8.24E-05	1.99E-05	1.45E-05	NO DATA	2.22E-05	1.25E-03	1.55E-05
ZR 97	1.07E-07	1.83E-08	8.36E-09	NO DATA	1.85E-08	7.88E-05	1.00E-04
NB 95	1.12E-05	4.59E-06	2.70E-06	NO DATA	3.37E-06	3.42E-04	9.05E-06
MO 99	NO DATA	1.18E-07	2.31E-08	NO DATA	1.89E-07	9.63E-05	3.48E-05
TC 99M	9.98E-13	2.06E-12	2.66E-11	NO DATA	2.22E-11	5.79E-07	1.45E-06
TC 101	4.65E-14	5.88E-14	5.80E-13	NO DATA	6.99E-13	4.17E-07	6.03E-07
RU 103	1.44E-06	NO DATA	4.85E-07	NO DATA	3.03E-06	3.94E-04	1.15E-05
RU 105	8.74E-10	NO DATA	2.93E-10	NO DATA	6.42E-10	1.12E-05	3.46E-05
RU 106	6.20E-05	NO DATA	7.77E-06	NO DATA	7.61E-05	8.26E-03	1.17E-04
AG 110M	7.13E-06	5.16E-06	3.57E-06	NO DATA	7.80E-06	2.62E-03	2.36E-05
TE 125M	3.40E-06	1.42E-06	4.70E-07	1.16E-06	NO DATA	3.19E-04	9.22E-06
TE 127M	1.19E-05	4.93E-06	1.48E-06	3.48E-06	2.68E-05	9.37E-04	1.95E-05
TE 127	1.59E-09	6.81E-10	3.49E-10	1.32E-09	3.47E-09	7.39E-06	1.74E-05
TE 129M	1.01E-05	4.35E-06	1.59E-06	3.91E-06	2.27E-05	1.20E-03	4.93E-05
TE 129	5.63E-11	2.48E-11	1.34E-11	4.82E-11	1.25E-10	2.14E-06	1.88E-05
TE 131M	7.62E-08	3.93E-08	2.59E-08	6.38E-08	1.89E-07	1.42E-04	8.51E-05
TE 131	1.24E-11	5.87E-12	3.57E-12	1.13E-11	2.85E-11	1.47E-06	5.87E-06
TE 132	2.66E-07	1.69E-07	1.26E-07	1.99E-07	7.39E-07	2.43E-04	3.15E-05
I 130	4.54E-06	9.91E-06	3.98E-06	1.14E-03	1.09E-05	NO DATA	1.42E-06
I 131	2.71E-05	3.17E-05	1.40E-05	1.06E-02	3.70E-05	NO DATA	7.56E-07
I 132	1.21E-06	2.53E-06	8.99E-07	1.21E-04	2.82E-06	NO DATA	1.36E-06
I 133	9.46E-06	1.37E-05	4.00E-06	2.54E-03	1.60E-05	NO DATA	1.54E-06
I 134	6.58E-07	1.34E-06	4.75E-07	3.18E-05	1.49E-06	NO DATA	9.21E-07
I 135	2.76E-06	5.43E-06	1.98E-06	4.97E-04	6.05E-06	NO DATA	1.31E-06
CS 134	2.83E-04	5.02E-04	5.32E-05	NO DATA	1.36E-04	5.69E-05	9.53E-07
CS 136	3.45E-05	9.61E-05	3.78E-05	NO DATA	4.03E-05	8.40E-06	1.02E-06
CS 137	3.92E-04	4.37E-04	3.25E-05	NO DATA	1.23E-04	5.09E-05	9.53E-07
CS 138	3.61E-07	5.58E-07	2.84E-07	NO DATA	2.93E-07	4.67E-08	6.26E-07
BA 139	1.06E-09	7.03E-13	3.07E-11	NO DATA	4.23E-13	4.25E-06	3.64E-05

TABLE A.2-4 (cont'd)

INHALATION DOSE FACTORS FOR INFANT
(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA 140	4.00E-05	4.00E-08	2.07E-06	NO DATA	9.59E-09	1.14E-03	2.74E-05
BA 141	1.12E-10	7.70E-14	3.55E-12	NO DATA	4.64E-14	2.12E-06	3.39E-06
BA 142	2.84E-11	2.36E-14	1.40E-12	NO DATA	1.36E-14	1.11E-06	4.95E-07
LA 140	3.61E-07	1.43E-07	3.68E-08	NO DATA	NO DATA	1.20E-04	6.06E-05
LA 142	7.36E-10	2.69E-10	6.46E-11	NO DATA	NO DATA	5.87E-06	4.25E-05
CE 141	1.98E-05	1.19E-05	1.42E-06	NO DATA	3.75E-06	3.69E-04	1.54E-05
CE 143	2.09E-07	1.38E-07	1.58E-08	NO DATA	4.03E-08	8.30E-05	3.55E-05
CE 144	2.28E-03	8.65E-04	1.26E-04	NO DATA	3.84E-04	7.03E-03	1.06E-04
PR 143	1.00E-05	3.74E-06	4.99E-07	NO DATA	1.41E-06	3.09E-04	2.66E-05
PR 144	3.42E-11	1.32E-11	1.72E-12	NO DATA	4.80E-12	1.15E-06	3.06E-06
ND 147	5.67E-06	5.81E-06	3.57E-07	NO DATA	2.25E-06	2.30E-04	2.23E-05
W 187	9.26E-09	6.44E-09	2.23E-09	NO DATA	NO DATA	2.83E-05	2.54E-05
NP 239	2.65E-07	2.37E-08	1.34E-08	NO DATA	4.73E-08	4.25E-05	1.78E-05

TABLE A.2-5*

EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND
(mrem/hr per pCi/m^2)

Element	Total Body	Skin
H-3	0.0	0.0
C-14	0.0	0.0
NA-24	2.50E-08	2.90E-08
P-32	0.0	0.0
Cr-51	2.20E-10	2.60E-10
Mn-54	5.80E-09	6.80E-09
Mn-56	1.10E-08	1.30E-08
Fe-55	0.0	0.0
Fe-59	8.00E-09	9.40E-09
Co-58	7.00E-09	8.20E-09
Co-60	1.70E-08	2.00E-08
Ni-63	0.0	0.0
Nr-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 A.2-5 (cont'd)

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 A.3-1*

INGESTION DOSE FACTORS FOR ADULTS
(MREM PER PCI INGESTED)

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

*Taken from Regulatory Guide 1.109 (Rev. 1)

TABLE A.3-1 (cont'd)

INGESTION DOSE FACTORS FOR ADULTS
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	2.68E-09	NO DATA	7.40E-11	NO DATA	NO DATA	NO DATA	8.50E-05
ZR 95	3.04E-08	9.75E-09	6.60E-09	NO DATA	1.53E-08	NO DATA	3.09E-05
ZR 97	1.68E-09	3.39E-10	1.55E-10	NO DATA	5.12E-10	NO DATA	1.05E-04
NB 95	6.22E-09	3.46E-09	1.86E-09	NO DATA	3.42E-09	NO DATA	2.10E-05
MO 99	NO DATA	4.31E-06	8.20E-07	NO DATA	9.76E-06	NO DATA	9.99E-06
TC 99M	2.47E-10	6.98E-10	8.89E-09	NO DATA	1.06E-08	3.42E-10	4.13E-07
TC 101	2.54E-10	3.66E-10	3.59E-09	NO DATA	6.59E-09	1.87E-10	1.10E-21
RU 103	1.85E-07	NO DATA	7.97E-08	NO DATA	7.06E-07	NO DATA	2.16E-05
RU 105	1.54E-08	NO DATA	6.08E-09	NO DATA	1.99E-07	NO DATA	9.42E-06
RU 106	2.75E-06	NO DATA	3.48E-07	NO DATA	5.31E-06	NO DATA	1.78E-04
AG 110M	1.60E-07	1.48E-07	8.79E-08	NO DATA	2.91E-07	NO DATA	6.04E-05
TE 125M	2.68E-06	9.71E-07	3.59E-07	8.06E-07	1.09E-05	NO DATA	1.07E-05
TE 127M	6.77E-06	2.42E-06	8.25E-07	1.73E-06	2.75E-05	NO DATA	2.27E-05
TE 127	1.10E-07	3.95E-08	2.38E-08	8.15E-08	4.48E-07	NO DATA	8.68E-06
TE 129M	1.15E-05	4.29E-06	1.82E-06	3.95E-06	4.80E-05	NO DATA	5.79E-05
TE 129	3.14E-08	1.18E-08	7.65E-09	2.41E-08	1.32E-07	NO DATA	2.37E-08
TE 131M	1.73E-06	8.46E-07	7.05E-07	1.34E-06	8.57E-06	NO DATA	8.40E-05
TE 131	1.97E-08	8.23E-09	6.22E-09	1.62E-08	8.63E-08	NO DATA	2.79E-09
TE 132	2.52E-06	1.63E-06	1.53E-06	1.80E-06	1.57E-05	NO DATA	7.71E-05
I 130	7.56E-07	2.23E-06	8.80E-07	1.89E-04	3.48E-06	NO DATA	1.92E-06
I 131	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	NO DATA	1.57E-06
I 132	2.03E-07	5.43E-07	1.90E-07	1.90E-05	8.65E-07	NO DATA	1.02E-07
I 133	1.42E-06	2.47E-06	7.53E-07	3.63E-04	4.31E-06	NO DATA	2.22E-06
I 134	1.06E-07	2.88E-07	1.03E-07	4.99E-06	4.58E-07	NO DATA	2.51E-10
I 135	4.43E-07	1.16E-06	4.28E-07	7.65E-05	1.86E-06	NO DATA	1.31E-06
CS 134	6.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E-06
CS 136	6.51E-06	2.57E-05	1.85E-05	NO DATA	1.43E-05	1.96E-06	2.92E-06
CS 137	7.97E-05	1.09E-04	7.14E-05	NO DATA	3.70E-05	1.23E-05	2.11E-06
CS 138	5.52E-08	1.09E-07	5.40E-08	NO DATA	8.01E-08	7.91E-09	4.65E-13
BA 139	9.70E-08	6.91E-11	2.84E-09	NO DATA	6.46E-11	3.92E-11	1.72E-07

TABLE A.3-1 (cont'd)

INGESTION DOSE FACTORS FOR ADULTS
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA 140	2.03E-05	2.55E-08	1.33E-06	NO DATA	8.67E-09	1.46E-08	4.18E-05
BA 141	4.71E-08	3.56E-11	1.59E-09	NO DATA	3.31E-11	2.02E-11	2.22E-17
BA 142	2.13E-08	2.19E-11	1.34E-09	NO DATA	1.85E-11	1.24E-11	3.00E-26
LA 140	2.50E-09	1.26E-09	3.33E-10	NO DATA	NO DATA	NO DATA	9.25E-05
LA 142	1.28E-10	5.82E-11	1.45E-11	NO DATA	NO DATA	NO DATA	4.25E-07
CE 141	9.36E-09	6.33E-09	7.18E-10	NO DATA	2.94E-09	NO DATA	2.42E-05
CE 143	1.65E-09	1.22E-06	1.35E-10	NO DATA	5.37E-10	NO DATA	4.56E-05
CE 144	4.88E-07	2.04E-07	2.62E-08	NO DATA	1.21E-07	NO DATA	1.65E-04
PR 143	9.20E-09	3.69E-09	4.56E-10	NO DATA	2.13E-09	NO DATA	4.03E-05
PR 144	3.01E-11	1.25E-11	1.53E-12	NO DATA	7.05E-12	NO DATA	4.33E-18
ND 147	6.29E-09	7.27E-09	4.35E-10	NO DATA	4.25E-09	NO DATA	3.49E-05
W 187	1.03E-07	8.61E-08	3.01E-08	NO DATA	NO DATA	NO DATA	2.82E-05
NP 239	1.19E-09	1.17E-10	6.45E-11	NO DATA	3.65E-10	NO DATA	2.40E-05

TABLE A.3-2*

INGESTION DOSE FACTORS FOR TEENAGERS
(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
C 14	4.06E-06	8.12E-07	8.12E-07	8.12E-07	8.12E-07	8.12E-07	8.12E-07
NA 24	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06
P 32	2.76E-04	1.71E-05	1.07E-05	NO DATA	NO DATA	NO DATA	2.32E-05
CR 51	NO DATA	NO DATA	3.60E-09	2.00E-09	7.89E-10	5.14E-09	6.05E-07
MN 54	NO DATA	5.90E-06	1.17E-06	NO DATA	1.76E-06	NO DATA	1.21E-05
MN 56	NO DATA	1.58E-07	2.81E-08	NO DATA	2.00E-07	NO DATA	1.04E-05
FE 55	3.78E-06	2.68E-06	6.25E-07	NO DATA	NO DATA	1.70E-06	1.16E-06
FE 59	5.87E-06	1.37E-05	5.29E-06	NO DATA	NO DATA	4.32E-06	3.24E-05
CO 58	NO DATA	9.72E-07	2.24E-06	NO DATA	NO DATA	NO DATA	1.34E-05
CO 60	NO DATA	2.81E-06	6.33E-06	NO DATA	NO DATA	NO DATA	3.66E-05
NI 63	1.77E-04	1.25E-05	6.00E-06	NO DATA	NO DATA	NO DATA	1.99E-06
NI 65	7.49E-07	9.57E-08	4.36E-08	NO DATA	NO DATA	NO DATA	5.19E-06
CU 64	NO DATA	1.15E-07	5.41E-08	NO DATA	2.91E-07	NO DATA	8.92E-06
ZN 65	5.76E-06	2.00E-05	9.33E-06	NO DATA	1.28E-05	NO DATA	8.47E-06
ZN 69	1.47E-08	2.80E-08	1.96E-09	NO DATA	1.83E-08	NO DATA	5.16E-08
BR 83	NO DATA	NO DATA	5.74E-08	NO DATA	NO DATA	NO DATA	LT E-24
BR 84	NO DATA	NO DATA	7.22E-08	NO DATA	NO DATA	NO DATA	LT E-24
BR 85	NO DATA	NO DATA	3.05E-09	NO DATA	NO DATA	NO DATA	LT E-24
RB 86	NO DATA	2.98E-05	1.40E-05	NO DATA	NO DATA	NO DATA	4.41E-06
RB 88	NO DATA	8.52E-08	4.54E-08	NO DATA	NO DATA	NO DATA	7.30E-15
RB 89	NO DATA	5.50E-08	3.89E-08	NO DATA	NO DATA	NO DATA	8.43E-17
SR 89	4.40E-04	NO DATA	1.26E-05	NO DATA	NO DATA	NO DATA	5.24E-05
SR 90	8.30E-03	NO DATA	2.05E-03	NO DATA	NO DATA	NO DATA	2.33E-04
SR 91	8.07E-06	NO DATA	3.21E-07	NO DATA	NO DATA	NO DATA	3.66E-05
SR 92	3.05E-06	NO DATA	1.30E-07	NO DATA	NO DATA	NO DATA	7.77E-05
Y 90	1.37E-08	NO DATA	3.69E-10	NO DATA	NO DATA	NO DATA	1.13E-04
Y 91M	1.29E-10	NO DATA	4.93E-12	NO DATA	NO DATA	NO DATA	6.09E-09
Y 91	2.01E-07	NO DATA	5.39E-09	NO DATA	NO DATA	NO DATA	8.24E-05
Y 92	1.21E-09	NO DATA	3.50E-11	NO DATA	NO DATA	NO DATA	3.32E-05

*Taken from Regulatory Guide 1.109 (Rev. 1)

TABLE A.3-2 (cont'd)

INGESTION DOSE FACTORS FOR TEENAGERS
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
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-17
RU 103	2.55E-07	NO DATA	1.09E-07	NO DATA	8.99E-07	NO DATA	2.13E-05
RU 105	2.18E-08	NO DATA	8.46E-09	NO DATA	2.75E-07	NO DATA	1.76E-05
RU 106	3.92E-06	NO DATA	4.94E-07	NO DATA	7.56E-06	NO DATA	1.88E-04
AG 110M	2.05E-07	1.94E-07	1.18E-07	NO DATA	3.70E-07	NO DATA	5.45E-05
TE 125M	3.83E-06	1.38E-06	5.12E-07	1.07E-06	NO DATA	NO DATA	1.13E-05
TE 127M	9.67E-06	3.43E-06	1.15E-06	2.30E-06	3.92E-05	NO DATA	2.41E-05
TE 127	1.58E-07	5.60E-08	3.40E-08	1.09E-07	6.40E-07	NO DATA	1.22E-05
TE 129M	1.63E-05	6.05E-06	2.58E-06	5.26E-06	6.82E-05	NO DATA	6.12E-05
TE 129	4.48E-08	1.67E-08	1.09E-08	3.20E-08	1.88E-07	NO DATA	2.45E-07
TE 131M	2.44E-06	1.17E-06	9.76E-07	1.76E-06	1.22E-05	NO DATA	9.39E-05
TE 131	2.79E-08	1.15E-08	8.72E-09	2.15E-08	1.22E-07	NO DATA	2.29E-09
TE 132	3.49E-06	2.21E-06	2.08E-06	2.33E-06	2.12E-05	NO DATA	7.00E-05
I 130	1.03E-06	2.98E-06	1.19E-06	2.43E-04	4.59E-06	NO DATA	2.29E-06
I 131	5.85E-06	8.19E-06	4.40E-06	2.39E-03	1.41E-05	NO DATA	1.62E-06
I 132	2.79E-07	7.30E-07	2.62E-07	2.46E-05	1.5E-06	NO DATA	3.18E-07
I 133	2.01E-06	3.41E-06	1.04E-06	4.76E-04	5.98E-06	NO DATA	2.58E-05
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 A.3-2 (cont'd)

INGESTION DOSE FACTORS FOR TEENAGERS
(MREM PER PCI INGESTED)

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

TABLE A.3-3*

INGESTION DOSE FACTORS FOR CHILD
(MREM PER PCI INGESTED)

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

*Taken from Regulatory Guide 1.109 (Rev. 1)

TABLE A.3-3 (cont'd)

INGESTION DOSE FACTORS FOR CHILD
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
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	3.64E-07	2.91E-07	NO DATA	6.78E-07	NO DATA	4.33E-05
TE 125M	1.14E-05	3.09E-06	1.52E-06	3.20E-06	NO DATA	NO DATA	1.10E-05
TE 127M	2.89E-05	7.78E-06	3.43E-06	6.91E-06	8.24E-05	NO DATA	2.34E-05
TE 127	4.71E-07	1.27E-07	1.01E-07	3.26E-07	1.34E-06	NO DATA	1.84E-05
TE 129M	4.87E-05	1.36E-05	7.56E-06	1.57E-05	1.43E-04	NO DATA	5.94E-05
TE 129	1.34E-07	3.74E-08	3.18E-08	9.56E-08	3.92E-07	NO DATA	8.34E-06
TE 131M	7.20E-06	2.49E-06	2.65E-06	5.12E-06	2.41E-05	NO DATA	1.01E-04
TE 131	8.30E-08	2.53E-08	2.47E-08	6.35E-08	2.51E-07	NO DATA	4.36E-07
TE 132	1.01E-05	4.47E-06	5.40E-06	6.51E-06	4.15E-05	NO DATA	4.50E-05
I 130	2.92E-06	5.90E-06	3.04E-06	6.50E-04	8.82E-06	NO DATA	2.76E-06
I 131	1.72E-05	1.73E-05	9.83E-06	5.72E-03	2.84E-05	NO DATA	1.54E-06
I 132	8.00E-07	1.47E-06	6.76E-07	6.82E-05	2.25E-06	NO DATA	1.73E-06
I 133	5.92E-06	7.32E-06	2.77E-06	1.36E-03	1.22E-05	NO DATA	2.95E-06
I 134	4.19E-07	7.78E-07	3.58E-07	1.79E-05	1.19E-06	NO DATA	5.16E-07
I 135	1.75E-06	3.15E-06	1.49E-06	2.79E-04	4.83E-06	NO DATA	2.40E-06
CS 134	2.34E-04	3.84E-04	8.10E-05	NO DATA	1.19E-04	4.27E-05	2.07E-06
CS 136	2.35E-05	6.46E-05	4.18E-05	NO DATA	3.44E-05	5.13E-06	2.27E-06
CS 137	3.27E-04	3.13E-04	4.62E-05	NO DATA	1.02E-04	3.67E-05	1.96E-06
CS 138	2.28E-07	3.17E-07	2.01E-07	NO DATA	2.23E-07	2.40E-08	1.46E-07
BA 139	4.14E-07	2.21E-10	1.20E-08	NO DATA	1.93E-10	1.30E-10	2.39E-05

TABLE A.3-3 (cont'd)

INGESTION DOSE FACTORS FOR CHILD
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
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 A.3-4*

INGESTION DOSE FACTORS FOR INFANT
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07
C 14	2.37E-05	5.06E-06	5.06E-06	5.06E-06	5.06E-06	5.06E-06	5.06E-06
NA 24	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05
P 32	1.70E-03	1.00E-04	6.59E-05	NO DATA	NO DATA	NO DATA	2.30E-05
CR 51	NO DATA	NO DATA	1.41E-08	9.20E-09	2.01E-09	1.79E-08	4.11E-07
MN 54	NO DATA	1.99E-05	4.51E-06	NO DATA	4.41E-06	NO DATA	7.31E-06
MN 56	NO DATA	8.18E-07	1.41E-07	NO DATA	7.03E-07	NO DATA	7.43E-05
FE 55	1.39E-05	8.91E-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 A.3-4 (cont'd)

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	1.14E-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-06	NO DATA	2.73E-06
I 133	1.25E-05	1.82E-05	5.33E-06	3.31E-03	2.14E-05	NO DATA	3.08E-06
I 134	8.69E-07	1.78E-06	6.33E-07	4.15E-05	1.99E-06	NO DATA	1.84E-06
I 135	3.64E-06	7.24E-06	2.64E-06	6.49E-04	8.07E-06	NO DATA	2.62E-06
CS 134	3.77E-04	7.03E-04	7.10E-05	NO DATA	1.81E-04	7.42E-05	1.91E-06
CS 136	4.59E-05	1.35E-04	5.04E-05	NO DATA	5.38E-05	1.10E-05	2.05E-06
CS 137	5.22E-04	6.11E-04	4.33E-05	NO DATA	1.64E-04	6.64E-05	1.91E-06
CS 138	4.81E-07	7.82E-07	3.79E-07	NO DATA	3.90E-07	6.09E-08	1.25E-06
BA 139	8.81E-07	5.84E-10	2.55E-08	NO DATA	3.51E-10	3.54E-10	5.58E-05

TABLE A.3-4 (cont'd)

INGESTION DOSE FACTORS FOR INFANT
(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
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 A.3-5*

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
C	5.5E 00	1.2E-02	3.1E-02
Na	5.2E-02	4.0E-02	3.0E-02
P	1.1E 00	2.5E-02	4.6E-02
Cr	2.5E-04	2.2E-03	2.4E-03
Mn	2.9E-02	2.5E-04	8.0E-04
Fe	6.6E-04	1.2E-03	4.0E-02
Co	9.4E-03	1.0E-03	1.3E-02
Ni	1.9E-02	6.7E-03	5.3E-02
Cu	1.2E-01	1.4E-02	8.0E-03
Zn	4.0E-01	3.9E-02	3.0E-02
Rb	1.3E-01	3.0E-02	3.1E-02
Sr	1.7E-02	8.0E-04	6.0E-04
Y	2.6E-03	1.0E-05	4.6E-03
Zr	1.7E-04	5.0E-06	3.4E-02
Nb	9.4E-03	2.5E-03	2.8E-01
Mo	1.2E-01	7.5E-03	8.0E-03
Tc	2.5E-01	2.5E-02	4.0E-01
Ru	5.0E-02	1.0E-06	4.0E-01
Rh	1.3E 01	1.0E-02	1.5E-03
Ag	1.5E-01	5.0E-02	1.7E-02
Te	1.3E 00	1.0E-03	7.7E-02
I	2.0E-02	6.0E-03+	2.9E-03
Cs	1.0E-02	1.2E-02	4.0E-03
Ba	5.0E-03	4.0E-04	3.2E-03
La	2.5E-03	5.0E-06	2.0E-04
Ce	2.5E-03	1.0E-04	1.2E-03
Pr	2.5E-03	5.0E-06	4.7E-03
Nd	2.4E-03	5.0E-06	3.3E-03
W	1.8E-02	5.0E-04	1.3E-03
Np	2.5E-03	5.0E-06	2.0E-04

*Taken from Regulatory Guide 1.109 (Rev. 1)

+F_m for goat is 6.0E-2.

TABLE A.4-1

Total Dose Factors for Radionuclides

ELEMENT	Pi^I	Pi^G	Pi^F	Pox(i)
H 3	646.8	-0-	2.4E3	4.57E-1
C 14	2.65E4	-0-	2.4E9	4.72E1
Na 24	1.06E4	1.98E7	1.58E7	2.23
P 32	2.03E6	-0-	1.63E11	3.24E3
Cr 51	1.28E4	7.88E6	5.44E5	2.07
Mn 54	1.0E6	1.27E9	1.46E15	2.63E7
Mn 56	7.17E4	1.52E7	3.04E5	1.10E1
Fe 55	8.69E4	-0-	1.37E8	1.55E1
Fe 59	1.02E6	4.61E8	4.00E8	1.68E1
Co 58	7.77E5	6.23E8	6.16E7	1.29E2
Co 60	4.51E6	5.17E9	2.14E8	7.73E2
Ni 63	3.39E5	-0-	3.56E10	6.92E2
Ni 65	5.01E4	5.01E5	3.85E1	7.52
Cu 64	1.50E4	9.93E5	4.03E6	2.34
Zn 65	6.47E5	7.92E8	1.94E10	4.61E2
Zn 69	1.32E4	-0-	7.05E-9	1.98
Br 83	3.81E2	1.02E4	- - -	5.74E-2
Br 84	4.00E2	3.38E5	- - -	6.61E-2
Br 85	2.04E1	-0-	- - -	3.06E-3
Rb 86	1.90E5	1.47E7	6.04E8	3.96E1
Rb 88	5.57E2	5.40E4	1.91E-44	8.45E-2
Rb 89	3.21E2	2.10E5	2.45E-52	5.19E-2
Sr 89	2.03E6	3.71E4	1.29E10	5.37E2
Sr 90	4.09E7	-0-	1.24E11	2.27E4
Sr 91	7.34E4	3.65E6	3.55E5	1.11E1
Sr 92	1.4E5	1.23E6	4.86E1	2.10E1
Y 90	2.69E5	7.59E3	9.59E5	4.04E1
Y 91m	2.79E3	1.68E5	2.95E-15	4.22E-1
Y 91	2.45E6	1.72E6	5.36E6	3.68E2
Y 92	1.27E5	3.03E5	9.30E0	1.91E1
Y 93	1.67E5	3.65E5	1.88E4	2.51E1
Zr 95	1.75E6	4.08E8	8.45E5	2.70E2
Zr 97	1.40E5	4.96E6	4.64E4	2.11E1
Nb 95	4.79E5	2.29E8	2.10E8	7.98E1
Mo 99	1.35E5	6.71E6	3.23E8	2.62E8
Tc 99m	2.03E3	3.01E5	1.67E4	3.10E-1
Tc 101	8.44E2	3.19E4	7.32E-58	1.27E-1
Ru 103	5.52E5	1.81E8	1.07E5	8.61E1
Ru 105	4.84E4	1.03E6	3.24E0	7.28
Ru 106	1.16E7	3.59E8	1.47E6	1.75E3
Ag 110m	3.67E6	3.67E9	1.49E10	8.85E2
Te 125m	4.47E5	3.01E6	1.54E8	6.99E1
Te 127m	1.31E6	1.39E5	1.06E9	2.16E2
Te 127	2.44E4	4.59E3	1.24E5	3.66
Te 129m	1.68E6	3.35E7	1.43E9	2.78E2
Te 129	2.63E4	4.38E4	1.54E-7	3.95
Te 131m	1.99E5	1.36E7	2.34E7	3.05E1
Te 131	3.22E3	4.89E7	7.23E-31	2.11

TABLE A.4-1 (Cont.)

ELEMENT	Pi^I	PiG	PiF	Pox(i)
Te 132	3.40E5	7.06E6	6.59E7	5.23E1
I 130	1.60E6	9.61E6	1.82E8	2.43E2
I 131	1.48E7	2.99E7	2.15E11	6.09E3
I 132	1.69E5	2.06E6	2.11E1	2.54E1
I 133	3.56E6	4.16E6	1.84E9	5.67E2
I 134	4.45E4	7.50E5	1.12E-10	6.69
I 135	6.96E5	4.26E6	4.36E6	1.05E2
Cs 134	7.03E5	3.28E9	6.92E10	1.41E3
Cs 136	1.35E5	2.55E8	6.07E9	1.34E2
Cs 137	6.12E5	1.34E9	6.13E10	1.22E3
Cs 138	8.76E2	5.86E5	2.13E-22	1.42E-1
Ba 139	5.10E4	1.70E5	2.76E-5	7.65
Ba 140	1.60E6	3.35E7	2.45E8	2.45E2
Ba 141	4.75E3	6.69E4	9.02E-45	7.14E-1
Ba 142	1.55E3	7.17E4	2.99E-80	2.34E-1
La 140	1.68E5	3.11E7	1.91E5	2.58E1
La 142	5.95E4	1.26E6	5.32E-6	8.95
Ce 141	5.17E5	2.26E7	1.40E7	7.82E1
Ce 143	1.16E5	3.78E6	1.58E6	1.75E1
Ce 144	9.84E6	6.77E7	1.36E8	1.48E3
Pr 143	4.33E5	-0-	7.99E5	6.50E1
Pr 144	4.28E3	3.02E3	1.15E-48	6.42E-1
Nd 147	3.22E5	1.45E7	5.87E5	4.86E1
W 187	3.96E4	3.92E6	2.55E6	4.84E1
Np 239	5.95E4	2.82E6	9.55E4	8.98