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 10CFR50.36, 10 CFR 20.106, 10 CFR 50 Appendix I, and 40CFR190. 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 requirements in 10 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 10CFR20, 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.

The calculated alarm and trip action setpoints for the liquid effluent line monitors must satisfy the following equation:

$$\frac{cf}{F+f} \leq C$$

Where:

C = The liquid effluent concentration limit (MPC) implementing Radiological Effluent Technical Specification 3.11.1.1 in uCi/ml.

c = The setpoint, in μCi/ml, of the radioactivity monitor measuring the radioactivity concentration in the effluent line prior to dilution and subsequent release; the setpoint, which is inversely proportional to the volumetric flow of the effluent line and directly proportional to the volumetric flow of the dilution stream plus the effluent stream, represents a value, which, if exceeded, would result in concentrations exceeding the limits of 10CFR20 in the unrestricted area.

f = The pump flow rate as measured at the radiation monitor location, in volume per unit time, but in the same units as F, below

F = The dilution water flow rate as measured prior to the release point, in volume per unit time.

Thus, the expression for determining the setpoint on the liquid radwaste effluent line monitor becomes:

$$c \leq \frac{C(F+f)}{f} \quad (\mu Ci/ml)$$

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 as outlined in Section 2.1.2. 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 as outlined in Section 2.1.2. 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) Determine concentrations of radioactivity of the batch being considered for release.

   The isotopic concentration of the batch is the sum of the concentrations for the isotopes present as determined from the analysis required in Table 4.11-1 of the Radiological Effluent Technical Specifications.

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

Where:

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

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

*C_a = The measured concentration C_a of alpha emitting nuclides observed by gross alpha analysis of the monthly composite sample.

*C_s = The measured concentrations of Sr-89 and Sr-90 in liquid waste as determined by analysis of the quarterly composite sample.

$*C_t$ = The measured concentration of H-3 in liquid waste as determined by analysis of the monthly composite.

$*C_f$ = The measured concentration of Fe-55 in liquid waste as determined by analysis of the quarterly composite.

*Values for these concentrations will be based on previous composite sample analysis as required by Table 4.11-1 of the Radiological Effluent Technical Specifications.

2) The measured radionuclide concentrations are used to calculate a dilution factor, F_d, which is the ratio of total dilution flow rate to tank flow rate required to assure that the limiting concentrations of Technical Specification 3.11.1.1 are met at the point of discharge. This is referred to as the required dilution factor and is determined according to:

$$F_d = \left(\sum_i \frac{C_i}{MPC_i}\right) \times F_s$$

Where:

C_i = Measured concentrations of C_g, C_a, C_s, C_t and C_f, as defined in Step 1. Terms C_a, C_s, C_t and C_f, will be included in the calculation as appropriate.

MPC_i = MPC_g, MPC_a, MPC_s, MPC_t and MPC_f, are limiting concentrations of the appropriate radionuclide from 10CFR20, Appendix B, Table II, Column 2. For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-04, µCi/ml total activity.

F_s = the safety factor; a conservative factor used to compensate for statistical fluctuations and errors of measurement default value is 1.0

3) For the case $F_d \leq 1$, the waste tank effluent concentration meets the limits of 10CFR20 without dilution and the effluent may be released at any desired flow rate. For the case $F_d > 1$, a modified dilution factor, F_{dn}, must be determined so that available dilution flow may be apportioned among simultaneous discharge pathways.

$$F_{dn} = F_d \div F_a$$

Where F_a is the allocation factor which will modify the required dilution factor so that simultaneous liquid releases may be made without exceeding 10CFR20 limits.

The most straight-forward determination of allocation factor is

$$F_a = 1/n$$

Where:

n = The number of liquid discharge pathways for which $F_d > 1$ and which are planned for simultaneous release.

However, this value for F_a may be unnecessarily restrictive in that all release pathways are apportioned the same fraction of the available dilution stream, regardless of the relative concentrations of each of the sources.

Since the radionuclide concentration of the two continuous sources is expected to be less than that of the batch release source, it is acceptable to allocate smaller portions of the dilution stream to the continuous releases and a larger portion to the batch releases.

Therefore, F_a is defined as a flexible quantity with a default value of 1/n. Prior to initiating simultaneous release, a check will be made to assure that the sum of the allocation factors assigned to pathways for the simultaneous release is < 1.

4) The calculated maximum permissible waste tank effluent flow rate, F_{max}, is based on the modified dilution factor, F_{dn}, and the effective dilution flow rate, F_{eff}.

The cooling lake into which the effluent is discharged is also the source of the dilution stream. It is therefore necessary to take into account the recirculation of previously emitted radionuclides should they be detected by sample analysis of the cooling lake water. This is accomplished by defining an effective dilution flow rate as

$$F_{eff} = F_m \left[1 - \sum_i \frac{LC_i}{MPC_i}\right]$$

Where:

F_m = The expected minimum dilution water flow rate.

LC_i = Measured concentration of nuclide i in the cooling lake water sample.

MPC_i = Limiting concentration of radionuclide i from 10CFR20 Appendix B, Table II, Column 2.

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

Having established the values of F_{dn} and F_{eff}, the calculated maximum permissible waste tank flow rate is given by

$$f_{max} \leq \frac{F_{eff} + f_p}{F_{dn}} \qquad \frac{F_{eff}}{f_{dn}} \text{ for } f_p << F_{eff}$$

Where f_p is the expected effluent flow rate; normally the rated capacity of the effluent pump. Thus the pump flow rate is set at or below f_{max}. Even though the value of f_{max} may be larger than the actual effluent pump capacity, f_p, it does represent the upper limit to the effluent flow rate, whereby the requirement of 10CFR20 may still be met. If $F_d \leq 1$, the effluent pump flow rate may be assigned any value since the waste tank effluent concentration meets the limits of 10CFR20 without dilution and the release may be made without regard to the setpoints for other release pathways. For those discharge pathways selected to be secured during the release under consideration, the pump flow rate should be set at as low a value as practicable to detect any inadvertent release.

A setpoint for the dilution stream flow rate is not applicable since the minimum flow rate is administratively set.

5) The liquid radiation monitor setpoint may now be determined based on the values of $\sum_i C_i$, and f_{max}. The monitor response is primarily to gamma radiation, therefore, the actual setpoint is based on $\sum_g C_g$. The calculated monitor setpoint concentration is determined as follows:

$$c = A_g C_g \quad (\mu Ci/ml)$$

Where:

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

$$\frac{f_{max}}{f_p}$$

If A > 1, Calculate c and determine the maximum value for the actual monitor setpoint (μCi/ml)

If A < 1, No release may be made.

If F_d < 1, no further dilution is required and the release may be made without regard to available dilution or to other releases made simultaneously. However, it is necessary to establish a monitor setpoint which will provide alarm should the release concentration inadvertently exceed 10CFR20 limits. This can be accomplished by establishing the adjustment factor as follows:

$$A = 1/F_d$$

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 t_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. See Tables A.4-1 through A.4-4.

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

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 through 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.

2.4 CALIBRATION OF LIQUID EFFLUENT MONITORS

The four monitors associated with liquid releases are listed below

Monitor ID	Description
O-BM-RE-52	Steam Generator Blowdown Discharge Monitor
O-LE-RE-59	Turbine Building Drain Monitor
O-HF-RE-45	Secondary Liquid Waste System Monitor
O-HB-RE-18	Liquid Radwaste Discharge Monitor

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

2.4.2 Calibration of the liquid monitors shall be performed using three standard solutions of Cs-137. The solutions shall cover the appropriate range of the detector and have concentrations of approximately 5×10^{-7} uCi/cc, 1×10^{-5} uCi/cc, and 1×10^{-3} uCi/cc. The solutions shall be presented to the detector and the meter reading in counts per minute shall be recorded. A graph of counts per minute versus concentration shall be produced from the data. Immediately following monitor calibration the 9 µCi Cs-137 checksource shall be actuated. The counts per minute produced by the checksource shall be logged.

3.0 GASEOUS EFFLUENTS

3.1 GASEOUS EFFLUENT MONITOR SETPOINTS

Technical Specification 3.3.3.11 requires the gaseous effluent monitoring instrumentation channels shown in Table 3.3-13 to be operable with their Alarm/Trip setpoints set to ensure that the limits of Specification 3.11.2.1 are not exceeded. Specification 3.11.2.1 states that the dose rate due to radioactive materials released in gaseous effluents from the site shall be limited to less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin due to noble gases.

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

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

Monitor identifications are as follows:

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. Acts to isolate Waste Gas Decay Tank discharge)
O-GT-RE-22&33	Containment Purge System Monitor (acts to isolate the purge; is not an effluent monitor)
O-GT-RE-31&32	Containment Atmosphere Monitor (acts to isolate purge; not an effluent monitor)

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

3.1.2 TOTAL BODY DOSE RATE SETPOINT CALCULATION

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

$$S_{tb} \leq (SF \times AF) \times D_{tb} \times R_t \qquad (1)$$

where:

S_{tb} = The monitor alarm/trip setpoint based on the total body dose rate.

D_{tb} = Radiological Effluents Technical Specification 3.11.2.1 limit of 500 mrem/yr total body, conservatively interpreted as a continuous release over a one year period.

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

AF = Allocation factor for each release so that simultaneous releases can be made without exceeding the Technical Specification Limit. Normally AF is calculated as follows:

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

Where:

RF = Release Flow rate of the release point under consideration

TF = Total Flow rate of all release points including release under consideration

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

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

where:

c = The monitor response to the gaseous effluent noble gas corresponding to grab sample radionuclide concentrations.

$(\overline{X/Q})$ = The highest calculated annual average atmospheric dispersion (sec/m^3) at or beyond the unrestricted area boundary.

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

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

3.1.3 SKIN DOSE RATE CALCULATION

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

$$S_S \leq (SF \times AF) \times D_S \times R_S \qquad (2)$$

where:

S_S = The monitor alarm/trip setpoint based on the skin dose rate.

D_S = Radiological Effluents Technical Specification 3.11.2.1 limit of 3000 mrem/yr to the skin of the body, conservatively interpreted as a continuous release over a one year period.

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

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

where:

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

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

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

The factors SF, AF, c, $(\overline{X/Q})$ and Q_i are as defined in Section 3.1.2.

The results of equations (1) and (2) are compared to determine the smaller setpoint. The actual monitor setpoint is the lower of the two values.

A pre-release isotopic analysis is performed for batch releases from Waste Gas Decay Tanks and Containment Building Purges to determine the identity and quantity of the principal radionuclides. The appropriate alarm/trip setpoint(s) are adjusted accordingly to ensure that the limits of Radiological Technical Specification 3.11.2.1 are not exceeded.

3.1.4 ALERT ALARM SETPOINT CALCULATIONS

FSAR Table 11.5-4 states that the alert alarm for the Plant Unit Vent (O-GT-RE-21), Radwaste Building Exhaust Monitor (O-GT-RE-10), Auxiliary Ventilation Exhaust Monitor (O-GL-RE-60) and Access Control Area Ventilation Monitor (O-GK-RE-4) is set to alert operators to that average concentration which if maintained for a full year would result in the 10 CFR 50 Appendix I annual dose guidelines being reached. Technical Specification 3.11.2.2 limits the annual dose due to noble gases to $\leq$ 10 mrads for gamma radiation and $\leq$ 20 mrads for beta radiation. Technical Specification 3.11.2.3 limits the annual dose to a Member of the Public from Iodine-131, Iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents to $\leq$ 15 mrem to any organ. These two Technical Specifications contain the annual dose limits due to gaseous releases found in 10 CFR 50 Appendix I.

3.1.4.1 NOBLE GAS ALERT ALARM SETPOINT CALCULATION

The alert alarm setpoint is the lesser of

$$S \leq (SF \times AF) \times D_{\gamma} \times R_{\gamma} \qquad (3)$$

$$S \leq (SF \times AF) \times D_{\beta} \times R_{\beta} \qquad (4)$$

where:

S_γ = Monitor setpoint based on gamma radiation.

D_γ = Technical Specification 3.11.2.2 limit of 10 mrad/yr conservatively interpreted as a continuous release over a one year period.

R_γ = Monitor response per mrad/yr determined according to:

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

where:

M_i = Gamma Air Dose Factor (mrad/yr per $\mu Ci/m^3$). See Table A.1-2.

S_β = Monitor setpoint based on beta radiation.

D_β = Technical Specification 3.11.2.2 limit of 20 mrad/yr conservatively interpreted as a continuous release over a one year period.

R_β = Monitor response per mrad/yr determined according to:

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

where:

N_i = Beta Air Dose Factor (mrad/yr per $\mu Ci/m^3$). See Table A.1-2.

Formulas 3 and 4 are used to calculate the alert alarm setpoints for the gaseous monitors listed in Section 3.1.1 and for actual concentrations of radionuclides found in the effluent streams.

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

$$\text{Setpoint } (\mu Ci/cc) = \frac{(10 \text{ mrad/yr}) \ (.85) \ (AF)}{\left((\overline{X/Q}) \sum_i P_i \times M_i \times Q \right)} \qquad (5)$$

where:

P_i = Fractional value of isotope expected, C_i/C_T,

where:

C_i = Concentration in μCi/cc of isotope.

C_T = Total Gaseous Activity from FSAR Table 11.1-1.

AF = Either Unit Vent Flow or Radwaste Building Vent Flow divided by the combined flow of the Unit Vent and Radwaste Building Vent.

Q = Vent flow rate in cc/sec.

Isotopes used and P_i values are as follows:

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

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

3.1.4.2 PARTICULATE AND IODINE ALARM SETPOINTS

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

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

where:

MPC_i = 5×10^{-10} µCi/cc for Cs-137

= 1×10^{-10} µCi/cc for I-131

AF = as defined previously

SF = .0625 for I-131 *

= .9375 for C_s-137 *

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

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

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) = 2.2 E-06 sec/m^3, The highest calculated annual average relative concentration at the restricted area boundary in the North Sector 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:

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

where:

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

$P_{(i)}IN$ = The dose parameter for radionuclides other than noble gases for the inhalation pathway, in mrem/yr per μCi/m^3. See Table A.5-1.

X/Q = 2.2 E-06 sec/m^3 (the highest annual average). The highest calculated relative concentration for estimating the dose to an individual at the unrestricted area boundary in the N sector, or current X/Q.

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 equation for $P_{(i)IN}$ was taken from NUREG 0133:

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

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

where:

K' = a constant of unit conversion, 10^6 $pCi/\mu Ci$

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

DFA_i = the maximum organ inhalation dose factor for the child 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 child group. The child's breathing rate is taken as 3700 m^3/yr from Table E-5 of Regulatory Guide 1.109. The inhalation dose factors for the child, DFA_i are presented in Table E-9 of Regulatory Guide 1.109, in units of mrem/pCi.

Resolution of the units yields:

$$P_i \text{ (Inhalation)} = 3.7 \times 10^9 \ DFA_i$$

The P_i value for tritium is:

$$P_i \quad \text{(Inhalation)} = 3.7 \times 10^9 \, DFA_i$$

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;

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

For beta radiation;

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

b. During any calendar year:

For gamma radiation:

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

For beta radiation:

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

where:

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

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide, in mrad/yr per $\mu Ci/m^3$ 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 = 2.2 E-6 sec/m^3. The highest calculated annual average relative concentration for any area at the unrestricted area boundary or current X/Q.

Q_i = The release of noble gas radionuclides, 'i', in gaseous effluents, in μCi. Releases shall be cumulative over the calendar quarter or year as appropriate.

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.

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.

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

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 (e.g. delay the release of a Waste Gas Decay Tank) 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 mremto any organ; and

b. During any calendar year to $\leq$ 15 mremto any organ.

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. $D\ (mrem) = 3.17E\text{-}8 \sum_p \left[\sum_i R_i\ (WQ_i)\right] \leq 7.5\ mrem$

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

wnere:

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. The Q_i value shall be determined as the product of the flow rate through the release point and grab samples of the effluent analyzed in accordance wit~ Radiological Effluent Technical Specification 3.11.2.1.

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

W = (X/Q), 2.2 x 10^{-6} 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. See Table A.5-2 through Table A.5-5.

where:

Inhalation Pathway Factor,

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

where:

K' = a constant of unit conversion, 10^6 pCi/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, $R_i^G[D/Q]$

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

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/hr 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, $R_i^C[D/Q]$

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

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

where:

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

Q_F = The cow's consumption rate, in Kg/day (wet weight), 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 $\mu Ci/m^3$)

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

a. < 2.5 mrem/mo.

If the monthly average 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.

b. < 1.25 mrem/mo.

If the monthly average 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 doses are exceeded, evaluation of the causes should be performed and steps taken to reduce the activity or frequency of the Release.

3.4 CALIBRATION OF GASEOUS EFFLUENT MONITORS

The following monitors are asociated with gaseous releases

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

3.4.1 PARTICULATE DETECTOR CALIBRATION

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

3.4.1.2 For energy range calibration four sources shall be used. Each source consists of a 35 mm diameter filter paper impregnated with a beta emitting radionuclide. The radionuclides used should be Tc-99, Cs-137, Cl-36, and Rh-106. Each source shall be positioned in the filter paper retaining ring and counted separately. The count rates for each radionuclide source shall be recorded and the data plotted on a graph of cpm/µCi versus average beta energy. This curve represents the detectors response characteristics over the range of beta energies observed. The efficiency for setpoint calculations shall be based on the efficiency of the detector for Cs-137.

3.4.1.3 The detector shall be calibrated for its rate capabilities using a filter paper impregnated with stand activities of Cs-137. Increasing amounts of a standard Cs-137 solution shall be impregnated on a filter paper. The counts per minute for each Cs-137 standard shall be recorded and the data plotted on a graph of counts per minute versus activity. At least three sources covering approximately 1/4, 1/2, and 3/4 of full scale shall be checked. Immediately following monitor calibration the 0.05 µCi Cl-36 checksource shall be actuated. The counts per minute produced by the checksource shall be logged.

3.4.2 IODINE DETECTOR CALIBRATION

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

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

A. Ba-133: 356 KeV gamma is 0.69 efficient/disintegration

B. I-131: 364 KeV gamma is 0.82 efficient/disintegration

Therefore, each iodine disintegration will produce 0.82/0.69 x barium disintegrations. Assuming that the detector efficiency for 356 KeV is the same as for the 364 KeV, the sensitivity for I-131 equals 1.19 x Ba-133 (counts/min)/μCi. The standard sources shall be constructed by impregnating a standard Ba-133 solution into the charcoal filter element. The geometry shall simulate the iodine retention on the first surface of the charcoal. Sources shall be prepared to cover approximately 1/4, 1/2, and 3/4 of full scale. The barium counts per minute for each standard shall be adjusted to iodine counts per minute as described above. The adjusted counts per minute shall be plotted on a graph of counts per minute versus activity. Immediately following calibration the checksource shall be actuated. The counts per minute proudced by the Ba-133 checksource shall be logged.

3.4.3 GAS DETECTOR CALIBRATION

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

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

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.

4.1 INTERLABORATORY COMPARISON PROGRAM

Analysis of KG&E Radiological Environmental samples is presently performed by Teledyne Isotopes, which takes part in the EPA Laboratory Intercomparison Program. Results of intercomparisons are then provided to KG&E in revisions to Teledyne's Quality Control Manual (IWL-0032-361) which is maintained at KG&E corporate offices.

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 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.

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
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 trituim 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 trituim 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 Neosho River below Wolf Creek confluence.	Semiannually	Semiannual gamma isotopic analysis.

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

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
4. INGESTION			
a. Milk	Samples from B-8, F-1, Q-5, and a control sample from S-3 (Hartford); alternate location is 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 locations Q-1 and A-1 on Figure 4.3; control at S-4 (Hartford); alternate samples from locations 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

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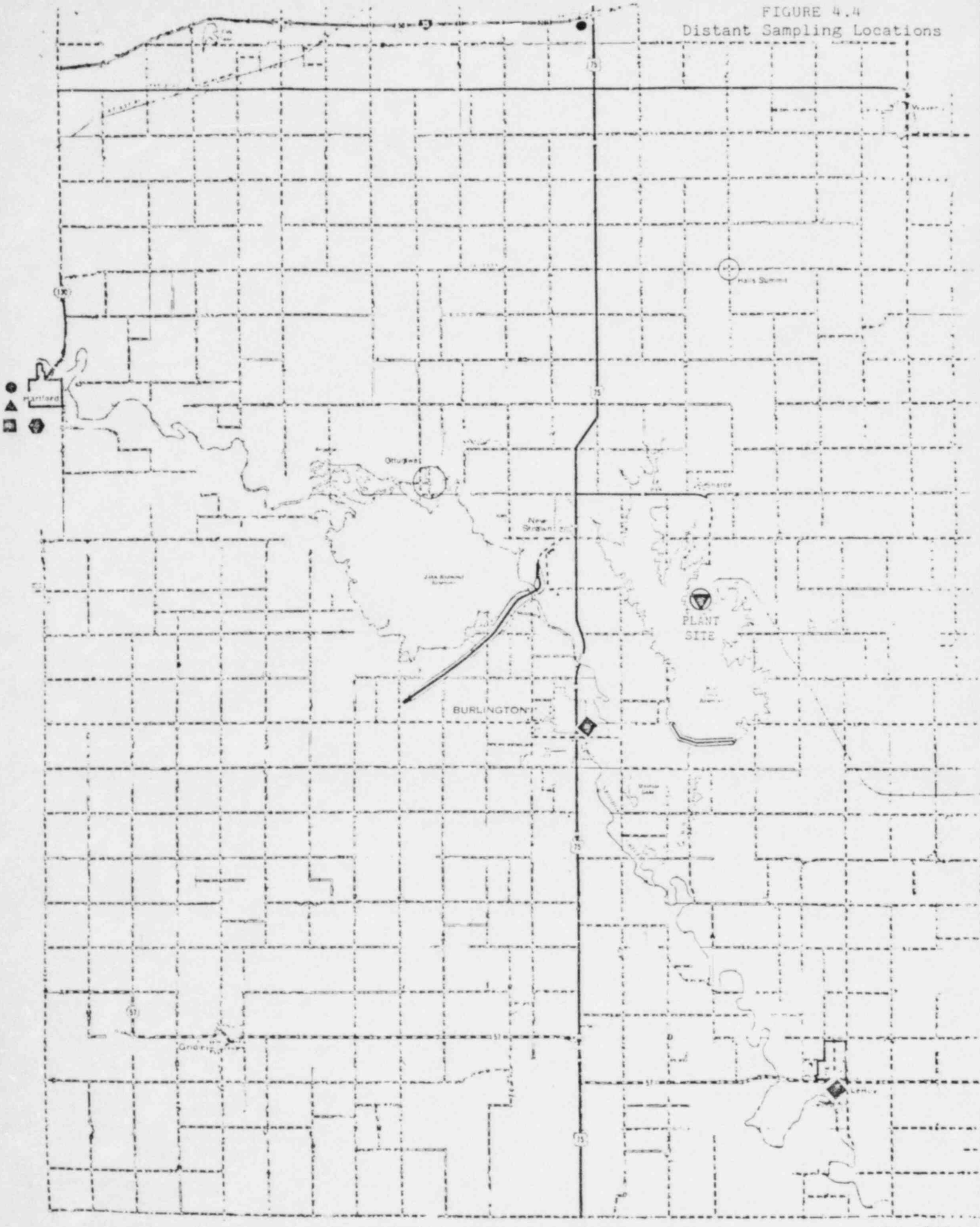
FIGURE 4.4
Distant Sampling Locations



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

REV. 8/83

5.0 40 CFR 190 DOSE EVALUATION

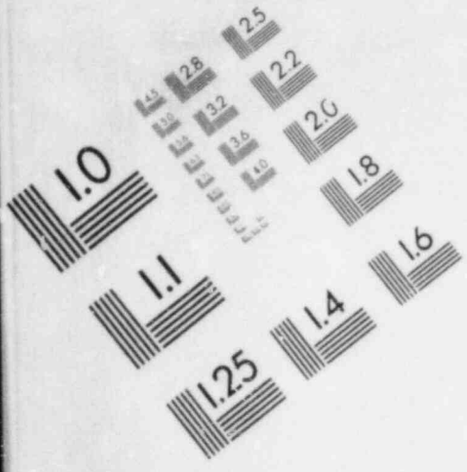
This section demonstrates compliance with Surveillance Requirements 4.11.4.1 and 4.11.4.2 of the Wolf Creek Generating Station Technical Specifications. Specifically, the annual (calendar year) dose or dose commitment to any Member of the Public due to release of radioactivity and to radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrems to the whole body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

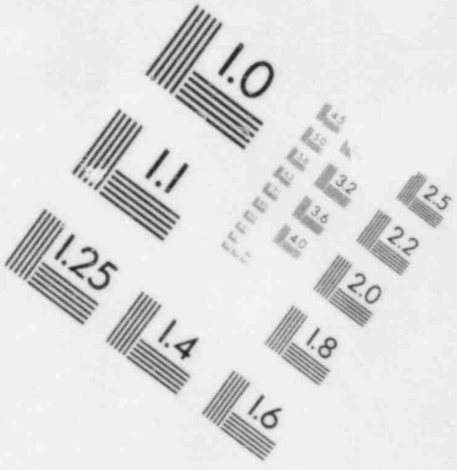
Dose evaluations to demonstrate compliance with Technical Specification 3.11.4 only need to be performed if the release of radioactive materials in liquid or gaseous effluents exceed twice the limits of Technical Specification 3.11.1.2a, 3.11.1.2b, 3.11.2.2a, 3.11.2.2b, 3.11.2.3a, or 3.11.2.3b. Otherwise, no further evaluation is required.

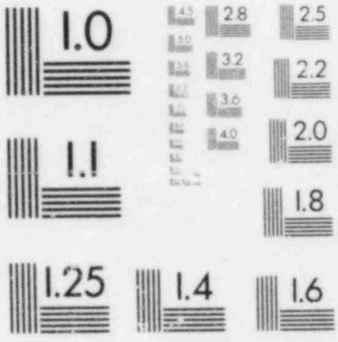
For the evaluation of doses to an individual from liquid releases, the method described in Section 2.0 will be used. For the evaluation of doses to an individual from gaseous releases, the methods described in Section 3.0 will be used.

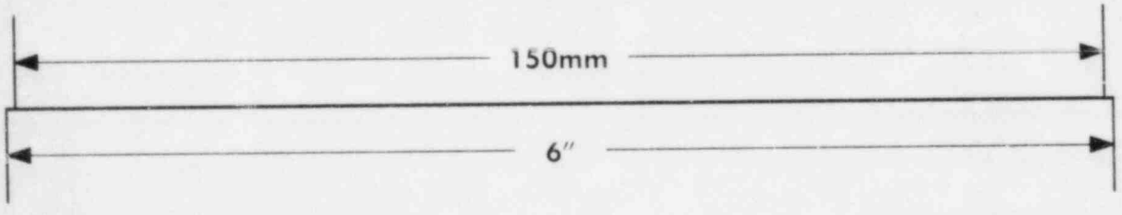
Cumulative dose contributions from direct radiation from the reactor unit and from radwaste storage tanks shall be determined utilizing the results of routine plant perimeter surveys, TLD data or a combination of both, when necessary.

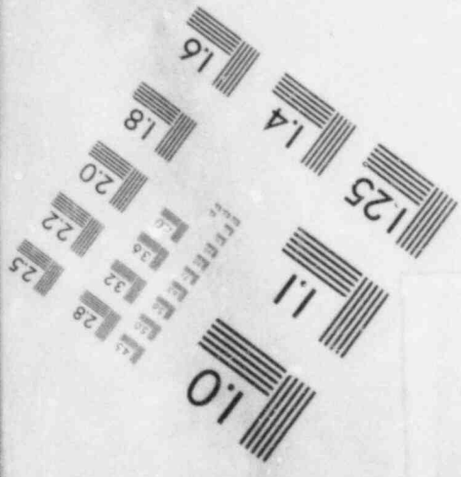
IMAGE EVALUATION
TEST TARGET (MT-3)











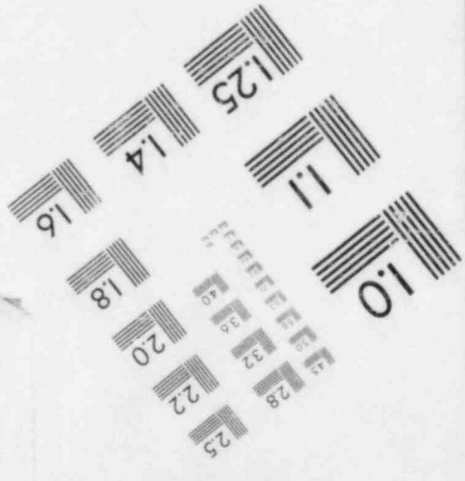
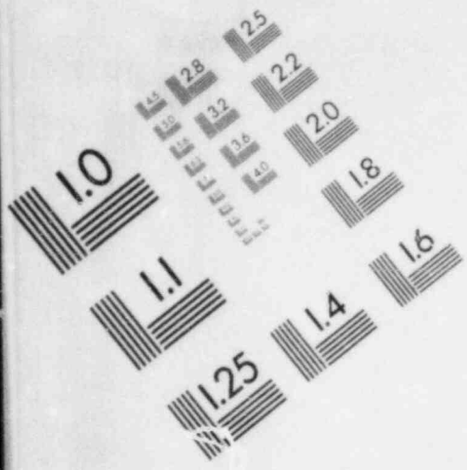
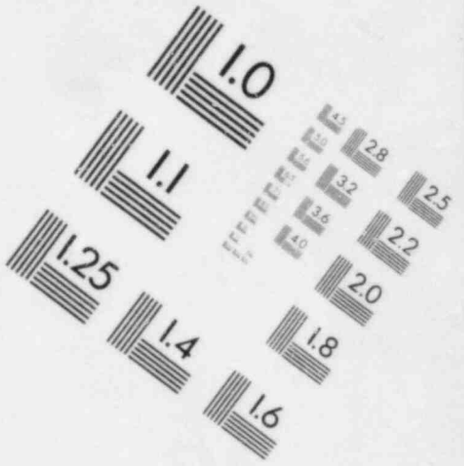
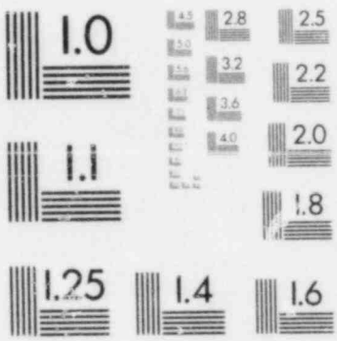
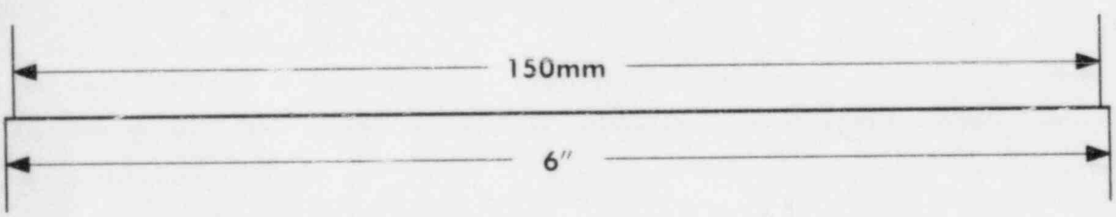


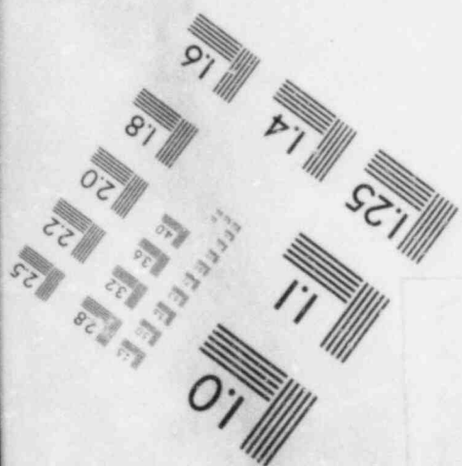
IMAGE EVALUATION
TEST TARGET (MT-3)

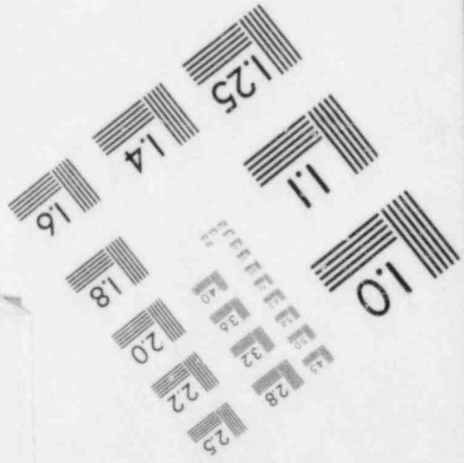












APPENDIX A

Dose Conversion Factor Tables

T E A.1-1*

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

ELEMENT	FRESHWATER FISH
H	9.0E-01
C	4.6E 03
Na	1.0E 02
P	1.0E 05
Cr	2.0E 02
Mn	4.0E 02
Fe	1.0E 02
Co	5.0E 01
Ni	1.0E 02
Cu	5.0E 01
Zn	2.0E 03
Br	4.2E 02
Rb	2.0E 03
Sr	3.0E 01
Y	2.5E 01
Zr	3.3E 00
Nb	3.0E 04
Mo	1.0E 01
Tc	1.5E 01
Ru	1.0E 01
Rh	1.0E 01
Te	4.0E 02
I	1.5E 01
Cs	2.0E 03
Ba	4.0E 00
La	2.5E 01
Ce	1.0E 00
Pr	2.5E 01
Nd	2.5E 01
W	1.2E 03
Np	1.0E 01

*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 = 7.56×10^{-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
R 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
PB 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
[illegible] 40	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-1[illegible]
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	1.15E-05	NO DATA	3.18E-07
I 133	2.01E-06	3.41E-06	1.04E-06	4.76E-04	5.98E-06	NO DATA	2.58E-06
I 134	1.46E-07	3.87E-07	1.39E-07	6.45E-06	6.10E-07	NO DATA	5.10E-09
I 135	6.10E-07	1.57E-06	5.82E-07	1.01E-04	2.48E-06	NO DATA	1.74E-06
CS 134	8.37E-05	1.97E-04	9.14E-05	NO DATA	6.26E-05	2.39E-05	2.45E-06
CS 136	8.59E-06	3.38E-05	2.27E-05	NO DATA	1.84E-05	2.90E-06	2.72E-06
CS 137	1.12E-04	1.49E-04	5.19E-05	NO DATA	5.07E-05	1.97E-05	2.12E-06
CS 138	7.76E-08	1.49E-07	7.45E-08	NO DATA	1.10E-07	1.28E-08	6.76E-11
BA 139	1.39E-07	9.78E-11	4.05E-09	NO DATA	9.22E-11	6.74E-11	1.24E-06

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
BA 140	2.84E-05	3.48E-08	1.83E-06	NO DATA	1.18E-08	2.34E-08	4.38E-05
BA 141	6.71E-08	5.01E-11	2.24E-09	NO DATA	4.65E-11	3.43E-11	1.43E-13
BA 142	2.99E-08	2.99E-11	1.84E-09	NO DATA	2.53E-11	1.99E-11	9.18E-20
LA 140	3.48E-09	1.71E-09	4.55E-10	NO DATA	NO DATA	NO DATA	9.82E-05
LA 142	1.79E-10	7.95E-11	1.98E-11	NO DATA	NO DATA	NO DATA	2.42E-06
CE 141	1.33E-08	8.88E-09	1.02E-09	NO DATA	4.18E-09	NO DATA	2.54E-05
CE 143	2.35E-09	1.71E-06	1.91E-10	NO DATA	7.67E-10	NO DATA	5.14E-05
CE 144	6.96E-07	2.88E-07	3.74E-08	NO DATA	1.72E-07	NO DATA	1.75E-04
PR 143	1.31E-08	5.23E-09	6.52E-10	NO DATA	3.04E-09	NO DATA	4.31E-05
PR 144	4.30E-11	1.76E-11	2.18E-12	NO DATA	1.01E-11	NO DATA	4.74E-14
ND 147	9.38E-09	1.02E-08	6.11E-10	NO DATA	5.99E-09	NO DATA	3.68E-05
W 187	1.46E-07	1.19E-07	4.17E-08	NO DATA	NO DATA	NO DATA	3.22E-05
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	8.98E-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 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	1.24E-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-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-02
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

SITE RELATED DOSE COMMITMENT FACTOR AIT
MREM/HR PER UCI/ML
ADULT

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E-01	8.96E 00	8.96E 00	8.96E 00	8.96E 00	8.96E 00	8.96E 00
C-14	3.15E 04	6.30E 03	6.30E 03	6.30E 03	6.30E 03	6.30E 03	6.30E 03
NA-24	5.48E 02	5.48E 02	5.48E 02	5.48E 02	5.48E 02	5.48E 02	5.48E 02
P-32	4.62E 07	2.87E 06	1.79E 06	0.00E-01	0.00E-01	0.00E-01	5.20E 06
CR-51	0.00E-01	0.00E-01	1.49E 00	8.94E-01	3.29E-01	1.98E 00	3.76E 02
MN-54	0.00E-01	4.76E 03	9.08E 02	0.00E-01	1.42E 03	0.00E-01	1.46E 04
MN-56	0.00E-01	1.20E 02	2.12E 01	0.00E-01	1.52E 02	0.00E-01	3.80E 03
FE-55	8.87E 02	6.13E 02	1.43E 02	0.00E-01	0.00E-01	3.42E 02	3.52E 02
FE-59	1.40E 03	3.29E 03	1.26E 03	0.00E-01	0.00E-01	9.19E 02	1.10E 04
CO-58	0.00E-01	1.51E 02	3.39E 02	0.00E-01	0.00E-01	0.00E-01	3.06E 03
CO-60	0.00E-01	4.34E 02	9.58E 02	0.00E-01	0.00E-01	0.00E-01	8.16E 03
NI-63	4.19E 04	2.94E 03	1.41E 03	0.00E-01	0.00E-01	0.00E-01	6.07E 02
NI-65	1.70E 02	2.21E 01	1.01E 01	0.00E-01	0.00E-01	0.00E-01	5.61E 02
CU-64	0.00E-01	1.69E 01	7.93E 00	0.00E-01	4.26E-01	0.00E-01	1.44E 03
ZN-65	2.36E 04	7.50E 04	3.39E 04	0.00E-01	5.02E 04	0.00E-01	4.73E 04
ZN-69	5.02E 01	9.60E 01	6.67E 00	0.00E-01	6.24E-01	0.00E-01	1.44E 01
BR-83	0.00E-01	0.00E-01	4.38E 01	0.00E-01	0.00E-01	0.00E-01	6.30E 01
BR-84	0.00E-01	0.00E-01	5.67E 01	0.00E-01	0.00E-01	0.00E-01	4.45E-04
BR-85	0.00E-01	0.00E-01	2.33E 00	0.00E-01	0.00E-01	0.00E-01	1.09E-19
RB-86	0.00E-01	1.03E 05	4.79E 04	0.00E-01	0.00E-01	0.00E-01	2.03E 04
RB-88	0.00E-01	2.95E 02	1.56E 02	0.00E-01	0.00E-01	0.00E-01	4.07E-09
RB-89	0.00E-01	1.95E 02	1.37E 02	0.00E-01	0.00E-01	0.00E-01	1.13E-11
SR-89	4.78E 04	0.00E-01	1.37E 03	0.00E-01	0.00E-01	0.00E-01	7.66E 03
SR-90	1.18E 06	0.00E-01	2.88E 05	0.00E-01	0.00E-01	0.00E-01	3.40E 04
SR-91	8.79E 02	0.00E-01	3.55E 01	0.00E-01	0.00E-01	0.00E-01	4.19E 03
SR-92	3.33E 02	0.00E-01	1.44E 01	0.00E-01	0.00E-01	0.00E-01	6.60E 03
Y-90	1.38E 00	0.00E-01	3.69E-02	0.00E-01	0.00E-01	0.00E-01	1.46E 04
Y-91M	1.30E-02	0.00E-01	5.04E-04	0.00E-01	0.00E-01	0.00E-01	3.82E-02
Y-91	2.02E 01	0.00E-01	5.39E-01	0.00E-01	0.00E-01	0.00E-01	1.11E 04
Y-92	1.21E-01	0.00E-01	3.53E-03	0.00E-01	0.00E-01	0.00E-01	2.12E 03

TABLE A.4-1 (cont'd)

SITE RELATED DOSE COMMITMENT FACTOR AIT
MREM/HR PER UCI/ML
ADULT

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	3.83E-01	0.00E-01	1.06E-02	0.00E-01	0.00E-01	0.00E-01	1.22E 04
ZR-95	2.77E 00	8.88E-01	6.01E-01	0.00E-01	1.39E 00	0.00E-01	2.82E 03
ZR-97	1.53E-01	3.09E-02	1.41E-02	0.00E-01	4.67E-02	0.00E-01	9.57E 03
NB-95	4.47E 02	2.49E 02	1.34E 02	0.00E-01	2.46E 02	0.00E-01	1.51E 06
MO-99	0.00E-01	4.62E 02	8.79E 01	0.00E-01	1.05E 03	0.00E-01	1.07E 03
TC-99M	2.94E-02	8.32E-02	1.06E 00	0.00E-01	1.26E 00	4.07E-02	4.92E 01
TC-101	3.03E-02	4.36E-02	4.28E-01	0.00E-01	7.85E-01	2.23E-02	1.31E-13
RU-103	1.98E 01	0.00E-01	8.54E 00	0.00E-01	7.57E 01	0.00E-01	2.31E 03
RU-105	1.65E 00	0.00E-01	6.52E-01	0.00E-01	2.13E 01	0.00E-01	1.01E 03
RU-106	2.95E 02	0.00E-01	3.73E 01	0.00E-01	5.69E 02	0.00E-01	1.91E 04
* AG-110M	1.33E 01	1.23E 01	7.32E 00	0.00E-01	2.42E 01	0.00E-01	5.03E 03
TE-125M	2.79E 03	1.01E 03	3.74E 02	8.39E 02	1.13E 04	0.00E-01	1.11E 04
TE-127M	7.05E 03	2.52E 03	8.59E 02	1.80E 03	2.86E 04	0.00E-01	2.36E 04
TE-127	1.14E 02	4.11E 01	2.48E 01	8.48E 01	4.66E 02	0.00E-01	9.03E 03
TE-129M	1.20E 04	4.47E 03	1.89E 03	4.11E 03	5.00E 04	0.00E-01	6.03E 04
TE-129	3.27E 01	1.23E 01	7.96E 00	2.51E 01	1.37E 02	0.00E-01	2.47E 01
TE-131M	1.80E 03	8.81E 02	7.34E 02	1.39E 03	8.92E 03	0.00E-01	8.74E 04
TE-131	2.05E 01	8.57E 00	6.47E 00	1.69E 01	8.98E 01	0.00E-01	2.90E 00
TE-132	2.62E 03	1.70E 03	1.59E 03	1.87E 03	1.63E 04	0.00E-01	8.02E 04
I-130	9.01E 01	2.66E 02	1.05E 02	2.25E 04	4.15E 02	0.00E-01	2.29E 02
I-131	4.96E 02	7.09E 02	4.06E 02	2.32E 05	1.22E 03	0.00E-01	1.87E 02
I-132	2.42E 01	6.47E 01	2.26E 01	2.26E 03	1.03E 02	0.00E-01	1.22E 01
I-133	1.69E 02	2.94E 02	8.97E 01	4.32E 04	5.13E 02	0.00E-01	2.64E 02
I-134	1.26E 01	3.43E 01	1.23E 01	5.94E 02	5.46E 01	0.00E-01	2.99E-02
I-135	5.28E 01	1.38E 02	5.10E 01	9.11E 03	2.22E 02	0.00E-01	1.56E 02
CS-134	3.03E 05	7.21E 05	5.89E 05	0.00E-01	2.33E 05	7.75E 04	1.26E 04
CS-136	3.17E 04	1.25E 05	9.01E 04	0.00E-01	6.97E 04	9.55E 03	1.42E 04
CS-137	3.88E 05	5.31E 05	3.48E 05	0.00E-01	1.80E 05	5.99E 04	1.03E 04
CS-138	2.69E 02	5.31E 02	2.63E 02	0.00E-01	3.90E 02	3.85E 01	2.27E-03
BA-139	9.00E 00	6.41E-03	2.64E-01	0.00E-01	5.99E-03	3.64E-03	1.60E 01

* Bioaccumulation factor assumed to be zero since no data was available.

TABLE A.4-1 (cont'd)

SITE RELATED DOSE COMMITMENT FACTOR AIT
MREM/HR PER UCI/ML
ADULT

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	1.88E 03	2.37E 00	1.23E 02	0.00E-01	8.05E-01	1.35E 00	3.88E 03
BA-141	4.37E 00	3.30E-03	1.48E-01	0.00E-01	3.07E-03	1.87E-03	2.06E-09
BA-142	1.98E 00	2.03E-03	1.24E-01	0.00E-01	1.72E-03	1.15E-03	2.78E-18
LA-140	3.58E-01	1.80E-01	4.76E-02	0.00E-01	0.00E-01	0.00E-01	1.32E 04
LA-142	1.83E-02	8.33E-03	2.07E-03	0.00E-01	0.00E-01	0.00E-01	6.08E 01
CE-141	8.01E-01	5.42E-01	6.15E-02	0.00E-01	2.52E-01	0.00E-01	2.07E 03
CE-143	1.41E-01	1.04E 02	1.16E-02	0.00E-01	4.60E-02	0.00E-01	3.90E 03
CE-144	4.18E 01	1.75E 01	2.24E 00	0.00E-01	1.04E 01	0.00E-01	1.41E 04
PR-143	1.32E 00	5.28E-01	6.52E-02	0.00E-01	3.05E-01	0.00E-01	5.77E 03
PR-144	4.31E-03	1.79E-03	2.19E-04	0.00E-01	1.01E-03	0.00E-01	6.19E-10
ND-147	9.00E-01	1.04E 00	6.22E-02	0.00E-01	6.08E-01	0.00E-01	4.99E 03
W-187	3.04E 02	2.55E 02	8.90E 01	0.00E-01	0.00E-01	0.00E-01	8.34E 04
NP-239	1.28E-01	1.25E-02	6.91E-03	0.00E-01	3.91E-02	0.00E-01	2.57E 03

TABLE A.4-2

SITE RELATED DOSE COMMITMENT FACTOR AIT
MREM/HR PER UCI/ML
TEEN

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

TABLE A.4-2 (cont'd)

SITE RELATED DOSE COMMITMENT FACTOR AIT
MREM/HR PER UCI/ML
TEEN

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	3.97E-01	0.00E-01	1.09E-02	0.00E-01	0.00E-01	0.00E-01	1.21E 04
ZR-95	2.64E 00	8.34E-01	5.74E-01	0.00E-01	1.23E 00	0.00E-01	1.92E 03
ZR-97	1.52E-01	3.01E-02	1.39E-02	0.00E-01	4.56E-02	0.00E-01	8.15E 03
NB-95	4.50E 02	2.50E 02	1.37E 02	0.00E-01	2.42E 02	0.00E-01	1.07E 06
MO-99	0.00E-01	4.61E 02	8.78E 01	0.00E-01	1.05E 03	0.00E-01	8.25E 02
TC-99M	2.84E-02	7.92E-02	1.03E 00	0.00E-01	1.18E 00	4.39E-02	5.20E 01
TC-101	3.08E-02	4.38E-02	4.30E-01	0.00E-01	7.92E-01	2.67E-02	7.48E-09
RU-103	1.95E 01	0.00E-01	8.33E 00	0.00E-01	6.87E 01	0.00E-01	1.63E 03
RU-105	1.67E 00	0.00E-01	6.46E-01	0.00E-01	2.10E 01	0.00E-01	1.34E 03
RU-106	2.99E 02	0.00E-01	3.77E 01	0.00E-01	5.77E 02	0.00E-01	1.44E 04
* AG-110M	1.19E 01	1.13E 01	6.86E 00	0.00E-01	2.15E 01	0.00E-01	3.17E 03
TE-125M	3.02E 03	1.09E 03	4.03E 02	8.43E 02	0.00E-01	0.00E-01	8.90E 03
TE-127M	7.62E 03	2.70E 03	9.06E 02	1.81E 03	3.09E 04	0.00E-01	1.90E 04
TE-127	1.24E 02	4.41E 01	2.68E 01	8.59E 01	5.04E 02	0.00E-01	9.61E 03
TE-129M	1.28E 04	4.77E 03	2.03E 03	4.14E 03	5.37E 04	0.00E-01	4.82E 04
TE-129	3.53E 01	1.32E 01	8.59E 00	2.52E 01	1.48E 02	0.00E-01	1.93E 02
TE-131M	1.92E 03	9.22E 02	7.69E 02	1.39E 03	9.61E 03	0.00E-01	7.40E 04
TE-131	2.20E 01	9.06E 00	6.87E 00	1.69E 01	9.61E 01	0.00E-01	1.80E 00
TE-132	2.75E 03	1.74E 03	1.64E 03	1.84E 03	1.67E 04	0.00E-01	5.51E 04
I-130	8.31E 01	2.55E 02	1.02E 02	2.08E 04	3.92E 02	0.00E-01	1.96E 02
I-131	5.00E 02	7.00E 02	3.76E 02	2.04E 05	1.21E 03	0.00E-01	1.39E 02
I-132	2.39E 01	6.24E 01	2.24E 01	2.10E 03	9.83E 01	0.00E-01	2.72E 01
I-133	1.72E 02	2.92E 02	8.89E 01	4.07E 04	5.11E 02	0.00E-01	2.21E 02
I-134	1.25E 01	3.31E 01	1.19E 01	5.51E 02	5.22E 01	0.00E-01	4.36E-01
I-135	5.22E 01	1.34E 02	4.98E 01	8.64E 03	2.12E 02	0.00E-01	1.49E 02
CS-134	3.10E 05	7.30E 05	3.39E 05	0.00E-01	2.32E 05	8.86E 04	9.08E 03
CS-136	3.18E 04	1.25E 05	8.41E 04	0.00E-01	6.82E 04	1.07E 04	1.01E 04
CS-137	4.15E 05	5.52E 05	1.92E 05	0.00E-01	1.88E 05	7.30E 04	7.86E 03
CS-138	2.88E 02	5.52E 02	2.76E 02	0.00E-01	4.08E 02	4.74E 01	2.51E-01
BA-139	9.10E 00	6.40E-03	2.65E-01	0.00E-01	6.03E-03	4.41E-03	8.11E 01

* Bioaccumulation factor assumed to be zero since no data was available.

TABLE A.4-2 (cont'd)

SITE RELATED DOSE COMMITMENT FACTOR AIT
MREM/HR PER UCI/ML
TEEN

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	1.86E 03	2.28E 00	1.20E 02	0.00E-01	7.72E-01	1.53E 00	2.87E 03
BA-141	4.39E 00	3.28E-03	1.47E-01	0.00E-01	3.04E-03	2.24E-03	9.36E-06
BA-142	1.96E 00	1.96E-03	1.20E-01	0.00E-01	1.66E-03	1.30E-03	6.01E-12
LA-140	3.61E-01	1.77E-01	4.72E-02	0.00E-01	0.00E-01	0.00E-01	1.02E 04
LA-142	1.86E-02	8.25E-03	2.05E-03	0.00E-01	0.00E-01	0.00E-01	2.51E 02
CE-141	7.98E-01	5.32E-01	6.12E-02	0.00E-01	2.51E-01	0.00E-01	1.52E 03
CE-143	1.41E-01	1.03E 02	1.15E-02	0.00E-01	4.60E-02	0.00E-01	3.08E 03
CE-144	4.17E 01	1.73E 01	2.24E 00	0.00E-01	1.03E 01	0.00E-01	1.05E 04
PR-143	1.36E 00	5.43E-01	6.76E-02	0.00E-01	3.15E-01	0.00E-01	4.47E 03
PR-144	4.46E-03	1.83E-03	2.26E-04	0.00E-01	1.05E-03	0.00E-01	4.92E-06
ND-147	9.73E-01	1.06E 00	6.34E-02	0.00E-01	6.21E-01	0.00E-01	3.82E 03
W-187	3.28E 02	2.67E 02	9.37E 01	0.00E-01	0.00E-01	0.00E-01	7.24E 04
NP-239	1.34E-01	1.27E-02	7.04E-03	0.00E-01	3.98E-02	0.00E-01	2.04E 03

TABLE A.4-3

SITE RELATED DOSE COMMITMENT FACTOR AIT
MREM/HR PER UCI/ML
CHILD

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

TABLE A.4-3 (cont'd)

SITE RELATED DOSE COMMITMENT FACTOR AIT
MREM/HR PER UCI/ML
CHILD

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	8.87E-01	0.00E-01	2.44E-02	0.00E-01	0.00E-01	0.00E-01	1.32E 04
ZR-95	7.05E 00	1.55E 00	1.38E 00	0.00E-01	2.22E 00	0.00E-01	1.62E 03
ZR-97	4.25E-01	6.13E-02	3.62E-02	0.00E-01	8.81E-02	0.00E-01	9.29E 03
NB-95	5.32E 02	2.07E 02	1.48E 02	0.00E-01	1.95E 02	0.00E-01	3.83E 05
MO-99	0.00E-01	8.78E 02	2.17E 02	0.00E-01	1.87E 03	0.00E-01	7.26E 02
TC-99M	6.46E-02	1.27E-01	2.10E 00	0.00E-01	1.84E 00	6.43E-02	7.20E 01
TC-101	7.48E-02	7.83E-02	9.93E-01	0.00E-01	1.34E 00	4.14E-02	2.49E-01
RU-103	4.83E 01	0.00E-01	1.85E 01	0.00E-01	1.21E 02	0.00E-01	1.25E 03
RU-105	4.26E 00	0.00E-01	1.54E 00	0.00E-01	3.74E 01	0.00E-01	2.78E 03
RU-106	7.72E 02	0.00E-01	9.64E 01	0.00E-01	1.04E 03	0.00E-01	1.20E 04
* AG-110M	3.13E 01	2.12E 01	1.69E 01	0.00E-01	3.94E 01	0.00E-01	2.52E 03
TE-125M	4.25E 03	1.15E 03	5.67E 02	1.19E 03	0.00E-01	0.00E-01	4.10E 03
TE-127M	1.08E 04	2.90E 03	1.28E 03	2.58E 03	3.07E 04	0.00E-01	8.72E 03
TE-127	1.76E 02	4.73E 01	3.77E 01	1.22E 02	5.00E 02	0.00E-01	6.86E 03
TE-129M	1.82E 04	5.07E 03	1.70E 03	5.85E 03	5.33E 04	0.00E-01	2.21E 04
TE-129	5.00E 01	1.39E 01	1.19E 01	3.56E 01	1.46E 02	0.00E-01	3.11E 03
TE-131M	2.68E 03	9.28E 02	9.88E 02	1.91E 03	8.98E 03	0.00E-01	3.77E 04
TE-131	3.09E 01	9.43E 00	9.21E 00	2.37E 01	9.36E 01	0.00E-01	1.63E 02
TE-132	3.77E 03	1.67E 03	2.01E 03	2.43E 03	1.55E 04	0.00E-01	1.68E 04
I-130	2.04E 02	4.13E 02	2.13E 02	4.55E 04	6.17E 02	0.00E-01	1.93E 02
I-131	1.20E 03	1.21E 03	6.88E 02	4.00E 05	1.99E 03	0.00E-01	1.08E 02
I-132	5.60E 01	1.03E 02	4.73E 01	4.77E 03	1.57E 02	0.00E-01	1.21E 02
I-133	4.14E 02	5.12E 02	1.94E 02	9.51E 04	8.53E 02	0.00E-01	2.06E 02
I-134	2.93E 01	5.44E 01	2.50E 01	1.25E 03	8.32E 01	0.00E-01	3.61E 01
I-135	1.22E 02	2.20E 02	1.04E 02	1.95E 04	3.38E 02	0.00E-01	1.68E 02
CS-134	3.82E 05	6.26E 05	1.32E 05	0.00E-01	1.94E 05	6.97E 04	3.38E 03
CS-136	3.83E 04	1.05E 05	6.82E 04	0.00E-01	5.61E 04	8.37E 03	3.70E 03
CS-137	5.33E 05	5.11E 05	7.54E 04	0.00E-01	1.66E 05	5.99E 04	3.20E 03
CS-138	3.72E 02	5.17E 02	3.28E 02	0.00E-01	3.64E 02	3.92E 01	2.38E 02
BA-139	2.54E 01	1.35E-02	7.35E-01	0.00E-01	1.18E-02	7.97E-03	1.47E 03

* Bioaccumulation factor assumed to be zero since no data was available.

TABLE A.4-3 (cont'd)

SITE RELATED DOSE COMMITMENT FACTOR AIT
MREM/HR PER UCI/ML
CHILD

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	5.09E 03	4.46E 00	2.97E 02	0.00E-01	1.45E 00	2.66E 00	2.58E 03
BA-141	1.23E 01	6.86E-03	3.99E-01	0.00E-01	5.94E-03	4.03E-02	6.99E 00
BA-142	5.36E 00	3.85E-03	2.99E-01	0.00E-01	3.12E-03	2.27E-03	6.99E-02
LA-140	7.86E-01	2.75E-01	9.26E-02	0.00E-01	0.00E-01	0.00E-01	7.66E 03
LA-142	4.08E-02	1.30E-02	4.07E-03	0.00E-01	0.00E-01	0.00E-01	2.58E 03
CE-141	2.34E 00	1.17E 00	1.73E-01	0.00E-01	5.11E-01	0.00E-01	1.46E 03
CE-143	4.12E-01	2.23E 02	3.24E-02	0.00E-01	9.37E-02	0.00E-01	3.27E 03
CE-144	1.23E 02	3.84E 01	5.54E 00	0.00E-01	2.13E 01	0.00E-01	1.00E 04
PR-143	3.06E 00	9.18E-01	1.52E-01	0.00E-01	4.97E-01	0.00E-01	3.30E 03
PR-144	1.00E-02	3.10E-03	5.05E-04	0.00E-01	1.64E-03	0.00E-01	6.68E 00
ND-147	2.17E 00	1.76E 00	1.36E-01	0.00E-01	9.65E-01	0.00E-01	2.79E 03
W-187	4.30E 02	2.55E 02	1.14E 02	0.00E-01	0.00E-01	0.00E-01	3.58E 04
NP-239	3.47E-01	2.49E-02	1.75E-02	0.00E-01	7.19E-02	0.00E-01	1.84E 03

TABLE A.4-4

SITE RELATED DOSE COMMITMENT FACTOR AIT
MREM/HR PER UCI/ML
INFANT

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

TABLE A.4-4 (cont'd)

SITE RELATED DOSE COMMITMENT FACTOR AIT
MREM/HR PER UCI/ML
INFANT

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-93	9.14E-01	0.00E-01	2.49E-02	0.00E-01	0.00E-01	0.00E-01	7.22E 03
ZR-95	7.75E 00	1.89E 00	1.34E 00	0.00E-01	2.04E 00	0.00E-01	9.41E 02
ZR-97	5.57E-01	9.56E-02	4.36E-02	0.00E-01	9.63E-02	0.00E-01	6.09E 03
NB-95	1.58E 00	6.51E-01	3.76E-01	0.00E-01	4.66E-01	0.00E-01	5.49E 02
MO-99	0.00E-01	1.28E 03	2.49E 02	0.00E-01	1.91E 03	0.00E-01	4.21E 02
TC-99M	7.22E-02	1.49E-01	1.92E 00	0.00E-01	1.60E 00	7.79E-02	4.33E 01
TC-101	8.54E-02	1.08E-01	1.06E 00	0.00E-01	1.28E 00	5.87E-02	1.83E 01
RU-103	5.57E 01	0.00E-01	1.86E 01	0.00E-01	1.16E 02	0.00E-01	6.77E 02
RU-105	5.12E 00	0.00E-01	1.72E 00	0.00E-01	3.76E 01	0.00E-01	2.04E 03
RU-106	9.07E 02	0.00E-01	1.13E 02	0.00E-01	1.07E 03	0.00E-01	6.88E 03
* AG-110M	3.75E 01	2.73E 01	1.81E 01	0.00E-01	3.91E 01	0.00E-01	1.42E 03
TE-125M	8.77E 02	2.93E 02	1.19E 02	2.95E 02	0.00E-01	0.00E-01	4.18E 02
TE-127M	2.20E 03	7.30E 02	2.66E 02	6.36E 02	5.42E 03	0.00E-01	8.88E 02
TE-127	3.76E 01	1.26E 01	8.09E 00	3.06E 01	9.18E 01	0.00E-01	7.90E 02
TE-129M	3.76E 03	1.29E 03	5.79E 02	1.44E 03	9.41E 03	0.00E-01	2.25E 03
TE-129	1.07E 01	3.68E 00	2.49E 00	8.95E 00	2.66E 01	0.00E-01	8.54E 02
TE-131M	5.72E 02	2.30E 02	1.90E 02	4.66E 02	1.58E 03	0.00E-01	3.87E 03
TE-131	6.62E 00	2.45E 00	1.86E 00	5.91E 00	1.69E 01	0.00E-01	2.67E 02
TE-132	7.82E 02	3.87E 02	3.62E 02	5.72E 02	2.42E 03	0.00E-01	1.43E 03
I-130	2.26E 02	4.97E 02	1.99E 02	5.57E 04	5.45E 02	0.00E-01	1.06E 02
I-131	1.35E 03	1.59E 03	7.00E 02	5.23E 05	1.86E 03	0.00E-01	5.68E 01
I-132	6.24E 01	1.27E 02	4.51E 01	5.94E 03	1.41E 02	0.00E-01	1.03E 02
I-133	4.70E 02	6.85E 02	2.01E 02	1.25E 05	8.05E 02	0.00E-01	1.16E 02
I-134	3.27E 01	6.70E 01	2.38E 01	1.56E 03	7.49E 01	0.00E-01	6.92E 01
I-135	1.37E 02	2.72E 02	9.93E 01	2.44E 04	3.04E 02	0.00E-01	9.85E 01
CS-134	1.42E 04	2.64E 04	2.67E 03	0.00E-01	6.81E 03	2.42E 03	7.19E 01
CS-136	1.73E 03	5.08E 03	1.90E 03	0.00E-01	2.02E 03	4.14E 02	7.71E 01
CS-137	1.96E 04	2.30E 04	1.63E 03	0.00E-01	6.17E 03	2.50E 03	7.19E 01
CS-138	1.81E 01	2.94E 01	1.43E 01	0.00E-01	1.47E 01	2.29E 00	4.70E 01
BA-139	3.31E 01	2.20E-02	9.59E-01	0.00E-01	1.32E-02	1.33E-02	2.10E 03

* Bioaccumulation factor assumed to be zero since no data was available.

TABLE A.4-4 (cont'd)

SITE RELATED DOSE COMMITMENT FACTOR AIT
MREM/HR PER UCI/ML
INFANT

NUCLIDE	BONE	LIVER	T BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA-140	6.43E 03	6.43E 00	3.31E 02	0.00E-01	1.53E 00	3.95E 00	1.58E 03
BA-141	1.60E 01	1.09E-02	5.04E-01	0.00E-01	6.58E-03	6.66E-03	1.95E 02
BA-142	6.92E 00	5.76E-03	3.41E-01	0.00E-01	3.31E-03	3.48E-03	2.86E 01
LA-140	7.94E-01	3.13E-01	8.05E-02	0.00E-01	0.00E-01	0.00E-01	3.68E 03
LA-142	4.14E-02	1.52E-02	3.64E-03	0.00E-01	0.00E-01	0.00E-01	2.58E 03
CE-141	2.96E 00	1.81E 00	2.13E-01	0.00E-01	5.57E-01	0.00E-01	9.33E 02
CE-143	5.57E-01	3.69E 02	4.21E-02	0.00E-01	1.08E-01	0.00E-01	2.16E 03
CE-144	1.12E 02	4.59E 01	6.28E 00	0.00E-01	1.85E 01	0.00E-01	6.43E 03
PR-143	3.06E 00	1.14E 00	1.52E-01	0.00E-01	4.25E-01	0.00E-01	1.61E 03
PR-144	1.03E-02	3.99E-03	5.19E-04	0.00E-01	1.44E-03	0.00E-01	1.85E 02
ND-147	2.08E 00	2.14E 00	1.31E-01	0.00E-01	8.24E-01	0.00E-01	1.35E 03
W-187	3.40E 01	2.36E 01	8.16E 00	0.00E-01	0.00E-01	0.00E-01	1.39E 03
NP-239	4.18E-01	3.74E-02	2.11E-02	0.00E-01	7.45E-02	0.00E-01	1.08E 03

TABLE A.5-1

INHALATION DOSE PARAMETER FOR THE CHILD, PI
MREM/YR PER UCI/M3

H-3	1.12E 03	RU-103	6.62E 05
C-14	3.59E 04	RU-105	9.95E 04
NA-24	1.61E 04	RU-106	1.43E 07
P-32	2.60E 06	AG-110M	5.48E 06
CR-51	1.70E 04	TE-125M	4.77E 05
MN-54	1.58E 06	TE-127M	1.48E 06
MN-56	1.23E 05	TE-127	5.62E 04
FE-55	1.11E 05	TE-129M	1.76E 06
FE-59	1.27E 06	TE-129	2.55E 04
CO-58	1.11E 06	TE-131M	3.08E 05
CO-60	7.07E 06	TE-131	2.05E 03
NI-63	8.21E 05	TE-132	3.77E 05
NI-65	8.40E 04	I-130	1.85E 06
CU-64	3.67E 04	I-131	1.62E 07
ZN-65	9.95E 05	I-132	1.94E 05
ZN-69	1.02E 04	I-133	3.85E 06
BR-83	4.74E 02	I-134	5.07E 04
BR-84	5.48E 02	I-135	7.92E 05
BR-85	2.53E 01	CS-134	1.01E 06
RB-86	1.98E 05	CS-136	1.71E 05
RB-88	5.62E 02	CS-137	9.07E 05
RB-89	3.45E 02	CS-138	8.40E 02
SR-89	2.16E 06	BA-139	5.77E 04
SR-90	1.01E 08	BA-140	1.74E 06
SR-91	1.74E 05	BA-141	2.92E 03
SR-92	2.42E 05	BA-142	1.64E 03
Y-90	2.68E 05	LA-140	2.26E 05
Y-91M	2.81E 03	LA-142	7.59E 04
Y-91	2.63E 06	CE-141	5.44E 05
Y-92	2.39E 05	CE-143	1.27E 05
Y-93	3.89E 05	CE-144	1.20E 07
ZR-95	2.23E 05	PR-143	4.33E 05
ZR-97	3.51E 05	PR-144	1.57E 03
NB-95	6.14E 05	ND-147	3.28E 05
MO-99	1.35E 05	W-187	9.10E 04
TC-99M	4.81E 03	NP-239	6.40E 04
TC-101	5.85E 02		

TABLE A.5-2

PATHWAY DOSE FACTORS RI
ADULT

NUCLIDE	INHALATION PATHWAY	GROUND PLANE	GRASS COW MILK	GRASS COW MEAT	VEGETATION PATHWAY
H-3	1.26E 03	0.00E-01	7.63E 02	3.25E 02	2.26E 03
C-14	1.82E 04	0.00E-01	2.63E 08	2.41E 08	2.28E 08
NA-24	1.02E 04	1.19E 07	2.44E 06	1.36E-03	2.69E 05
P-32	1.32E 06	0.00E-01	1.71E 10	4.65E 09	1.40E 09
CR-51	1.44E 04	4.66E 06	7.19E 06	1.77E 06	1.17E 07
MN-54	1.40E 06	1.39E 09	2.58E 07	2.81E 07	9.58E 08
MN-56	2.02E 04	9.03E 05	1.33E-01	0.00E-01	5.08E 02
FE-55	7.21E 04	0.00E-01	2.51E 07	2.93E 08	2.09E 08
FE-59	1.02E 06	2.73E 08	2.33E 08	2.08E 09	9.88E 08
CO-58	9.28E 05	2.79E 08	9.56E 07	3.70E 08	6.23E 08
CO-60	5.97E 06	2.15E 10	3.08E 08	1.41E 09	3.14E 09
NI-63	4.32E 05	0.00E-01	6.73E 09	1.89E 10	1.04E 10
NI-65	1.23E 04	3.02E 05	1.53E 00	0.00E-01	2.28E 02
CU-64	4.90E 04	6.07E 05	2.03E 06	2.33E-05	7.85E 05
ZN-65	8.64E 05	7.46E 08	4.37E 09	1.13E 09	1.01E 09
ZN-69	9.20E 02	0.00E-01	9.99E-12	0.00E-01	1.68E-05
BR-83	2.41E 02	4.87E 03	0.00E-01	0.00E-01	4.48E 00
BR-84	3.13E 02	2.03E 05	0.00E-01	0.00E-01	2.49E-11
BR-85	1.28E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
RB-86	1.35E 05	8.99E 06	2.59E 09	4.87E 08	2.19E 08
RB-88	3.87E 02	3.31E 04	0.00E-01	0.00E-01	3.47E-22
RB-89	2.56E 02	1.21E 05	0.00E-01	0.00E-01	1.41E-26
SR-89	1.40E 06	2.16E 04	1.45E 09	3.02E 08	9.97E 09
SR-90	9.92E 07	0.00E-01	4.68E 10	1.24E 10	6.05E 11
SR-91	1.91E 05	2.14E 06	1.37E 05	6.76E-10	1.44E 06
SR-92	4.30E 04	7.77E 05	9.70E 00	0.00E-01	8.46E 03
Y-90	5.06E 05	4.49E 03	7.50E 05	1.13E 06	1.41E 08
Y-91M	1.92E 03	1.00E 05	1.77E-19	0.00E-01	1.54E-08
Y-91	1.70E 06	1.07E 06	4.73E 06	6.23E 08	2.81E 09
Y-92	7.35E 04	1.80E 05	9.79E-01	0.00E-01	1.60E 04

TABLE A.5-2 (cont'd)

PATHWAY DOSE FACTORS RI
ADULT

NUCLIDE	INHALATION PATHWAY	GROUND PLANE	GRASS COW MILK	GRASS COW MEAT	VEGETATION PATHWAY
Y-93	4.22E 05	1.85E 05	7.39E 03	2.09E-07	5.52E 06
ZR-95	1.77E 06	2.45E 08	9.59E 05	1.90E 09	1.20E 09
ZR-97	5.23E 05	2.96E 06	2.71E 04	1.30E 00	2.11E 07
NB-95	5.05E 05	1.37E 08	2.79E 08	7.76E 09	4.81E 08
MO-99	2.48E 05	3.99E 06	5.74E 07	2.32E 05	1.43E 07
TC-99M	4.16E 03	1.84E 05	5.56E 03	7.53E-18	5.19E 03
TC-101	3.99E 02	2.04E 04	0.00E-01	0.00E-01	2.16E-29
RU-103	5.05E 05	1.08E 08	1.19E 05	1.23E 10	5.56E 08
RU-105	4.82E 04	6.36E 05	5.25E-01	3.59E-25	3.30E 04
RU-106	9.36E 06	4.21E 08	1.32E 06	1.81E 11	1.25E 10
AG-110M	4.63E 06	3.44E 09	2.20E 10	2.52E 09	3.98E 09
TE-125M	3.14E 05	1.55E 06	6.63E 07	1.46E 09	3.93E 08
TE-127M	9.60E 05	9.17E 04	1.86E 08	4.53E 09	1.42E 09
TE-127	5.74E 04	2.98E 03	5.16E 04	1.69E-08	4.47E 05
TE-129M	1.16E 06	1.98E 07	3.03E 08	5.71E 09	1.27E 09
TE-129	1.94E 03	2.62E 04	1.19E-09	0.00E-01	3.22E-03
TE-131M	5.56E 05	8.03E 06	1.75E 07	2.20E 04	4.43E 07
TE-131	1.39E 03	2.92E 04	1.61E-32	0.00E-01	6.63E-15
TE-132	5.10E 05	4.23E 06	7.35E 07	4.35E 07	1.32E 08
I-130	1.14E 06	5.51E 06	1.05E 08	5.30E-04	9.81E 07
I-131	1.19E 07	1.72E 07	1.39E 11	5.04E 09	3.79E 10
I-132	1.14E 05	1.25E 06	1.54E 01	0.00E-01	5.40E 03
I-133	2.15E 06	2.45E 06	9.90E 08	9.37E 01	5.33E 08
I-134	2.98E 04	4.47E 05	9.57E-11	0.00E-01	4.56E-03
I-135	4.48E 05	2.53E 06	2.22E 06	7.73E-15	6.74E 06
CS-134	8.48E 05	6.86E 09	1.35E 10	1.56E 09	1.11E 10
CS-136	1.46E 05	1.49E 08	1.03E 09	4.66E 07	1.66E 08
CS-137	6.21E 05	1.03E 10	1.01E 10	1.19E 09	8.70E 09
CS-138	6.21E 02	3.59E 05	1.81E-23	0.00E-01	7.78E-11
BA-139	3.76E 03	1.06E 05	8.09E-08	0.00E-01	5.15E-02

TABLE A.5-2 (cont'd)

PATHWAY DOSE FACTORS RI
ADULT

NUCLIDE	INHALATION PATHWAY	GROUND PLANE	GRASS COW MILK	GRASS COW MEAT	VEGETATION PATHWAY
BA-140	1.27E 06	2.05E 07	5.54E 07	5.92E 07	2.65E 08
BA-141	1.94E 03	4.18E 04	0.00E-01	0.00E-01	1.28E-21
BA-142	1.19E 03	4.49E 04	0.00E-01	0.00E-01	0.00E-01
LA-140	4.58E 05	1.92E 07	1.67E 05	1.39E 03	7.33E 07
LA-142	6.33E 03	7.37E 05	3.12E-08	0.00E-01	4.70E-01
CE-141	3.62E 05	1.37E 07	1.25E 07	3.63E 07	5.10E 08
CE-143	2.26E 05	2.31E 06	1.15E 06	5.56E 02	2.76E 07
CE-144	7.78E 06	6.96E 07	1.21E 08	4.93E 08	1.11E 10
PR-143	2.81E 05	0.00E-01	6.92E 05	9.19E 07	2.74E 08
PR-144	1.02E 03	1.83E 03	0.00E-01	0.00E-01	3.13E-26
ND-147	2.21E 05	8.46E 06	5.25E 05	3.98E 07	1.87E 08
W-187	1.55E 05	2.36E 06	1.80E 06	5.93E 00	1.05E 07
NP-239	1.19E 05	1.71E 06	7.41E 04	5.22E 03	2.88E 07

TABLE A.5-3

PATHWAY DOSE FACTORS RI
TEEN

NUCLIDE	INHALATION PATHWAY	GROUND PLANE	GRASS COW MILK	GRASS COW MEAT	VEGETATION PATHWAY
H-3	1.27E 03	0.00E-01	9.94E 02	1.94E 02	2.59E 03
C-14	2.60E 04	0.00E-01	4.86E 08	2.04E 08	3.69E 08
NA-24	1.38E 04	1.19E 07	4.26E 06	1.09E-03	2.39E 05
P-32	1.89E 06	0.00E-01	3.15E 10	3.93E 09	1.61E 09
CR-51	2.10E 04	4.66E 06	8.39E 06	9.47E 05	1.04E 07
MN-54	1.98E 06	1.39E 09	2.87E 07	1.44E 07	9.32E 08
MN-56	5.74E 04	9.03E 05	4.85E-01	0.00E-01	9.45E 02
FE-55	1.24E 05	0.00E-01	4.45E 07	2.38E 08	3.25E 08
FE-59	1.53E 06	2.73E 08	2.86E 08	1.17E 09	9.90E 08
CO-58	1.34E 06	3.79E 08	1.09E 08	1.94E 08	6.01E 08
CO-60	8.72E 06	2.15E 10	3.62E 08	7.60E 08	3.24E 09
NI-63	5.80E 05	0.00E-01	1.18E 10	1.52E 10	1.61E 10
NI-65	3.67E 04	3.02E 05	5.88E 00	0.00E-01	4.47E 02
CU-64	6.14E 04	6.07E 05	3.30E 06	1.73E-05	6.47E 05
ZN-65	1.24E 06	7.46E 08	7.31E 09	8.69E 08	1.47E 09
ZN-69	1.58E 03	0.00E-01	3.38E-11	0.00E-01	2.88E-05
BR-83	3.44E 02	4.87E 02	0.00E-01	0.00E-01	2.92E 00
BR-84	4.33E 02	2.03E 05	0.00E-01	0.00E-01	2.27E-11
BR-85	1.83E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
RB-86	1.90E 05	8.99E 06	4.73E 09	4.07E 08	2.74E 08
RB-88	5.46E 02	3.31E 04	0.00E-01	0.00E-01	3.21E-22
RB-89	3.52E 02	1.21E 05	0.00E-01	0.00E-01	1.26E-26
SR-89	2.42E 06	2.16E 04	2.67E 09	2.55E 08	1.51E 10
SR-90	1.08E 08	0.00E-01	6.61E 10	8.05E 09	7.51E 11
SR-91	2.59E 05	2.14E 06	2.39E 05	5.41E-10	1.28E 06
SR-92	1.19E 05	7.77E 05	2.28E 01	0.00E-01	1.01E 04
Y-90	5.59E 05	4.49E 03	1.07E 06	7.41E 05	1.02E 08
Y-91M	3.20E 03	1.00E 05	5.22E-18	0.00E-01	2.30E-07
Y-91	2.94E 06	1.07E 06	6.48E 06	3.91E 08	3.21E 09
Y-92	1.65E 05	1.80E 05	2.83E 00	0.00E-01	2.36E 04

TABLE A.5-3 (cont'd)

PATHWAY DOSE FACTORS RI
TEFN

NUCLIDE	INHALATION PATHWAY	GROUND PLANE	GRASS COW MILK	GRASS COW MEAT	VEGETATION PATHWAY
Y-93	5.79E 05	1.85E 05	1.31E 04	1.70E-07	4.99E 06
ZR-95	2.69E 06	2.45E 08	1.20E 06	1.09E 09	1.25E 09
ZR-97	6.30E 05	2.96E 06	4.23E 04	9.27E-01	1.67E 07
NB-95	7.51E 05	1.37E 08	3.34E 08	4.26E 09	4.57E 08
MO-99	2.69E 05	3.99E 06	1.02E 08	1.89E 05	1.29E 07
TC-99M	6.13E 03	1.84E 05	1.06E 04	6.55E-18	5.02E 03
TC-101	6.67E 02	2.04E 04	0.00E-01	0.00E-01	2.00E-29
RU-103	7.83E 05	1.08E 08	1.51E 05	7.15E 09	5.69E 08
RU-105	9.04E 04	6.36E 05	1.27E 00	3.96E-25	4.04E 04
RU-106	1.61E 07	4.21E 08	1.80E 06	1.13E 11	1.48E 10
AG-110M	6.75E 06	3.44E 09	2.56E 10	1.35E 09	4.03E 09
TE-125M	5.36E 05	1.55E 06	8.86E 07	8.94E 08	4.38E 08
TE-127M	1.66E 06	9.17E 04	3.42E 08	3.82E 09	2.24E 09
TE-127	8.08E 04	2.98E 03	9.35E 04	1.40E-08	4.12E 05
TE-129M	1.98E 06	1.98E 07	4.61E 08	3.97E 09	1.51E 09
TE-129	3.30E 03	2.62E 04	2.86E-09	0.00E-01	3.92E-03
TE-131M	6.21E 05	8.03E 06	2.53E 07	1.45E 04	3.25E 07
TE-131	2.34E 03	2.92E 04	2.93E-32	0.00E-01	6.15E-15
TE-132	4.63E 05	4.23E 06	8.61E 07	2.33E 07	7.84E 07
I-130	1.49E 06	5.51E 06	1.74E 08	4.03E-04	8.28E 07
I-131	1.46E 07	1.72E 07	2.20E 11	3.65E 09	3.14E 10
I-132	1.51E 05	1.25E 06	2.58E 01	0.00E-01	4.59E 03
I-133	2.92E 06	2.45E 06	1.67E 09	7.26E 01	4.59E 08
I-134	3.95E 04	4.47E 05	1.60E-10	0.00E-01	3.87E-03
I-135	6.21E 05	2.53E 06	3.78E 06	6.03E-15	5.84E 06
CS-134	1.13E 06	6.86E 09	2.31E 10	1.23E 09	1.67E 10
CS-136	1.94E 05	1.49E 08	1.75E 09	3.62E 07	1.68E 08
CS-137	8.48E 05	1.03E 10	1.78E 10	9.63E 08	1.35E 10
CS-138	8.56E 02	3.59E 05	3.19E-23	0.00E-01	6.98E-11
BA-139	6.46E 03	1.06E 05	7.53E-07	0.00E-01	2.44E-01

TABLE A.5-3 (cont'd)

PATHWAY DOSE FACTORS RI
TEEN

NUCLIDE	INHALATION PATHWAY	GROUND PLANE	GRASS COW MILK	GRASS COW MEAT	VEGETATION PATHWAY
BA-140	2.03E 06	2.05E 07	7.48E 07	3.67E 07	2.13E 08
BA-141	3.29E 03	4.18E 04	0.00E-01	0.00E-01	1.19E-21
BA-142	1.91E 03	4.49E 04	0.00E-01	0.00E-01	0.00E-01
LA-140	4.87E 05	1.92E 07	2.29E 05	8.72E 02	5.11E 07
LA-142	1.20E 04	7.37E 05	2.29E-07	0.00E-01	1.76E 00
CE-141	6.14E 05	1.37E 07	1.70E 07	2.25E 07	5.41E 08
CE-143	2.55E 05	2.31E 06	1.67E 06	3.70E 02	2.04E 07
CE-144	1.34E 07	6.96E 07	1.66E 08	3.09E 08	1.33E 10
PR-143	4.83E 05	0.00E-01	9.55E 05	5.81E 07	2.31E 08
PR-144	1.75E 03	1.83E 03	0.00E-01	0.00E-01	2.93E-26
ND-147	3.72E 05	8.46E 06	7.15E 05	2.48E 07	1.44E 08
W-187	1.77E 05	2.36E 06	2.65E 06	4.00E 00	7.84E 06
NP-239	1.32E 05	1.71E 06	1.06E 05	3.43E 03	2.10E 07

TABLE A.5-4

PATHWAY DOSE FACTORS RI
CHILD

NUCLIDE	INHALATION PATHWAY	GROUND PLANE	GRASS COW MILK	GRASS COW MEAT	VEGETATION PATHWAY
H-3	1.12E 03	0.00E-01	1.57E 03	2.34E 02	4.01E 03
C-14	3.59E 04	0.00E-01	1.19E 09	3.83E 08	8.89E 08
NA-24	1.61E 04	1.19E 07	8.86E 06	1.73E-03	3.73E 05
P-32	2.60E 06	0.00E-01	7.77E 10	7.41E 09	3.37E 09
CR-51	1.70E 04	4.66E 06	5.40E 06	4.66E 05	6.21E 06
MN-54	1.58E 06	1.39E 09	2.10E 07	8.01E 06	6.65E 08
MN-56	1.23E 05	9.03E 05	1.86E 00	0.00E-01	2.72E 03
FE-55	1.11E 05	0.00E-01	1.12E 08	4.57E 08	8.00E 08
FE-59	1.27E 06	2.73E 08	2.02E 08	6.34E 08	6.69E 08
CO-58	1.11E 06	3.79E 08	7.07E 07	9.58E 07	3.76E 08
CO-60	7.07E 06	2.15E 10	2.39E 08	3.84E 08	2.10E 09
NI-63	8.21E 05	0.00E-01	2.96E 10	2.91E 10	3.95E 10
NI-65	8.40E 04	3.02E 05	2.39E 01	0.00E-01	1.37E 03
CU-64	3.67E 04	6.07E 05	3.51E 06	1.41E-05	5.16E 05
ZN-65	9.95E 05	7.46E 08	1.10E 10	1.00E 09	2.16E 09
ZN-69	1.02E 04	0.00E-01	2.15E-09	0.00E-01	1.38E-03
BR-83	4.74E 02	4.87E 03	0.00E-01	0.00E-01	5.38E 00
BR-84	5.48E 02	2.03E 05	0.00E-01	0.00E-01	3.85E-11
BR-85	2.53E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
RB-86	1.98E 05	8.99E 06	8.77E 09	5.77E 08	4.52E 08
RB-88	5.62E 02	3.31E 04	0.00E-01	0.00E-01	4.43E-22
RB-89	3.45E 02	1.21E 05	0.00E-01	0.00E-01	1.67E-26
SR-89	2.16E 06	2.16E 04	6.62E 09	4.82E 08	3.60E 10
SR-90	1.01E 08	0.00E-01	1.12E 11	1.04E 10	1.24E 12
SR-91	1.74E 05	2.14E 06	2.85E 05	4.94E-10	1.15E 06
SR-92	2.42E 05	7.77E 05	4.15E 01	0.00E-01	1.38E 04
Y-90	2.68E 05	4.49E 03	9.15E 05	4.84E 05	6.56E 07
Y-91M	2.81E 03	1.00E 05	5.29E-16	0.00E-01	1.75E-05
Y-91	2.63E 06	1.07E 06	5.20E 06	2.40E 08	2.48E 09
Y-92	2.39E 05	1.80E 05	7.33E 00	0.00E-01	4.58E 04

TABLE A.5-4 (cont'd)

PATHWAY DOSE FACTORS RI
CHILD

NUCLIDE	INHALATION PATHWAY	GROUND PLANE	GRASS COW MILK	GRASS COW MEAT	VEGETATION PATHWAY
Y-93	3.89E 05	1.85E 05	1.57E 04	1.56E-07	4.48E 06
ZR-95	2.23E 06	2.45E 08	8.79E 05	6.11E 08	8.85E 08
ZR-97	3.51E 05	2.96E 06	4.20E 04	7.05E-01	1.25E 07
NB-95	6.14E 05	1.37E 08	2.29E 08	2.23E 09	2.96E 08
MO-99	1.35E 05	3.99E 06	1.74E 08	2.45E 05	1.65E 07
TC-99M	4.81E 03	1.84E 05	1.48E 04	7.00E-18	5.26E 03
TC-101	5.85E 02	2.04E 04	0.00E-01	0.00E-01	2.55E-29
RU-103	6.62E 05	1.08E 08	1.11E 05	4.00E 09	3.96E 08
RU-105	9.95E 04	6.36E 05	2.50E 00	5.98E-25	5.99E 04
RU-106	1.43E 07	4.21E 08	1.44E 06	6.90E 10	1.16E 10
AG-110M	5.48E 06	3.44E 09	1.68E 10	6.74E 08	2.58E 09
TE-125M	4.77E 05	1.55E 06	7.38E 07	5.69E 08	3.51E 08
TE-127M	1.48E 06	9.17E 04	5.93E 08	5.06E 09	3.77E 09
TE-127	5.62E 04	2.98E 03	1.16E 05	1.33E-08	3.85E 05
TE-129M	1.76E 06	1.98E 07	7.97E 08	5.26E 09	2.47E 09
TE-129	2.55E 04	2.62E 04	8.03E-08	0.00E-01	8.25E-02
TE-131M	3.08E 05	8.03E 06	2.24E 07	9.84E 03	2.16E 07
TE-131	2.05E 03	2.92E 04	8.64E-32	0.00E-01	1.36E-14
TE-132	3.77E 05	4.23E 06	4.57E 07	9.46E 06	3.12E 07
I-130	1.85E 06	5.51E 06	3.85E 08	6.80E-04	1.37E 08
I-131	1.62E 07	1.72E 07	4.33E 11	5.51E 09	4.76E 10
I-132	1.94E 05	1.25E 06	5.89E 01	0.00E-01	7.87E 03
I-133	3.85E 06	2.45E 06	3.95E 09	1.31E 02	8.12E 08
I-134	5.07E 04	4.47E 05	3.65E-10	0.00E-01	6.65E-03
I-135	7.92E 05	2.53E 06	8.62E 06	1.05E-14	9.98E 06
CS-134	1.01E 06	6.86E 09	3.72E 10	1.51E 09	2.63E 10
CS-136	1.71E 05	1.49E 08	2.76E 09	4.36E 07	2.21E 08
CS-137	9.07E 05	1.03E 10	3.22E 10	1.33E 09	2.39E 10
CS-138	8.40E 02	3.59E 05	5.60E-2[illegible]	0.00E-01	9.20E-11
BA-139	5.77E 04	1.06E 05	1.20E-05	0.00E-01	2.91E 00

TABLE A.5-4 (cont'd)

PATHWAY DOSE FACTORS RI
CHILD

NUCLIDE	INHALATION PATHWAY	GROUND PLANE	GRASS COW MILK	GRASS COW MEAT	VEGETATION PATHWAY
BA-140	1.74E 06	2.05E 07	1.17E 08	4.39E 07	2.77E 08
BA-141	2.92E 03	4.18E 04	0.00E-01	0.00E-01	2.20E-21
BA-142	1.64E 03	4.49E 04	0.00E-01	0.00E-01	0.00E-01
LA-140	2.26E 05	1.92E 07	1.89E 05	5.51E 02	3.17E 07
LA-142	7.59E 04	7.37E 05	2.58E-06	0.00E-01	1.49E 01
CE-141	5.44E 05	1.37E 07	1.36E 07	1.38E 07	4.08E 08
CE-143	1.27E 05	2.31E 06	1.49E 06	2.52E 02	1.36E 07
CE-144	1.20E 07	6.96E 07	1.33E 08	1.89E 08	1.04E 10
PR-143	4.33E 05	0.00E-01	7.75E 05	3.60E 07	1.57E 08
PR-144	1.57E 03	1.83E 03	0.00E-01	0.00E-01	3.62E-23
ND-147	3.28E 05	8.46E 06	5.73E 05	1.52E 07	9.29E 07
W-187	9.10E 04	2.36E 06	2.42E 06	2.80E 00	5.38E 06
NP-239	6.40E 04	1.71E 06	9.16E 04	2.26E 03	1.36E 07

TABLE A.5-5

PATHWAY DOSE FACTORS RI
INFANT

NUCLIDE	INHALATION PATHWAY	GROUND PLANE	GRASS COW MILK	GRASS COW MEAT	VEGETATION PATHWAY
H-3	6.47E 02	0.00E-01	2.38E 03	0.00E-01	0.00E-01
C-14	2.65E 04	0.00E-01	2.34E 09	0.00E-01	0.00E-01
NA-24	1.06E 04	1.19E 07	1.54E 07	0.00E-01	0.00E-01
P-32	2.03E 06	0.00E-01	1.60E 11	0.00E-01	0.00E-01
CR-51	1.28E 04	4.66E 06	4.70E 06	0.00E-01	0.00E-01
MN-54	1.00E 06	1.39E 09	3.90E 07	0.00E-01	0.00E-01
MN-56	7.17E 04	9.03E 05	2.86E 00	0.00E-01	0.00E-01
FE-55	8.69E 04	0.00E-01	1.35E 08	0.00E-01	0.00E-01
FE-59	1.02E 06	2.73E 08	3.92E 08	0.00E-01	0.00E-01
CO-58	7.77E 05	3.79E 08	6.05E 07	0.00E-01	0.00E-01
CO-60	4.51E 06	2.15E 10	2.10E 08	0.00E-01	0.00E-01
NI-63	3.39E 05	0.00E-01	3.49E 10	0.00E-01	0.00E-01
NI-65	5.01E 04	3.02E 05	3.78E 01	0.00E-01	0.00E-01
CU-64	1.50E 04	6.07E 05	3.81E 06	0.00E-01	0.00E-01
ZN-65	6.47E 05	7.46E 08	1.90E 10	0.00E-01	0.00E-01
ZN-69	1.32E 04	0.00E-01	7.40E-09	0.00E-01	0.00E-01
BR-83	3.81E 02	4.87E 03	0.00E-01	0.00E-01	0.00E-01
BR-84	4.00E 02	2.03E 05	0.00E-01	0.00E-01	0.00E-01
BR-85	2.04E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
RB-86	1.90E 05	8.99E 06	2.23E 10	0.00E-01	0.00E-01
RB-88	5.57E 02	3.31E 04	0.00E-01	0.00E-01	0.00E-01
RB-89	3.21E 02	1.21E 05	0.00E-01	0.00E-01	0.00E-01
SR-89	2.03E 06	2.16E 04	1.26E 10	0.00E-01	0.00E-01
SR-90	4.09E 07	0.00E-01	1.22E 11	0.00E-01	0.00E-01
SR-91	7.34E 04	2.14E 06	3.19E 05	0.00E-01	0.00E-01
SR-92	1.40E 05	7.77E 05	5.02E 01	0.00E-01	0.00E-01
Y-90	2.69E 05	4.49E 03	9.39E 05	0.00E-01	0.00E-01
Y-91M	2.79E 03	1.00E 05	1.91E-15	0.00E-01	0.00E-01
Y-91	2.45E 06	1.07E 06	5.25E 06	0.00E-01	0.00E-01
Y-92	1.27E 05	1.80E 05	1.03E 01	0.00E-01	0.00E-01

TABLE A.5-5 (cont'd)

PATHWAY DOSE FACTORS RI
INFANT

NUCLIDE	INHALATION PATHWAY	GROUND PLANE	GRASS COW MILK	GRASS COW MEAT	VEGETATION PATHWAY
Y-93	1.67E 05	1.85E 05	1.78E 04	0.00E-01	0.00E-01
ZR-95	1.75E 06	2.45E 08	8.26E 05	0.00E-01	0.00E-01
ZR-97	1.40E 05	2.96E 06	4.45E 04	0.00E-01	0.00E-01
NB-95	4.79E 05	1.37E 08	2.06E 08	0.00E-01	0.00E-01
MO-99	1.35E 05	3.99E 06	3.11E 08	0.00E-01	0.00E-01
TC-99M	2.03E 03	1.84E 05	1.65E 04	0.00E-01	0.00E-01
TC-101	8.44E 02	2.04E 04	0.00E-01	0.00E-01	0.00E-01
RU-103	5.52E 05	1.08E 08	1.05E 05	0.00E-01	0.00E-01
RU-105	4.84E 04	6.36E 05	3.21E 00	0.00E-01	0.00E-01
RU-106	1.16E 07	4.21E 08	1.44E 06	0.00E-01	0.00E-01
AG-110M	3.67E 06	3.44E 09	1.46E 10	0.00E-01	0.00E-01
TE-125M	4.47E 05	1.55E 06	1.51E 08	0.00E-01	0.00E-01
TE-127M	1.31E 06	9.17E 04	1.04E 09	0.00E-01	0.00E-01
TE-127	2.44E 04	2.98E 03	1.33E 05	0.00E-01	0.00E-01
TE-129M	1.68E 06	1.98E 07	1.39E 09	0.00E-01	0.00E-01
TE-129	2.63E 04	2.62E 04	2.19E-07	0.00E-01	0.00E-01
TE-131M	1.99E 05	8.03E 06	2.29E 07	0.00E-01	0.00E-01
TE-131	8.22E 03	2.92E 04	1.41E-30	0.00E-01	0.00E-01
TE-132	3.40E 05	4.23E 06	6.53E 07	0.00E-01	0.00E-01
I-130	1.60E 06	5.51E 06	8.76E 08	0.00E-01	0.00E-01
I-131	1.48E 07	1.72E 07	1.05E 12	0.00E-01	0.00E-01
I-132	1.69E 05	1.25E 06	1.37E 02	0.00E-01	0.00E-01
I-133	3.56E 06	2.45E 06	9.61E 09	0.00E-01	0.00E-01
I-134	4.45E 04	4.47E 05	8.47E-10	0.00E-01	0.00E-01
I-135	6.96E 05	2.53E 06	2.00E 07	0.00E-01	0.00E-01
CS-134	7.03E 05	6.86E 09	6.80E 10	0.00E-01	0.00E-01
CS-136	1.35E 05	1.49E 08	5.76E 09	0.00E-01	0.00E-01
CS-17	6.12E 05	1.03E 10	6.02E 10	0.00E-01	0.00E-01
CS-138	8.76E 02	3.59E 05	2.21E-22	0.00E-01	0.00E-01
BA-139	5.10E 04	1.06E 05	2.80E-05	0.00E-01	0.00E-01

TABLE A.5-5 (cont'd)

PATHWAY DOSE FACTORS RI
INFANT

NUCLIDE	INHALATION PATHWAY	GROUND PLANE	GRASS COW MILK	GRASS COW MEAT	VEGETATION PATHWAY
BA-140	1.60E 06	2.05E 07	2.41E 08	0.00E-01	0.00E-01
BA-141	4.75E 03	4.18E 04	0.00E-01	0.00E-01	0.00E-01
BA-142	1.55E 03	4.49E 04	0.00E-01	0.00E-01	0.00E-01
LA-140	1.68E 05	1.92E 07	1.88E 05	0.00E-01	0.00E-01
LA-142	5.95E 04	7.37E 05	5.36E-06	0.00E-01	0.00E-01
CE-141	5.17E 05	1.37E 07	1.37E 07	0.00E-01	0.00E-01
CE-143	1.16E 05	2.31E 06	1.54E 06	0.00E-01	0.00E-01
CE-144	9.84E 06	6.96E 07	1.33E 08	0.00E-01	0.00E-01
PR-143	4.33E 05	0.00E-01	7.84E 05	0.00E-01	0.00E-01
PR-144	4.28E 03	1.83E 03	0.00E-01	0.00E-01	0.00E-01
ND-147	3.22E 05	8.46E 06	5.77E 05	0.00E-01	0.00E-01
W-187	3.96E 04	2.36E 06	2.50E 06	0.00E-01	0.00E-01
NP-239	5.95E 04	1.71E 06	9.43E 04	0.00E-01	0.00E-01

Appendix B

Accident Doses

APPENDIX B

B.0 ACCIDENTAL RELEASES

In the event of an accidental release of radioactive liquids or gases from the plant, the normal effluent restrictions set out in 10CFR Parts 20 and 50 may or may not be violated. Proper emergency response planning (as described in NUREG-0654) requires rapid estimates of uncontrolled releases. Radiological Emergency Plan Implementing Procedure (EPIP) ADM 12-11.0, "Dose Projections," will be the guiding procedure in the event of an accidental release.

B.1 ACCIDENT DOSES - LIQUID RELEASES

In the event of an accidental liquid release, the released quantity of activity will be estimated based upon operational records. The projected accident dose will then be calculated in the same manner as normal effluent doses (Section 2.3).

If the calculated release concentrations at the circulating water discharge are above Part 50 and Part 20 limits, a sample will be taken from the lake once every 8 hours and an isotopic analysis performed once every 24 hours until lake concentrations are below Part 50 and Part 20 limits.

If activity measured in the lake is above Part 50 and Part 20 limits then the Radiological Emergency Plan Implementing Procedure (EPIP) ADM 12-11.3 "Dose Projections" will be used to control emergency action.

B.2 ACCIDENT DOSES - GASEOUS RELEASES

The Radioactive Release Information System (RRIS) is specifically designed to provide this information. The system makes use of on-line effluent monitors and meteorological monitors, as well as sampling and computer modelling to estimate and predict doses to the surrounding population. If the RRIS is unavailable at the time of an accident, Emergency Plan Implementing Procedure ADM 12-11.2 "Dose Projections" will be used to control emergency action.

Appendix C

Meteorological Model

APPENDIX C

PROPRIETARY INFORMATION SUPPLIED BY SAI

The X/Q's and D/Q's are calculated using the guidance of Reg. Guide 1.111

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

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

Where:

h_e = Effective release height (m). (All releases from Wolf Creek Generating Station are considered as ground releases therefore h = 0.)

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

N = Total hours of valid data

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

x = Distance downwind (m)

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

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

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

$$\left(\sigma^2_{zj}(x) + 0.5D_z^2/\pi\right)^{1/2}$$

or

$$\sqrt{3}\,\sigma_{zj}(x)$$

where

D_z = Maximum adjacent building height either up- or down-wind from the release point

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

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

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

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

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

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

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

Where:

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

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

D/Q = Relative deposition per unit area (m).

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

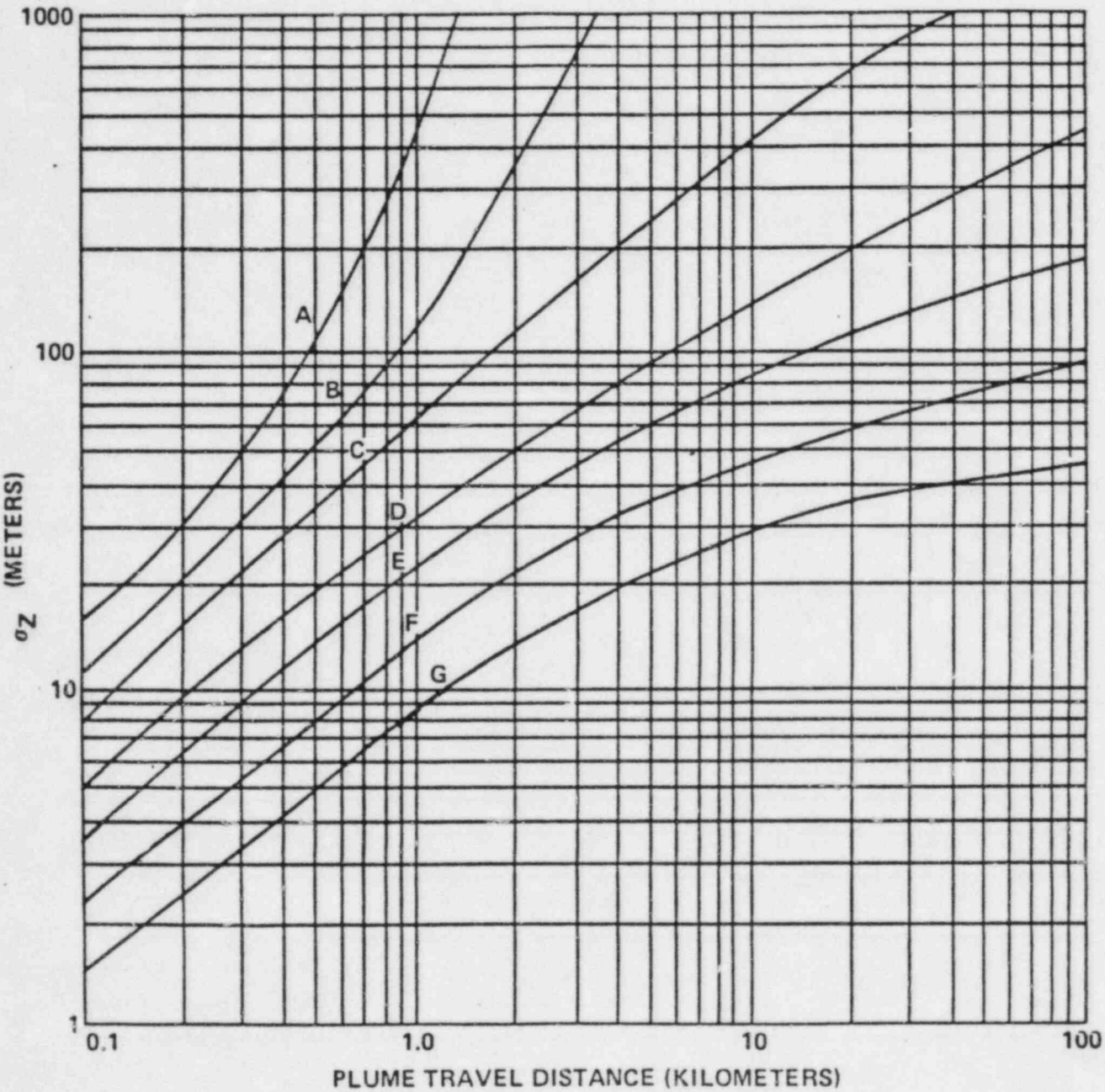
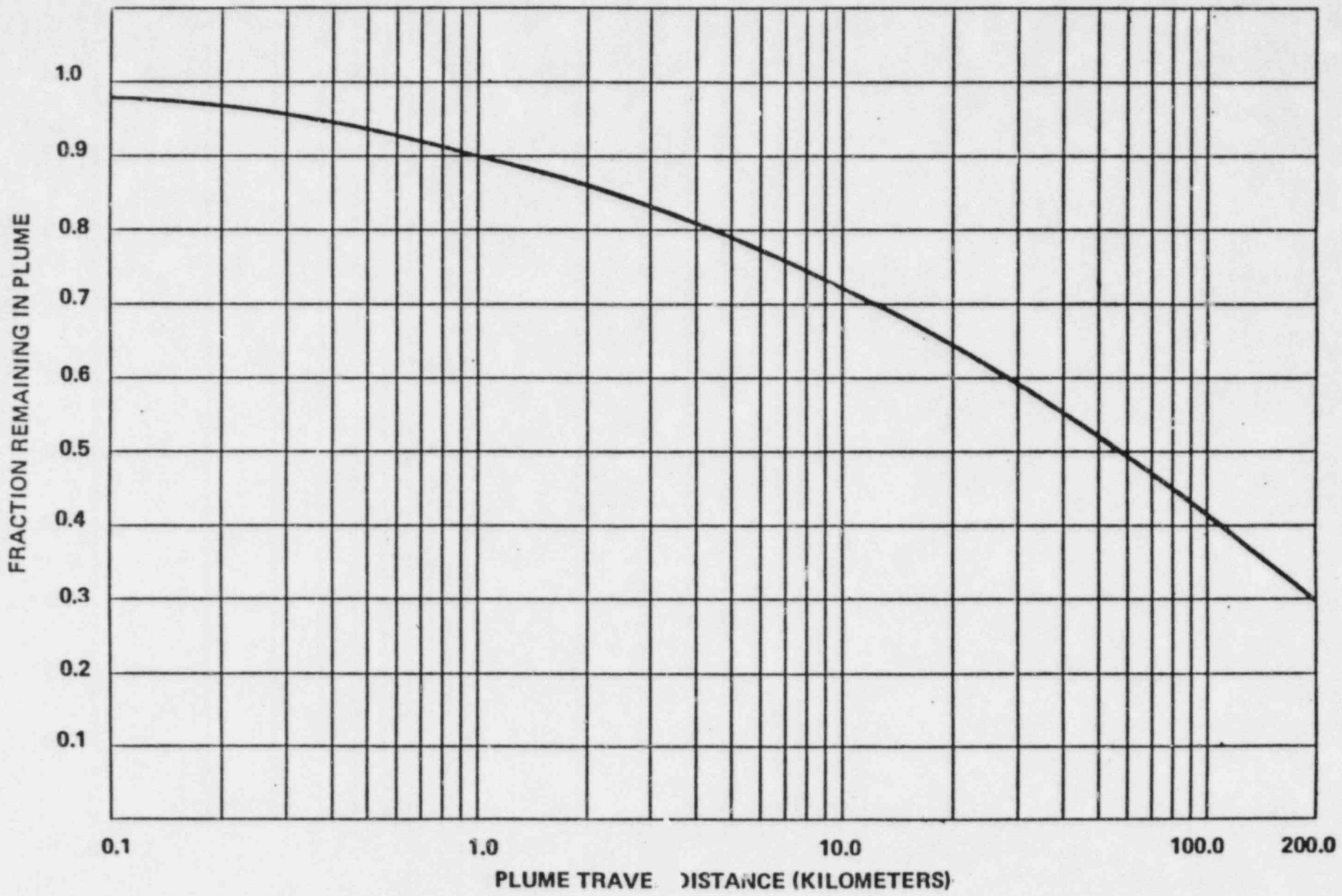
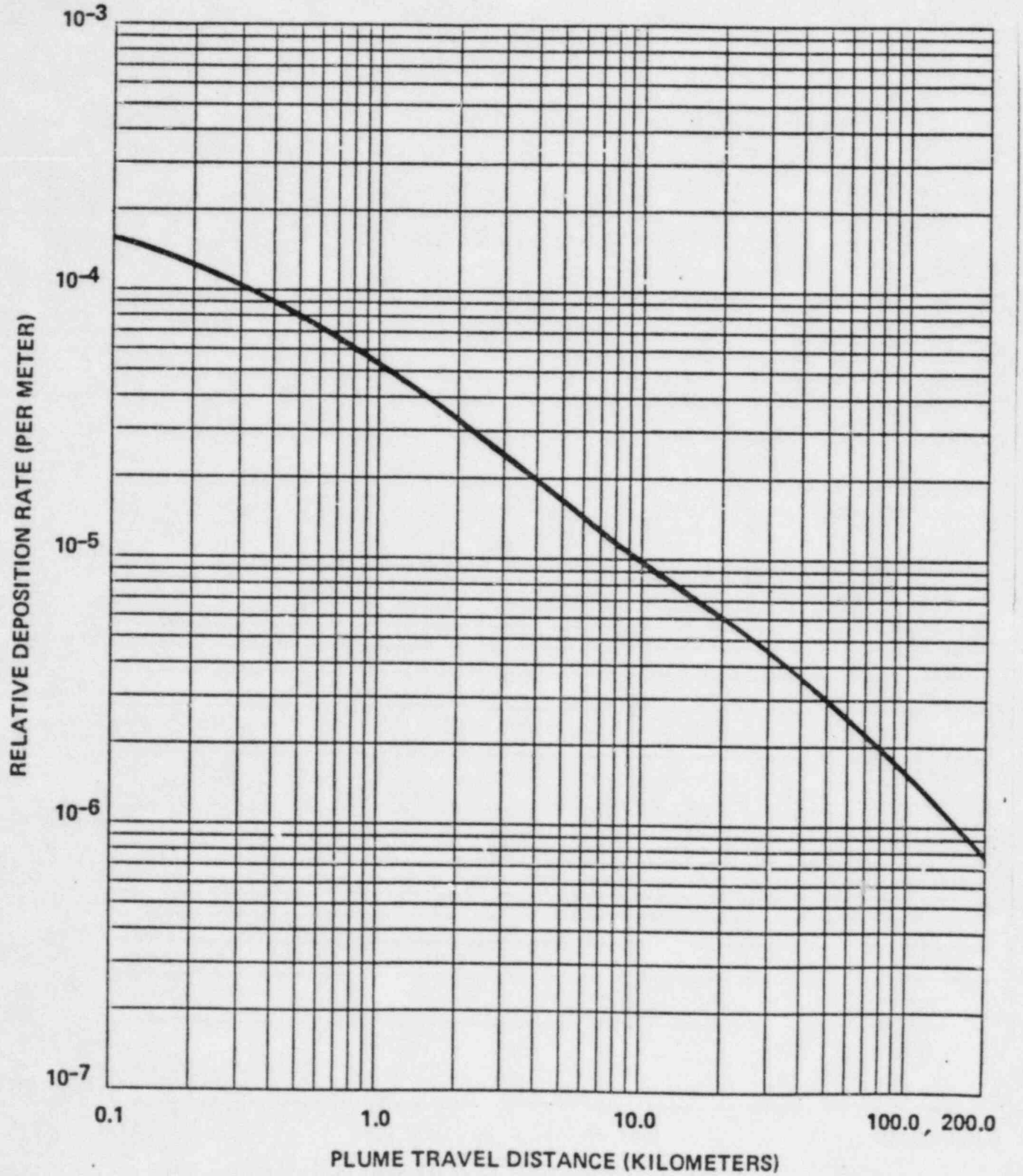


Figure 1. Vertical Standard Deviation of Material in a Plume (Letters denote Pasquill Stability Class)

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


FRACTION REMAINING IN PLUME
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.1
1.0
10.0
100.0
200.0
PLUME TRAVE DISTANCE (KILOMETERS)


10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
RELATIVE DEPOSITION RATE (PER METER)
0.1
1.0
10.0
100.0, 200.0
PLUME TRAVEL DISTANCE (KILOMETERS)