ILLINOIS POWER COMPANY

CLINTON POWER STATION

UNIT 1

OFFSITE DOSE CALCULATION MANUAL

Docket No. 50-461

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Illinois Power Company

Clinton Power Station

OFFSITE DOSE CALCULATION MANUAL

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1.0 PREFACE

The Clinton Power Station OFFSITE DOSE CALCULATION MANUAL (CPS-ODCM) provides the methodologies and parameters to be used by Illinois Power Company (IPC) to assure compliance with the dose limitations stated in the CPS Radiological Effluent Technical Specifications (CPS RETS). The RETS show compliance with 10CFR20, 10CFR50 Appendix A (GDC60 and 64), 10CFR50 Appendix I, and 40CFR190.

The CPS-ODCM was prepared based on guidance provided in NUREG-0133, PREPARATION OF RADIOLOGICAL EFFLUENT TECHNICAL SPECIFICATIONS FOR NUCLEAR POWER PLANTS (October 1978), and NUREG-0473, RADIOLOGICAL EFFLUENT TECHNICAL SPECIFICATIONS FOR BOILING WATER REACTORS (Draft 7" to Revision 3). This manual along with station procedures will be used by CPS personnel to demonstrate compliance with the CPS RETS.

Changes to the CPS-ODCM shall be provided in the SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT.

2.0 LIQUID EFFLUENTS

2.1 Introduction

Liquid radwaste effluent released from CPS will meet 10CFR20 concentration limits at the point of discharge to the unrestricted area shown in Figure 2.1-1. This design and operation objective will be achieved at all times. Actual discharges of liquid radwaste effluent will occur on a batch basis and the average concentration at the point of discharge will normally be only a small percentage of the allowed limits. Reference Clinton FSAR Section 11.5 for a description of radiation monitoring, sampling and effluent control systems.

Cumulative quarterly dose contributions due to radioactive effluents released to the unrestricted area will be determined once every 31 days using NUREG-0133 and Regulatory Guide 1.109 methodology and parameters.

2.2 Liquid Radwaste Discharge Process Radiation Monitoring (PRM) System

This monitoring subsystem measures liquid radwaste effluent radioactivity prior to the effluent joining plant service water and circulating water dilution streams. A high radioactivity signal from this gamma scintillation detector automatically terminates the liquid radwaste effluent release. The liquid radwaste effluent flow, variable from 10-60 GPM or 50-300 GPM, combines with plant service water flow (22,000 GPM minimum) and plant circulating water flow (0-567,000 GPM) in the Seal Well prior to entering the 3.4 mile discharge flume to Lake Clinton.

2.2.1 Method of Representative Sampling

To obtain a representative sample of the liquid radwaste tank to be discharged, the tank is recirculated a minimum of two tank volumes at which time a sample is obtained for isotopic analysis.

2.3 10CFR20 Release Rate Limits

The requirements pertaining to discharge of liquid radwaste effluent to the unrestricted area are specified in CPS RETS 3.11.1.1:

"The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS shall be limited to the concentrations specified in 10CFR20, Appendix B, Table II, Column 2 for non-noble gas radionuclides. For dissolved or entrained noble gases, the concentration shall be limited to 2E-04 μCi/ml total activity."

To comply with the above requirements, setpoints will be calculated to assure that Seal Well concentrations do not exceed 10CFR20, Appendix B, Table II, Column 2 values at any time.

2.3.1 Liquid Radwaste Discharge PRM Setpoints

To achieve CPS RETS 3.11.1.1, and for the purpose of implementation of CPS RETS 3.3.7.11, the alarm/trip setpoints for liquid effluent monitors and flow measurement devices are set to assure that the following equation is satisfied:

$$\frac{cf}{F + f} \leq C_{MPC} \qquad (1)$$

C_{MPC} = the effluent concentration limit (CPS RETS 3.11.1.1) implementing 10CFR20 for the site, corresponding to the specific mix of radionuclides in the effluent stream being considered, in μCi/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 proportional to the volumetric flow of the dilution stream(s) plus the effluent stream, represents a value, if exceeded, would result in concentrations exceeding the limits of 10CFR20 in the unrestricted area

F = the dilution water flow setpoint as determined at the Seal Well, in volume per unit time

f = The flow setpoint as determined at the liquid radwaste discharge PRM location, in volume per unit time (same units as F)

The available dilution water flow (F) should be constant for a given release, and the liquid radwaste tank discharge flow (f) and monitor setpoint (c) are set to meet the condition of equation (1) for a given effluent concentration (C_{MPC}). The method by which this is accomplished is illustrated in sections 2.3.1.1 through 2.3.1.5.

2.3.1.1 The isotopic concentration for a liquid radwaste tank to be discharged is obtained from the sum of the measured concentrations as determined by the analyses required in CPS RETS Table 4.11-1:

$$\sum_i C_i = \sum_g C_g + \sum_a C_a + \sum_s C_s + (C_T + C_{Fe} + C_I), \ \mu Ci/ml \qquad (2)$$

where

$\sum_g C_g$ = The sum of concentrations C_g of each measured gamma emitter g observed by gamma spectroscopy of the waste sample, µCi/ml.

$\sum_a C_a$ = The sum of Concentrations C_a of a alpha emitters (a) in liquid radwaste as measured in the MONTHLY composite sample, µCi/ml.

$\sum_s C_s$ = The sum of concentrations C_s of Sr-89/Sr-90 in liquid radwaste as observed in the QUARTERLY composite sample, µCi/ml.

C_T = The measured concentration of H-3 in liquid radwaste as determined from analysis of the MONTHLY composite sample, µCi/ml.

C_{Fe} = The measured concentration of Fe-55 in liquid radwaste as observed in the QUARTERLY composite sample, µCi/ml.

C_I = The measured concentration of I-131 in the liquid radwaste sample, µCi/ml

2.3.1.2 The measured radionuclide concentrations are used to calculated a DILUTION FACTOR (DF) which is the ratio of total dilution flow rate to liquid radwaste tank effluent flow rate required to assure that the limiting concentrations of 10CFR20, Appendix B, Table II, Column 2 are met at the point of discharge to the unrestricted area.

$$DF = SF \left[\sum \frac{C_i}{MPC_i}\right] \text{ dimensionless} \quad (3)$$

$$= SF \left[\sum_g \frac{C_g}{MPC_g} + \sum_a \frac{C_a}{MPC_a} + \sum_s \frac{C_s}{MPC_s} + \frac{C_T}{MPC_T} + \frac{C_{Fe}}{MPC_{Fe}} + \frac{C_I}{MPC_I}\right]$$

where

C_i = The measured concentrations C_g, C_a, C_s, C_T, C_{Fe}, C_I as defined in equation (2), µCi/ml.

MPC_i = The limiting concentration of the corresponding radionuclide MPC_g, MPC_a, MPC_s, MPC_T, MPC_{Fe} and MPC_I from 10CFR20, Appendix B, Table II, Column 2, µCi/ml. For dissolved or entrained noble gases, the concentration shall be limited to 2E-04 µCi/ml total activity.

SF = The conservative SAFETY FACTOR normally applied to compensate for statistical fluctuations and measurement errors, dimensionless.

2.3.1.3 The maximum permissible liquid radwaste tank effluent flow rate prior to dilution, f_d, is calculated based on a fixed fraction of the minimum dilution flow rate, F_d:

$$f_d \leq \frac{F_d + f_d}{DF} \approx \frac{F_d}{DF} \; ; \; F_d >> f_d \quad (4)$$

where

F_d = 0.9 (Minimum Dilution Water Flow Rate), volume/time

DF = The DILUTION FACTOR calculated by equation (3), dimensionless

Equation (4) is valid only for DF $\geq$1; for DF <1, the liquid radwaste tank effluent concentration meets the limits of 10CFR20 <u>without dilution</u> and therefore f_d may assume any value.

2.3.1.4 The dilution flow rate setpoint for minimum dilution flow rate, F, and the liquid radwaste tank effluent flow rate setpoint for maximum liquid radwaste tank effluent flow rate, f, are calculated as follows:

$F=F_d=0.9$ (Minimum Dilution Water Flowrate), volume/time (5)

$f=0.9(f_d)=0.9$ (Calculated Maximum Radwaste Tank Effluent Flowrate), volume/time (6)

Accordingly, the radwaste discharge is automatically terminated if the dilution water flow rate falls below the assumed flow rate of 90 percent of the actual dilution flow or if the liquid radwaste tank effluent flow rate exceeds 90 percent of the calculated maximum flow rate.

2.3.1.5 The liquid radwaste discharge PRM setpoint may now be specified based on the values of ΣC_i (Eq.2), F(Eq.5) and f(Eq.6) which were determined to provide compliance with the limits of 10CFR20, Appendix B, Table II, Column 2. The monitor response is primarily a gamma response and the actual setpoint is therefore based on ΣC_g (Eq.2). The monitor setpoint, CPM, which corresponds to the particular setpoint concentration, C_M, is determined based on monitor calibration data or operational data which correlates monitor response to sample analyses associated with the actual liquid radwaste to discharged. The second method is considered valid only if the integrity of laboratory methods of determination are proven more accurate than the monitor data.

The set point concentration, C_M, is obtained by the following equation:

$$C_M = \frac{f_d}{f_a} \Sigma C_g, \ \mu Ci/ml \qquad (7)$$

where

f_a = The actual or maximum expected liquid radwaste effluent flow rate, volume/time

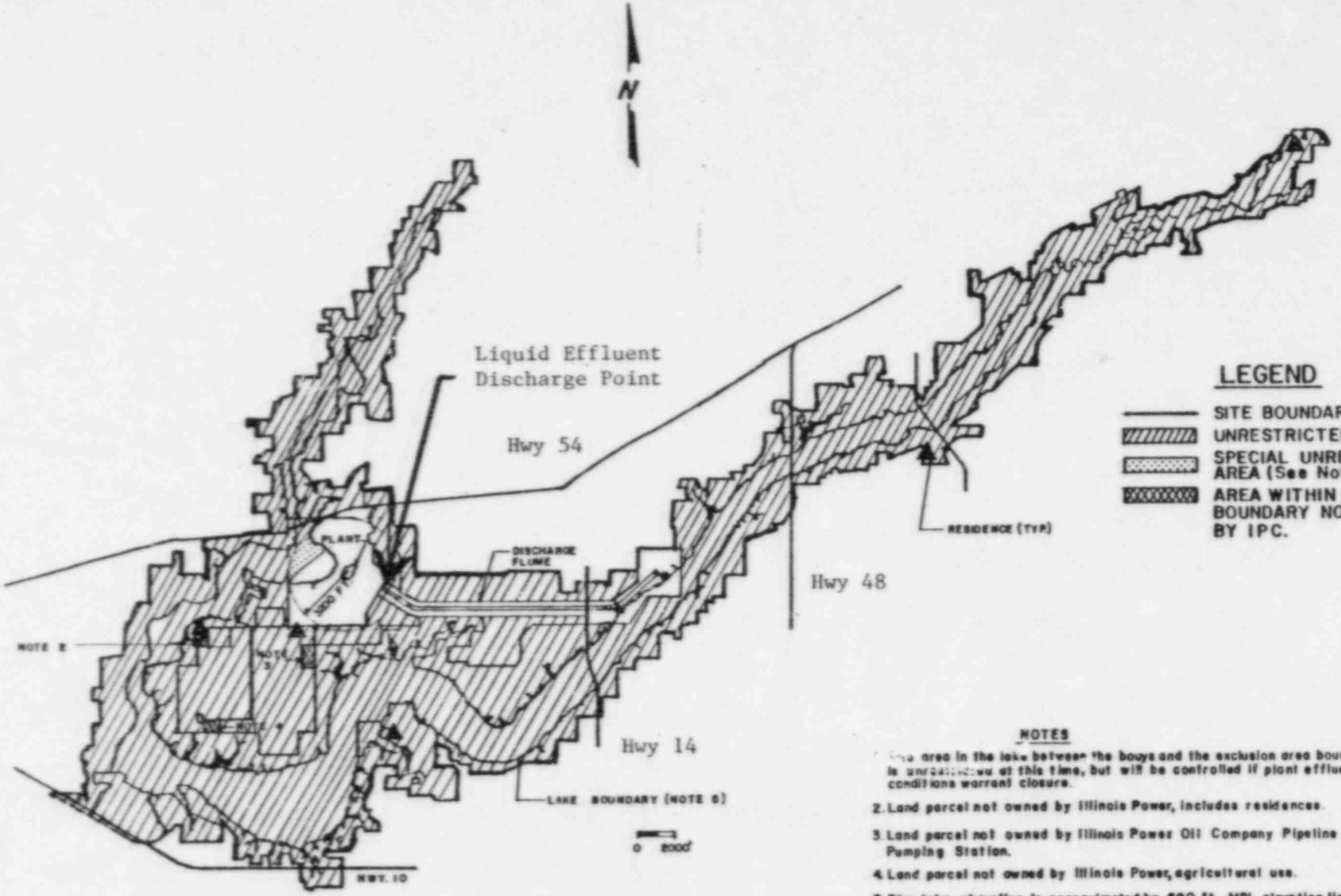
The other terms are as defined previously. If $(f_d/f_a) \geq 1$, the value obtained for C_M is used to determine the monitor setpoint above background, CPM, from either of the two methods described above. In the case where $(f_d/f_a) < 1$, no release may be made and the alternatives presented in sections 2.3.1.3 and 2.3.1.4 should be re-evaluated.

The setpoint concentration is conservative, even if f_d is attainable, since the calculated flow rate contains the SAFETY FACTOR, dilution flow rate and liquid radwaste tank effluent flow rate margins.

2.3.1.6 To prevent spurious alarms, revise the plant service water effluent PRM setpoint to coincide with the setpoint concentration, C_M, calculated by equation (7). This setpoint is valid only during periods of actual liquid radwaste discharges.

Figure 2.1-1

UNRESTRICTED AREA BOUNDARY FOR LIQUID EFFLUENTS



NOTES

1. The area in the lake between the buoys and the exclusion area boundary is unrestricted at this time, but will be controlled if plant effluent conditions warrant closure.
2. Land parcel not owned by Illinois Power, includes residences.
3. Land parcel not owned by Illinois Power Oil Company Pipeline Pumping Station.
4. Land parcel not owned by Illinois Power, agricultural use.
5. The lake shoreline is approximated by 690 ft. MSL elevation line.

2.3.2 Plant Service Water Effluent PRM Setpoints

Plant service water effluent continuously releases to the Seal Well where it mixes with circulating water effluent (if present) prior to entering Lake Clinton via the 3.4 mile discharge flume. The plant service water effluent is not considered a radioactive discharge pathway unless liquid radwaste discharges are in progress or any service water cooling load heat exchanger has been detected as failed. To ensure that the plant service water contains no radioactivity, the following actions will be taken: (a) grab sampling will be performed weekly and (b) the PRM setpoint should be established at three (3) times background. In no case shall the PRM setpoint exceed the corresponding MPC for the most limiting radionuclide (normally I-131) before applying the safety and dilution factors.

In the event radioactivity is detected in the plant service water, daily grab sampling will be performed. The grab samples will be analyzed for those radionuclides and at the corresponding Lower Limit of Detection (LLD) specified in CPS-RETS Table 4.11-1.A. The discharge through this pathway shall be assumed to cease when the measured radioactivity is below the more limiting LLD. PRM setpoints will then be determined following the methodology presented in section 2.3.1 as follows:

2.3.2.1 Perform section 2.3.1.2, solving equation (3) for DF using the appropriate values in the concentration term from the grab sample analysis. If DF <1, then perform section 2.3.1.5 to determine the PRM setpoint.

2.3.2.2 If DF ≥ 1, a modified dilution factor, DF_m, must be determined so that available dilution flows may be apportioned among simultaneous discharge pathways. The modified dilution factor is defined as:

$$DF_m = \frac{DF}{F_A} \qquad (8)$$

where F_A is an administrative allocation factor which may be assigned any value between 0 and 1 under the condition that

$$\sum_n (F_A)_n \leq 1 \qquad (9)$$

and where n = the number of liquid discharge pathways for which DF ≥ 1 and which are planned for simultaneous release. For simplicity, F_A may be assigned the value 1/n. Calculate f_d in equation (4) by substituting the value of DF_m for DF and perform the calculation specified in sections 2.3.1.4 and 2.3.1.5 to determine flow rate and PRM setpoints.

2.3.3 Shutdown Service Water (SX) Effluent PRM Setpoints

Shutdown Service Water, when initiated, is a potential continuous radioactive discharge pathway to the Ultimate Heat Sink (UHS). The SX effluent is not considered a radioactive discharge pathway unless any SX cooling load heat exchanger has been detected as failed. To ensure that SX contains no radioactivity, the following actions will be taken: (a) grab sampling will be performed weekly and (b) the PRM setpoint should be established at three (3) times background. In no case shall the PRM setpoint exceed the corresponding MPC for the most limiting radionuclide (normally I-131) before applying the safety and dilution factors.

In the event radioactivity is detected in the SX system, daily sampling will be performed. The grab samples will be analyzed for those radionuclides and at the corresponding Lower Limit of Detection (LLD) specified in CPS-RETS Table 4.11-1.A. The discharge through this pathway shall be assumed to cease when the measured radioactivity is below the more limiting LLD. PRM setpoints will then be determined following the methodology presented in sections 2.3.2.1 and 2.3.2.2 or section 2.3.1.

2.3.4 Fuel Pool Heat Exchanger Service Water Effluent PRM Setpoint

The Fuel Pool Heat Exchanger Service Water effluent is considered a potential radioactive discharge pathway when Shutdown Service Water (SX) replaces Component Cooling Water (CC) as the heat sink for the fuel pool heat exchangers. To ensure that CC contains no radioactivity, the following actions will be taken: (a) grab sampling will be performed weekly and (b) the PRM setpoint should be established at three (3) times background. In no case shall the PRM setpoint exceed the corresponding MPC for the most limiting radionuclide (normally I-131) before applying the safety and dilution factors.

In the event radioactivity is detected in the CC system, daily CC grab sampling will be performed. The grab samples will be analyzed for those radionuclides and at the corresponding Lower Limit of Detection (LLD) specified in CPS-RETS Table 4.11-1.A. The discharge through this pathway shall be assumed to cease when the measured radioactivity is below the more limiting LLD. The analysis data will then be used to determine the SX PRM setpoints (based on batch release of CC activity) following the methodology presented in sections 2.3.2.1 and 2.3.2.2 or section 2.3.1.

2.4 10CFR50, Appendix I Release Rate Limits

CPS RETS 3.11.1.2 requires that the cumulative dose contributions to an individual from radioactive material in liquid effluents released to the unrestricted area be determined at least once per 31 days. The applicable dose limits are:

$\leq$1.5 mrem/calendar quarter - TOTAL BODY
$\leq$5.0 mrem/calendar quarter - ANY ORGAN

and

$\leq$3 mrem/calendar year - TOTAL BODY
$\leq$10 mrem/calendar year - ANY ORGAN

The dose contribution to the maximum exposed individual from all radionuclides identified in liquid effluents released to the unrestricted area is calculated as follows:

$$D_j = \sum_i \left(A_{ij} \sum_{l=1}^{m} \Delta t_l \, C_{il} F_l \right), \text{ mrem} \qquad (10)$$

where

D_j = The cumulative calendar quarter or yearly dose to any organ j from liquid effluent for the total release period, mrem

Δt_l = The length of the lth release time period over which C_{il} and F_l are averaged for liquid releases, hours

C_{il} = The average concentration of nuclide i in undiluted liquid effluent during release period Δt_l for any liquid release, µCi/ml

F_l = The near field average dilution factor for C_{il} during any liquid effluent release, dimensionless. Defined as the ratio of the average undiluted liquid radwaste flow during the release to the product of the average flow from the discharge structure to unrestricted receiving water and Z

$$= \frac{\text{Average Undiluted Liquid Waste Flow}}{(\text{Average Discharge Structure Flow})\ Z} \qquad (11)$$

Z = The applicable dilution factor for Lake Clinton, dimensionless

= 1.0

A_{ij} = The composite ingestion dose commitment factor for the total body or critical organ of an adult for radionuclide i, mrem/hr per µCi/ml

$$= K_o \left(\frac{Uw}{Dw} + U_f BF_i \right) DF_i \qquad (12)$$

where

K_o = A units conversion factor, 1.14E+05 pCi-ml-yr/µCi-liter-hr

$$= \frac{(1.0E+06 \text{ pCi/µCi})(1.0E+03 \text{ ml/liter})}{8760 \text{ hr/yr}}$$

U_w = Annual water consumption by the maximum adult, 0 liter/yr

D_w = Dilution factor from the near field area to the nearest potable water intake, 1.0

U_f = Adult fish consumption rate, 21 kg/yr (Table E-5 of Regulatory Guide 1.109)

BF_i = Bioaccumulation factor for radionuclide i in fish, pCi/kg per pCi/liter (Table 2.4-2 taken from Table A-1 of Regulatory Guide 1.109)

DF_i = Adult ingestion dose conversion factor for radionuclide i, total body or critical organ, mrem/pCi (Table 2.4-3 taken from Table E-11 of Regulatory Guide 1.109)

Table 2.4-1 contains values for A_{ij} as calculated by equation (12).

The quarterly limits referenced at the beginning of this section represent one-half of the annual design objective of Section II.A of 10CFR50, Appendix I. If either the calendar quarter or calendar year limits are exceeded, a special report pursuant to Section IV.A of 10CFR50, Appendix I shall be filed with the NRC.

2.5 Compliance With CPS RETS 3.11.1.3/3.11.1.4

The projected doses due to releases of liquid radwaste effluents will be calculated for each batch using equation (10). If the sum of the accumulated dose to date for the month and the projected dose for the remainder of the month exceeds CPS RETS 3.11.1.3 limits, then the liquid radwaste treatment system shall be used. This is to ensure compliance with the OPERABILITY requirement of CPS RETS 3.11.1.3; Figure 2.5-1 shows the appropriate portions of the liquid radwaste treatment system which will be used.

The use of temporary liquid radwaste hold-up tanks may occur at CPS.

To comply with CPS RETS 3.11.1.4, the amount of liquid radwaste stored in such tanks shall be limited to 10 curies, excluding tritium and dissolved or entrained noble gases. In lieu of the 10 curie limit, the methodology presented in Appendix B of NUREG-0133 (BWR-RATAFR code) will be used to establish the curie limit.

TABLE 2.4-1

ADULT INGESTION DOSE COMMITMENT FACTORS - A_{ij}

(mrem/hr per μCi/ml)

ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01
C-14	3.12E+04*	6.24E+03	6.24E+03	6.24E+03	6.24E+03	6.24E+03	6.24E+03
NA-24	4.06E+02	4.06E+02	4.06E+02	4.06E+02	4.06E+02	4.06E+02	4.06E+02
P-32	4.61E+07	2.87E+06	1.78E+06	NO DATA	NO DATA	NO DATA	5.19E+06
CR-51	NO DATA	NO DATA	1.27E+00	7.60E-01	2.80E-01	1.68E+00	3.20E+02
MN-54	NO DATA	4.37E+03	8.34E+02	NO DATA	1.30E+03	NO DATA	1.34E+04
MN-56	NO DATA	1.10E+02	1.95E+01	NO DATA	1.40E+02	NO DATA	3.51E+03
FE-55	6.57E+02	4.54E+02	1.06E+02	NO DATA	NO DATA	2.53E+02	2.60E+02
FE-59	1.04E+03	2.44E+03	9.34E+02	NO DATA	NO DATA	6.81E+02	8.13E+03
CO-58	NO DATA	8.90E+01	2.00E+02	NO DATA	NO DATA	NO DATA	1.80E+03
CO-60	NO DATA	2.56E+02	5.64E+02	NO DATA	NO DATA	NO DATA	4.80E+03
NI-63	3.11E+04	2.15E+03	1.04E+03	NO DATA	NO DATA	NO DATA	4.49E+02
NI-65	1.26E+02	1.64E+01	7.48E+00	NO DATA	NO DATA	NO DATA	4.16E+02
CU-64	NO DATA	9.95E+01	4.67E+00	NO DATA	2.51E+01	NO DATA	8.48E+02
ZN-65	2.31E+04	7.36E+04	3.33E+04	NO DATA	4.92E+04	NO DATA	4.64E+04
ZN-69	4.92E+01	9.42E+01	6.55E+00	NO DATA	6.12E+01	NO DATA	1.41E+01
BR-83	NO DATA	NO DATA	4.03E+01	NO DATA	NO DATA	NO DATA	5.81E+01
BR-84	NO DATA	NO DATA	5.23E+01	NO DATA	NO DATA	NO DATA	4.10E-04
BR-85	NO DATA	NO DATA	2.15E+00	NO DATA	NO DATA	NO DATA	LT E-15**
RB-86	NO DATA	1.01E+05	4.70E+04	NO DATA	NO DATA	NO DATA	1.99E+04
RB-88	NO DATA	2.89E+02	1.53E+02	NO DATA	NO DATA	NO DATA	4.00E-09
RB-89	NO DATA	1.92E+02	1.35E+02	NO DATA	NO DATA	NO DATA	1.11E-11
SR-89	2.21E+04	NO DATA	6.34E+02	NO DATA	NO DATA	NO DATA	3.54E+03
SR-90	5.43E+05	NO DATA	1.33E+05	NO DATA	NO DATA	NO DATA	1.57E+04
SR-91	4.06E+02	NO DATA	1.64E+01	NO DATA	NO DATA	NO DATA	1.99E+03
SR-92	1.54E+02	NO DATA	6.67E+00	NO DATA	NO DATA	NO DATA	3.05E+03
Y-90	2.75E-01	NO DATA	1.54E-02	NO DATA	NO DATA	NO DATA	6.10E+03
Y-91m	5.43E-03	NO DATA	2.10E-04	NO DATA	NO DATA	NO DATA	1.60E-02
Y-91	8.42E+00	NO DATA	2.25E-01	NO DATA	NO DATA	NO DATA	4.64E+03
Y-92	5.05E-02	NO DATA	1.48E-03	NO DATA	NO DATA	NO DATA	8.84E+02
Y-93	1.60E-01	NO DATA	4.42E-03	NO DATA	NO DATA	NO DATA	5.08E+03
ZR-95	2.40E-01	7.69E-02	5.20E-02	NO DATA	1.21E-01	NO DATA	2.44E+02
ZR-97	1.32E-02	2.67E-03	1.22E-03	NO DATA	4.04E-03	NO DATA	8.28E+02
NB-95	4.46E+02	2.48E+02	1.33E+02	NO DATA	2.45E+02	NO DATA	1.51E+06
MO-99	NO DATA	1.03E+02	1.96E+01	NO DATA	2.33E+02	NO DATA	2.39E+02
TC-99m	8.86E-03	2.50E-02	3.19E-01	NO DATA	3.80E-01	1.23E-02	1.48E-01
TC-101	9.11E-03	1.31E-02	1.29E-01	NO DATA	2.36E-01	6.70E-03	3.94E-14
RU-103	4.42E+00	NO DATA	1.90E+00	NO DATA	1.69E+01	NO DATA	5.16E+02
RU-105	3.68E-01	NO DATA	1.45E-01	NO DATA	4.76E+00	NO DATA	2.25E+02
RU-106	6.57E+01	NO DATA	8.32E+00	NO DATA	1.27E+02	NO DATA	4.25E+03
AG-110m	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
TE-125m	2.57E+03	9.28E+02	3.43E+02	7.70E+02	1.04E+04	NO DATA	1.22E+04

TABLE 2.4-1 (continued)

ADULT INGESTION DOSE COMMITMENT FACTORS - A_{ij}

(mrem/hr per μCi/ml)

ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
TE-127m	6.47E+03	2.31E+03	7.89E+02	1.65E+03	2.63E+04	NO DATA	2.17E+04
TE-127	1.05E+02	3.77E+01	2.28E+01	7.79E+01	4.28E+02	NO DATA	8.30E+03
TE-129m	1.10E+04	4.10E+03	1.74E+03	3.78E+03	4.59E+04	NO DATA	5.54E+04
TE-129	3.00E+01	1.13E+01	7.31E+00	2.30E+01	1.26E+02	NO DATA	2.26E+01
TE-131m	1.65E+03	8.09E+02	6.74E+02	1.28E+03	8.19E+03	NO DATA	8.03E+04
TE-131	1.88E+01	7.87E+00	5.95E+00	1.55E+01	8.25E+01	NO DATA	2.67E+00
TE-132	2.41E+03	1.56E+03	1.46E+03	1.72E+03	1.50E+04	NO DATA	7.37E+04
I-130	2.71E+01	7.99E+01	3.15E+01	6.78E+03	1.25E+02	NO DATA	6.88E+01
I-131	1.49E+02	2.13E+02	1.22E+02	6.99E+04	3.66E+02	NO DATA	5.63E+01
I-132	7.28E+00	1.95E+01	6.81E+00	6.81E+02	3.10E+01	NO DATA	3.66E+00
I-133	5.09E+01	8.85E+01	2.70E+01	1.30E+04	1.54E+02	NO DATA	7.96E+01
I-134	3.80E+00	1.03E+01	3.69E+00	1.79E+02	1.64E+01	NO DATA	9.00E-03
I-135	1.59E+01	4.16E+01	1.53E+01	2.74E+03	6.67E+01	NO DATA	4.70E+01
CS-134	2.97E+05	7.07E+05	5.78E+05	NO DATA	2.29E+05	7.60E+04	1.24E+04
CS-136	3.11E+04	1.23E+05	8.84E+04	NO DATA	6.84E+04	9.37E+03	1.40E+04
CS-137	3.81E+05	5.21E+05	3.41E+05	NO DATA	1.77E+05	5.88E+04	1.01E+04
CS-138	2.64E+02	5.21E+02	2.58E+02	NO DATA	3.83E+02	3.78E+01	2.22E-03
BA-139	9.27E+01	6.60E-04	2.72E-02	NO DATA	6.18E-04	1.40E-01	4.00E+02
BA-140	1.94E+02	2.44E-01	1.27E+01	NO DATA	8.29E-02	1.40E-01	4.00E+02
BA-141	4.50E-01	3.40E-04	1.52E-02	NO DATA	3.16E-04	1.93E-04	2.12E-10
BA-142	2.04E-01	2.09E-04	1.28E-02	NO DATA	1.77E-04	1.18E-04	2.89E-19
LA-140	1.49E-01	7.53E-02	1.99E-02	NO DATA	NO DATA	NO DATA	5.53E+03
LA-142	7.65E-03	3.48E-03	8.66E-04	NO DATA	NO DATA	NO DATA	2.54E+01
CE-141	2.24E-02	1.51E-02	1.72E-03	NO DATA	7.03E-03	NO DATA	5.78E+01
CE-143	3.94E-03	2.92E+00	3.23E-04	NO DATA	1.28E-03	NO DATA	1.09E+02
CE-144	1.17E+00	4.88E-01	6.26E-02	NO DATA	2.89E-01	NO DATA	3.94E+02
PR-143	5.50E-01	2.20E-01	2.72E-02	NO DATA	1.27E-01	NO DATA	2.41E+03
PR-144	1.80E-03	7.47E-04	9.14E-05	NO DATA	4.21E-04	NO DATA	2.59E-10
ND-147	3.76E-01	4.34E-01	2.60E-02	NO DATA	2.54E-01	NO DATA	2.08E+03
W-187	2.95E+02	2.47E+02	8.63E+01	NO DATA	NO DATA	NO DATA	8.09E+04
NP-239	2.84E-02	2.80E-03	1.54E-03	NO DATA	8.72E-03	NO DATA	5.74E+02

* 3.12×10^{4}

** Less than 10^{-15}

TABLE 2.4-2

BIOACCUMULATION FACTORS -BF_i
(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

TABLE 2.4-3

ADULT INGESTION DOSE FACTORS -DF_i
(mrem/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-05	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

TABLE 2.4-3 (continued)

ADULT INGESTION DOSE FACTORS - DF_i
(mrem/pCi ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 91m	9.09E-11	NO DATA	3.52E-12	NO DATA	NO DATA	NO DATA	2.67E-10
Y 91	1.41E-07	NO DATA	3.77E-09	NO DATA	NO DATA	NO DATA	7.76E-05
Y 92	8.45E-10	NO DATA	2.47E-11	NO DATA	NO DATA	NO DATA	1.48E-05
Y 93	2.68E-09	NO DATA	7.40E-11	NO DATA	NO DATA	NO DATA	8.50E-05
ZR 95	3.04E-08	9.75E-09	6.60E-09	NO DATA	1.53E-08	NO DATA	3.09E-05
ZR 97	1.68E-09	3.39E-10	1.55E-10	NO DATA	5.12E-10	NO DATA	1.05E-04
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
TC101	2.54E-10	3.66E-10	3.59E-09	NO DATA	6.59E-09	1.87E-10	1.10E-21
RU103	1.85E-07	NO DATA	7.97E-08	NO DATA	7.06E-07	NO DATA	2.16E-05
RU105	1.54E-08	NO DATA	6.08E-09	NO DATA	1.99E-07	NO DATA	9.42E-06
RU106	2.75E-06	NO DATA	3.48E-07	NO DATA	5.31E-06	NO DATA	1.78E-04
AG110m	1.60E-07	1.48E-07	8.79E-08	NO DATA	2.91E-07	NO DATA	6.04E-05
TE125m	2.68E-06	9.71E-07	3.59E-07	8.06E-07	1.09E-05	NO DATA	1.07E-05
TE127m	6.77E-05	2.42E-06	8.25E-07	1.73E-06	2.75E-05	NO DATA	2.27E-05
TE127	1.10E-07	3.95E-08	2.38E-08	8.15E-08	4.48E-07	NO DATA	8.68E-06
TE129m	1.15E-05	4.29E-05	1.82E-05	3.95E-06	4.80E-05	NO DATA	5.79E-05
TE129	3.14E-08	1.18E-08	7.65E-09	2.41E-08	1.32E-07	NO DATA	2.37E-08
TE131m	1.73E-06	8.46E-07	7.05E-07	1.34E-06	8.57E-06	NO DATA	8.40E-05
TE131	1.97E-08	8.23E-09	6.22E-09	1.62E-08	8.63E-08	NO DATA	2.79E-09
TE132	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-05	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

TABLE 2.4-3 (continued)

ADULT INGESTION DOSE FACTORS - DF_i
(mrem/pCi ingested)

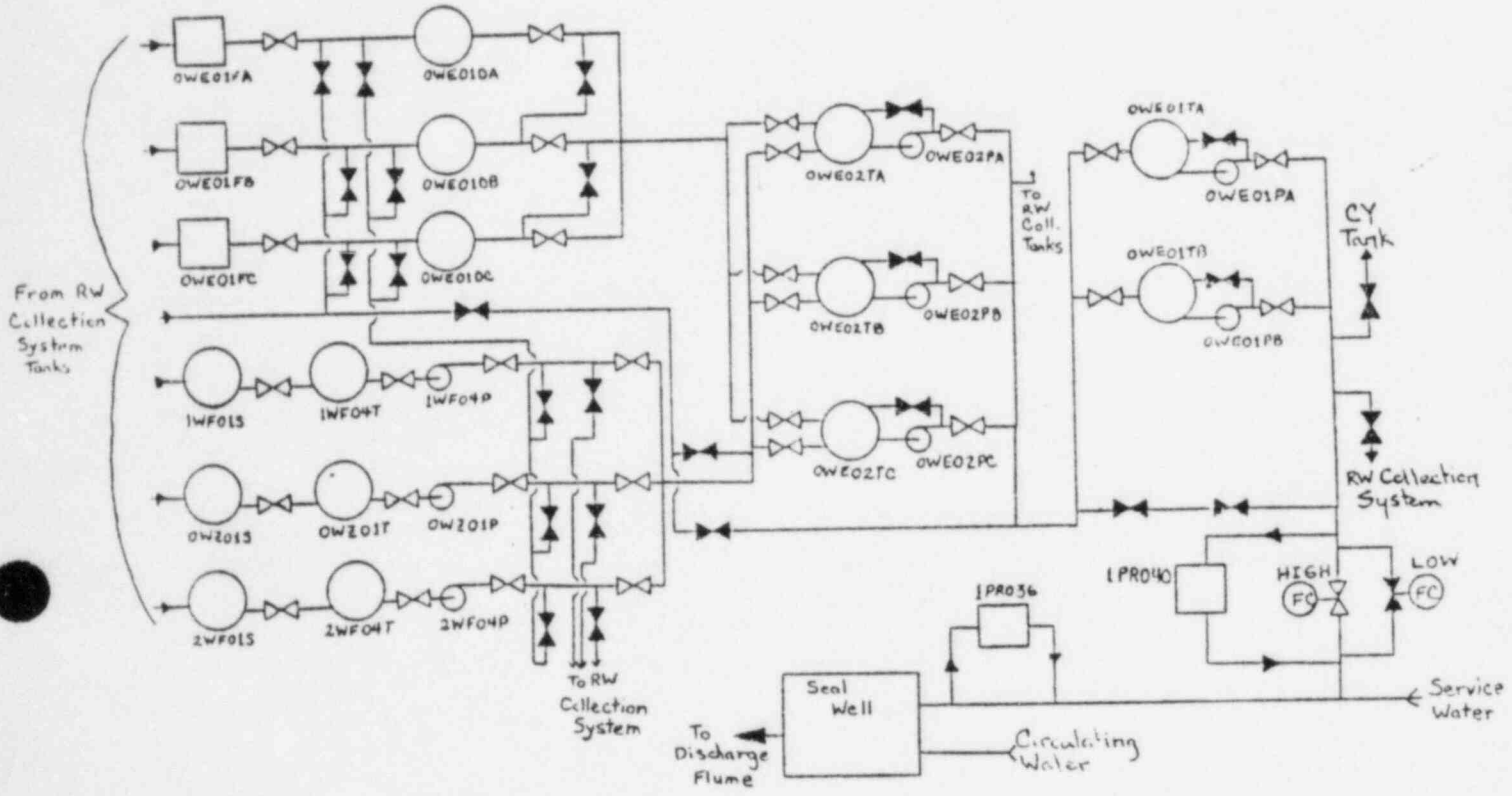
NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I 135	4.43E-07	1.16E-06	4.28E-07	7.65E-05	1.86E-06	NO DATA	1.31E-06
CS134	6.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E-06
CS136	6.51E-06	2.57E-05	1.85E-05	NO DATA	1.43E-05	1.96E-06	2.92E-06
CS137	7.97E-05	1.09E-04	7.14E-05	NO DATA	3.70E-05	1.23E-05	2.11E-06
CS138	5.52E-08	1.09E-07	5.40E-08	NO DATA	8.01E-08	7.91E-09	4.65E-13
BA139	9.70E-08	6.91E-11	2.85E-09	NO DATA	6.46E-11	3.92E-11	1.72E-07
BA140	2.03E-05	2.55E-08	1.33E-06	NO DATA	8.67E-09	1.46E-08	4.18E-05
BA141	4.71E-08	3.56E-11	1.59E-09	NO DATA	3.31E-11	2.02E-11	2.22E-17
BA142	2.13E-08	2.19E-11	1.34E-09	NO DATA	1.85E-11	1.24E-11	3.00E-26
LA140	2.50E-09	1.26E-09	3.33E-10	NO DATA	NO DATA	NO DATA	9.25E-05
LA142	1.28E-10	5.82E-11	1.45E-11	NO DATA	NO DATA	NO DATA	4.25E-07
CE141	9.36E-09	6.33E-09	7.18E-10	NO DATA	2.94E-09	NO DATA	2.42E-05
CE143	1.65E-09	1.22E-06	1.35E-10	NO DATA	5.37E-10	NO DATA	4.56E-05
CE144	4.88E-07	2.04E-07	2.62E-08	NO DATA	1.21E-07	NO DATA	1.65E-04
PR143	9.20E-09	3.69E-09	4.56E-10	NO DATA	2.13E-09	NO DATA	4.03E-05
PR144	3.01E-11	1.25E-11	1.53E-12	NO DATA	7.05E-12	NO DATA	4.33E-18
ND147	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
NP239	1.19E-09	1.17E-10	6.45E-11	NO DATA	3.65E-10	NO DATA	2.40E-05

* 2.84×10^{-06}

** Less than 10^{-24}

FIGURE 2.5-1

LIQUID RADWASTE TREATMENT SYSTEM



1WF01S Floor Drain Evaporator

2WF01S Floor Drain Evaporator

0WZ01S Chemical Waste Evaporator

1WF04T Floor Drain Evaporator Tank

0WZ01P Chem. Wst. Evap. Tank Pump

0WE01FA,B, and C Waste Filters

0WE01DA,B, and C Waste Demins

0WE02TA,B, and C Waste Sample Tks.

2WF04T Floor Drain Evaporator Tank

0WZ01T Chem. Waste Evaporator Tank

1WF04P Flr. Drn. Evap. Tank Pump

2WF04P Flr. Drn. Evap. Tank Pump

0WE02TA,B, and C Waste Samp. Tk Pumps

0WE01TA and B Excess Water Tanks

0WE01PA and B Excess Water Tank Pumps

1PR036 Service Water PRM

1PR040 Liquid RW Discharge PRM

2.6 Doses From Liquid Effluent Pathways

Methods for calculating radiation doses from potable water, aquatic food, shoreline deposits and irrigated food pathways are presented in Appendix A of Regulatory Guide 1.109. Equations (13) through (17) describe how doses from these pathways will be calculated.

Potable Water

$$R_{apj} = 1100 \frac{M_p U_{ap}}{F} \sum_i Q_i D_{aipj} \exp(-\lambda_i t_p), \text{ mrem/yr} \quad (13)$$

Aquatic Foods

$$R_{apj} = 1100 \frac{U_{ap} M_p}{F} \sum_i Q_i B_{ip} D_{aipj} \exp(-\lambda_i t_p), \text{ mrem/yr} \quad (14)$$

Shoreline Deposits

$$R_{apj} = 110{,}000 \frac{U_{ap} M_p W}{F} \sum_i Q_i T_i D_{aipj} [\exp(-\lambda_i t_p)] [1 - \exp(-\lambda_i t_b)], \text{ mrem/yr} \quad (15)$$

Irrigated Foods (excluding tritium)

$$R_{apj} = U_{ap}^{veg} \sum d_i \exp(-\lambda_i t_h) D_{aipj} \quad (16)$$

$$\left[\frac{r[1 - \lambda \exp(-\lambda_{Ei} t_e)]}{Y_v \lambda_{Ei}} + \frac{f_I B_{iv} [1 - \exp(-\lambda_i t_b)]}{P_i \lambda_i} \right]$$

$$+ U_{ap}^{animal} \sum_i F_{iA} D_{aipj} \left\{ Q_F d_i \exp(-\lambda_i t_h) \left[\frac{r[1 - \exp(-\lambda_{Ei} t_e)]}{Y_v \lambda_{Ei}} + \frac{f_I B_{iv} [1 - \exp(-\lambda_i t_b)]}{P_i \lambda_i} \right] + C_{iAw} Q_{Aw} \right\}, \text{ mrem/yr}$$

Tritium (irrigated foods)

$$R_{apj} = U_{ap}^{veg} \sum C_{iv} D_{aipj} \quad (17)$$

$$+ U_{ap}^{animal} \sum D_{aipj} F_{iA} (C_{iv} Q_F + C_{iAw} Q_{Aw}), \text{ mrem/yr}$$

where

B_{ip} = The equilibrium bioaccumulation factor for nuclide i in pathway p, expressed as the ratio of the concentration in biota, pCi/kg, to the nuclide concentration in water, pCi/liter, liter/kg

B_{iv} = The concentration factor for uptake of radionuclide i from soil by edible parts of crops, pCi/kg (wet) per pCi/kg (dry soil)

C_{iAw} = The concentration of radionuclide i in water consumed by animals, pCi/liter

C_{iv} = The concentration of radionuclide i in vegetation species v, pCi/kg

D_{aipj} = The dose factor specific to a given age group a, radionuclide i, pathway p and organ j. Used to calculate the dose from an intake of a radionuclide, mrem/pCi, or from exposure to a given concentration of a radionuclide in sediment, mrem/hr per pCi/m^2.

d_i = The deposition rate of radionuclide i from irrigation water, pCi/m^2 per hour

F = The flow rate of the liquid effluent, ft^3/sec

f_I = The fraction of the year crops are irrigated, dimensionless

F_{iA} = The stable element transfer coefficient that relates the daily intake rate by an animal to the concentration in an edible portion of animal product, pCi/liter (milk) per pCi/day or pCi/kg (animal product) per pCi/day

M_p = The mixing ratio (reciprocal of the dilution factor) at the point of exposure (or the point of withdrawal of drinking water or point of harvest of aquatic food), dimensionless

P = The effective "surface density" for soil, kg (dry soil)/m^2 (Table E-1, Regulatory Guide 1.109)

Q_{Aw} = The consumption rate of contaminated water by an animal, liters/day

Q_F = The consumption rate of contaminated feed or forage by an animal, kg/day (wet weight)

Q_i = The release rate of nuclide i, Ci/yr

r = The fraction of deposited activity retained on crops, dimensionless (Table E-15, Regulatory Guide 1.109)

R_{apj} = The total annual dose to organ j of individuals of age group (a) from all of the radionuclides in pathway p, mrem/yr

t_b = The period of time for which sediment or soil is exposed to contaminated water, hours (Table E-15, Regulatory Guide 1.109)

t_e = The time period that crops are exposed to contamination during the growing season, hours (Table E-15, Regulatory Guide 1.109)

t_h = A holdup time that represents the time interval between harvest and consumption of the food, hour (Table E-15, Regulatory Guide 1.109)

T_i = The radioactive half-life of nuclide i, days

t_p = The average transit time required for nuclides to reach the point of exposure. For internal dose, t_p is the total time elapsed between release of the nuclides and ingestion of food or water, hours (Table E-15, Regulatory Guide 1.109)

U_{ap} = A usage factor that specifies the exposure time or intake rate for an individual of age group (a) associated with pathway p, hr/yr, 1/yr, or kg/yr (Table E-5, Regulatory Guide 1.109)

W = The shoreline width factor, dimensionless (Table A-2, Regulatory Guide 1.109)

Y_v = The agricultural productivity (yield), kg (wet weight)/m^2 (Table E-15, Regulatory Guide 1.109)

λE_i = The effective removal rate constant for radionuclide i from crops, 1/hr, where $\lambda E_i = \lambda_i + \lambda_w$, λ_i is the radioactive decay constant, and λ_w is the removal rate constant for physical loss by weathering (Regulatory Guide 1.109, Table B-15)

λ_i = The radioactive decay constant of nuclide i, hr^{-1}

1100 = The factor to convert from (Ci/yr)/(ft^3/sec) to pCi/liter

TABLE 2.6-1

INPUT PARAMETERS FOR CALCULATING R_{apj}

Potable Water

The potable water pathway does not exist; therefore all usage factors are zero and the calculation of R_{apj} (Potable Water) using equation (13) is not performed.

Aquatic Food

Parameter		Value	Reference*
U_{ap} (kg/yr)	- Infant	0	Table E-5
	- Child	6.9	Table E-5
	- Teen	16	Table E-5
	- Adult	21	Table E-5
M_p (dimensionless)		1.0	CPS Site Specific
D_{aipj} (mrem/pCi)	- Infant	Table 3.5-6	Table E-14
	- Child	Table 3.5-7	Table E-13
	- Teen	Table 3.5-8	Table E-12
	- Adult	Table 3.5-9	Table E-11
B_{ip} (pCi/kg per pCi/liter)		Table 2.4-2	Table A-1
t_p (hour)		24	Page 1.109-12

Shoreline Deposits

Parameter		Value	Reference*
U_{ap} (hr/yr)	- Infant	0	Table E-5
	- Child	14	Table E-5
	- Teen	67	Table E-5
	- Adult	12	Table E-5

TABLE 2.6-1 (continued)

INPUT PARAMETERS FOR CALCULATING R_{apj}

Shoreline Deposits

Parameter	Value	Reference*
M_p (dimensionless)	1.0	CPS Site Specific
W (dimensionless)	0.3	Page 1.109-15
D_{aipj} (mrem/hr per pCi/m²) - Infant	Table 3.5-5	Table E-6
- Child	Table 3.5-5	Table E-6
- Teen	Table 3.5-5	Table E-6
- Adult	Table 3.5-5	Table E-6
t_p (hour)	24	Page 1.109-12

Irrigated Foods

The irrigated food pathway does not exist; therefore all usage factors are zero and the calculation of R_{apj} (Irrigated Foods) using equations (16) and (17) is not performed.

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* of Regulatory Guide 1.109 unless otherwise indicated

3.0 GASEOUS EFFLUENTS

3.1 Introduction

Gaseous effluents from CPS are released on both a batch and continuous basis. Gaseous effluents are normally discharged on a long term basis. High volume continuous containment purge and mechanical vacuum pump discharge may be condisered short term releases.

There are two gaseous effluent release points to the environment: the Common Station HVAC Stack and the Standby Gas Treatment System (SGTS) Stack. The height of these stacks is such that all gaseous effluents are treated as mixed-mode releases (reference Table 7.2-4). The SGTS is an Engineered Safety Feature filter system utilized following an accident to reduce iodine and particulate activity in gases leaking from the primary containment and which are potentially present in the secondary containment. The Common Station HVAC Stack ("HVAC Stack") receives process and ventilation exhaust from the following inputs:

1) Continuous Containment Purge (CCP)
2) Containment Building Ventilation
3) Turbine Building Ventilation
4) Radwaste Building Ventilation
5) Auxiliary Building Ventilation
6) Fuel Building Ventilation
7) Auxiliary Building Refrigerant Purge
8) Laboratory Ventilation System
9) Counting/Equipment Decon Rooms Ventilation
10) Steam Packing Exhauster
11) Mechanical Vacuum Pump
12) Drywell Purge

The effluent exiting the SGTS stack is monitored at the SGTS stack and the combined inputs to the HVAC stack are monitored at the HVAC stack. All inputs to the HVAC Stack, with the exception of input numbers 7 through 10, can be monitored prior to entering the stack.

Figure 3.1-1 delineates the CPS site boundary for implementation of the gaseous effluent CPS RETS.

3.2 Gaseous Effluent Release Point Monitoring

3.2.1 HVAC Stack Process Radiation Monitoring (PRM) System

The HVAC Stack inputs are monitored for radioactivity prior to discharge to the environment by the HVAC Stack PRM. The PRM detector configuration provides effluent monitoring using seven (7) channels as follows:

1) Beta scintillator for particulates

2) Alpha surface barrier detector to account for the radon/thoron contribution to the beta particulate measurement

3) Gamma scintillator for iodine

4) Iodine background subtraction

5) Beta scintillator for low range noble gas

6) Energy-compensated Geiger-Mueller (G-M) detector for high range noble gas

7) Energy-compensated G-M detector for gamma area subtraction

This monitor has no control function but annunciates in the Main Control Room and the Radiation Protection Office where proper response actions will be initiated in accordance with CPS procedures.

3.2.2 SGTS Stack Process Radiation Monitoring (PRM) System

As discussed in section 3.1, the SGTS is used to reduce post-accident concentrations of radioactivity in the primary and secondary containment via filter trains. The SGTS Stack PRM monitors the gaseous effluent of the filter trains at the SGTS Stack prior to release to the environment. The PRM detector configuration utilizes nine (9) channels as follows:

1) Beta scintillator for particulates

2) Gamma scintillator for low range iodine

3) De-sensitized gamma scintillator for high range iodine

4) Iodine background subtraction (low range)

5) Iodine background subtraction (high range)

6) Beta scintillator for low range noble gas

7) Energy-compensated G-M detector for intermediate range noble gas

8) Energy-compensated G-M detector for high range noble gas

9) Energy-compensated G-M detector for gamma area subtraction

This monitor has no control function but annunciates in the Main Control Room and the Radiation Protection Office where proper response actions will be initiated in accordance with CPS procedures.

3.3 Main Condenser Off-Gas Monitoring System

3.3.1 Pre-Treatment Air Ejector Off-Gas Process Radiation Monitor (PRM)

The Pre-Treatment Off-Gas PRM monitors hydrogen recombiner effluent for gross noble gas radioactivity. This effluent is then routed to the charcoal adsorbers for eventual release to the environment via the station HVAC Stack. The PRM detector configuration consists of a single energy-compensated G-M detector mounted in a gas volume.

The monitor has no control function but annunciates in the Main Control Room and the Radiation Protection Office where proper response actions will be initiated in accordance with CPS procedures.

3.3.2 Post-Treatment Air-Ejector Off-Gas Process Radiation Monitor (PRM)

The Post-Treatment Off-Gas PRM monitors the gaseous radioactivity at upstream, intermediate or downstream sections of the charcoal adsorber beds prior to the effluent entering the station HVAC Stack for release to the environment. The PRM detector configuration is as described for the HVAC Stack PRM (section 3.2.1).

The monitor has two control functions. Upon detection of noble gas activity in excess of the ALERT setpoint, the charcoal adsorber bypass valves shut (if in the charcoal bypass mode) and the off-gas is routed through the adsorbers.

Should noble gas activity exceed the HIGH setpoint, the off-gas system is automatically isolated from the HVAC Stack and a reactor scram subsequently occurs.

The Main Condenser Off-Gas Treatment System is shown in Figure 3.3-1.

3.4 10CFR20 Release Rate Limits

Limits for release of airborne effluents to the unrestricted area are stated in CPS RETS 3.11.2.1. The dose rate in unrestricted areas due to radioactive materials released in gaseous effluents from the site shall be limited to the following values:

(a) Noble Gases - ≤500 mrem/year to the total body

and

≤3000 mrem/year to the skin

(b) Radioiodines, Particulates and Tritium - ≤1500 mrem/year to any organ

3.4.1 Dose Rate Due To Noble Gases

In order to comply with CPS RETS 3.11.2.1(a), the dose rate at or beyond the site boundary due to noble gases shall be calculated as follows:

$$D_t = \sum_i K_i [(\overline{X/Q})_m Q_{im}] \quad (1)$$

= total body dose rate at time of release, mrem/year

$$D_s = \sum_i (L_i + 1.1 M_i)[(\overline{X/Q})_m Q_{im}] \quad (2)$$

= skin dose rate at time of release, mrem/year

The terms in the above equations are defined in section 3.4.2.

3.4.2 Dose Rate Due To Radioiodines, Particulates and Tritium

In order to comply with CPS RETS 3.11.2.1(b), organ dose rates due to radioiodines (I-131, I-133), particulates with half-lives 8 days and tritium shall be calculated as follows:

$$D_o = \sum_i P_i (\overline{X/Q})_m Q_{im} \quad (3)$$

= organ dose rate at time of release, mrem/yr

The terms used in equations (1) through (3) are defined as follows:

K_i = The total body dose factor due to gamma emissions for each identified noble gas radionuclide i, mrem/yr per $\mu Ci/m^3$

L_i = The skin dose factor due to beta emissions for each identified noble gas radionuclide i, mrem/yr per $\mu Ci/m^3$

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide i, mrem/yr per $\mu Ci/m^3$ (1.1 mrem/mrad converts air dose to skin dose)

P_i = The dose factor for non-noble gas radionuclide i which includes pathway transport parameters, receptor usage factors and the dosimetry of the exposure. The dose factors for the inhalation, mrem/yr per $\mu Ci/m^3$, pathway are listed in Table 3.4-2 (CHILD). Dose factors are based on NUREG-0133, Section 5.2.1.1 assumptions unless otherwise stated.

Q_{im} = The release rate of noble gas radionuclide i in gaseous effluent from mixed-mode release points, $\mu Ci/sec$

$\dot{Q}_{im}$ = The release rate of non-noble gas radionuclide i in gaseous effluent from mixed-mode release points, $\mu Ci/sec$

$(\overline{X/Q})_m$ = The highest calculated annual average relative concentration for any area at or beyond the site boundary from mixed-mode releases, sec/m^3

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 listed Table 3.4-1 and were obtained from Table B-1 of Regulatory Guide 1.109 after multiplying the values by the conversion 10^6 pCi/μCi.

10CFR20 organ dose rate calculations are limited to the inhalation pathway only. CPS RETS 3.11.2.1(a) is applicable to the unrestricted area location characterized by the $(\overline{X/Q})_m$ value which results in the maximum total body or skin dose commitment. Should the total body and skin locations differ, the selected location shall be that which minimizes allowable release rates. Therefore, the dispersion values used in the equations for the implementation of CPS RETS 3.11.2.1 are maximum annual average values resulting from mixed-mode releases. Table 7.2-5 lists site boundary dispersion parameters for implementing CPS RETS 3.11.2.1.

There are unrestricted areas within the CPS site boundary which are utilized by members of the public for residences, farming, recreation and camping. Annual doses to members of the public at controlling unrestricted area locations were calculated using section 3.4 methodology, occupancy factors and FSAR Table 11.3-9 gaseous source term. The dispersion value (ODCM Table 7.2-1) selected for each controlling location was that which results in the maximum annual dose to a member of the public. Dose calculation results for these unrestricted areas are summarized in Table 3.4-3. Table 3.4-3 will be revised to remain consistent with the most recent land use census, updated dispersion values and gaseous source term.

TABLE 3.4-1

DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS*

Radionuclide	Total Body Dose Factor K_i (mrem/yr per $\mu Ci/m^3$)	Skin Dose Factor L_i (mrem/yr per $\mu Ci/m^3$)	Gamma Air Dose Factor M_i (mrad/yr per $\mu Ci/m^3$)	Beta Air Dose Factor N_i (mrad/yr per $\mu Ci/m^3$)
Kr-85m	1.17E+03	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.61E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	5.92E+03	9.73E+03	6.17E+03	1.03E+04
Kr-88	1.47E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.66E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.56E+04	7.29E+03	1.63E+04	7.83E+03
Xe-131m	9.15E+01	4.76E+02	1.56E+02	1.11E+03
Xe-133m	2.51E+02	9.94E+02	3.27E+02	1.48E+03
Xe-133	2.94E+02	3.06E+02	3.53E+02	1.05E+03
Xe-135m	3.12E+03	7.11E+02	3.36E+03	7.39E+02
Xe-135	1.81E+03	1.86E+03	1.92E+03	2.46E+03
Xe-137	1.42E+03	1.22E+04	1.51E+03	1.27E+04
Xe-138	8.83E+03	4.13E+03	9.21E+03	4.75E+03
Ar-41	8.84E+03	2.69E+03	9.30E+03	3.28E+03

* The listed dose factors are for radionuclides that may be detected in gaseous effluents.

TABLE 3.4-2

PATHWAY DOSE FACTORS (CHILD) - P_i

Isotope	P_i (Inhalation) (mrem/yr per $\mu Ci/m^3$)	Isotope	P_i (Inhalation) (mrem/yr per $\mu Ci/m^3$)
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+05	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	9.06E+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	7.58E+04
Y-91	2.63E+06	CE-141	5.44E+05
Y-92	2.39E+05	CE-143	1.27E+05
Y-93	3.88E+05	CE-144	1.20E+07
ZR-95	2.23E+06	PR-143	4.33E+05
ZR-97	3.51E+05	PR-144	1.56E+03
NB-95	6.14E+05	ND-147	3.28E+05
MO-99	1.35E+05	W-187	9.10E+04
TC-99m	9.51E+02	NP-239	6.40E+04
TC-101	5.85E+02		

* 1.12×10^3

TABLE 3.4-3

ANNUAL DOSES IN UNRESTRICTED AREAS

Location	Distance (mile/meter)	Sector	Occupancy (hrs/yr)	Total Body Dose Rate (mrem/yr)	Skin Dose Rate (mrem/yr)	Organ Dose Rate* (mrem/yr)
Road	0.3/495	SE	243(1)	0.04	0.08	0.02
Agricultural Acreage (2)	0.9/1372	SSW	964(3)	0.02	0.05	0.01
Clinton Lake	0.2/335	NW	2208(4)	1	2	0.5
Department of Conservation Recreation Area	0.8/1287	ESE	2208(5)	0.1	0.2	0.05
Residence	0.8/1219	SW	8766	0.5	1	0.3

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(1) Assumes travel on road for forty minutes per day.

(2) Maximum farm acreage (276) within site boundary.

(3) Assumes 3.5 hours in field per acre farmed.

(4) Assumes continuous occupation on Clinton Lake for the months of June, July, and August.

(5) Assumes continuous occupation on Department of Conservation camping areas for the months of June, July, and August.

* Child inhalation

3.5 10CFR50, APPENDIX I RELEASE RATE LIMITS

The requirements pertaining to 10CFR50 gaseous release rate limits are stated in CPS RETS 3.11.2.2 and 3.11.2.3. CPS RETS 3.11.2.2 requires that the air dose at or beyond the site boundary, due to noble gases, shall be limited to the following:

(a) During any calendar quarter, ≤ 5 mrad (gamma) and ≤10 mrad (beta) and,

(b) During any calendar year, ≤10 mrad (gamma) and ≤20 mrad (beta).

CPS RETS 3.11.2.3 requires that the dose to an individual at or beyond the site boundary, due to radioiodines (I-131, I-133), tritium and all particulates with half-lives >8 days, shall be limited to the following:

(a) During any calendar quarter, ≤ 7.5 mrem to any organ and,

(b) During any calendar year, ≤ 15 mrem to any organ.

3.5.1 Noble Gas Air Dose

The air dose at or beyond the site boundary due to noble gases released in gaseous effluent will be determined using the following equations.

3.5.1.1 During any calendar quarter or calendar year, for gamma radiation:

$$D_\gamma = 3.17 \times 10^{-8} \sum_i M_i [(\overline{X/Q})_m Q_{im} + (x/q_m) q_{im}] \quad (4)$$

3.5.1.2 During any calendar quarter or calendar year, for beta radiation:

$$D_\beta = 3.17 \times 10^{-8} \sum_i N_i [(\overline{X/Q})_m Q_{im} + (x/q)_m q_{im}] \quad (5)$$

Where

M_i = The gamma air dose factor for each identified noble gas radionuclide i, mrad/year per $\mu Ci/m^3$ (M_i values are listed in Table 3.4-1).

N_i = The beta air dose factor for each identified noble gas radionuclide i, mrad/year per $\mu Ci/m^3$ (N_i values are listed in Table 3.4-1).

$(\overline{X/Q})_m$ = The highest calculated annual average relative concentration from mixed-mode release points for areas at or beyond the site boundary for long-term (>500 hrs/yr) releases.

$(x/q)_m$ = The relative concentration from mixed-mode release points for areas at or beyond the site boundary for short-term (≤500 hrs/yr) releases.

Q_{im} = The average release of noble gas radionuclide i for long-term releases from mixed-mode release points, μCi. Releases shall be cumulative over the calendar quarter or year, as appropriate.

q_{im} = The average release of noble gas radionuclide i for short-term releases from mixed-mode release points, μCi. Releases shall be cumulative over the calendar quarter or year, as appropriate.

3.17×10^{-8} = The inverse of the number of seconds in a year.

CPS RETS 3.11.2.2 noble gas dose calculations are evaluated at the site boundary location where maximum annual average air doses prevail. Should the beta and gamma locations differ, the selected location shall be that which minimizes allowable release rates due to the gamma component. Therefore, the dispersion values used in the equations for the implementation of CPS RETS 3.11.2.2 (long-term releases) are maximum annual average values resulting from mixed-mode releases.

For releases which occur less than 150 hours in any quarter not to exceed 500 hours in a calendar year, short term dispersion values will be used by calculating a short term correction factor as discussed in NUREG-0324 (reference section 7.3.12). The short-term diffusion estimates (5% X/Q) listed in FSAR Table 2.3-42 may also be used. When past short-term releases are determined to be sufficiently random in occurence to be represented by annual average dispersion conditions, such data will be used.

Table 7.2-5 lists site boundary dispersion parameters for implementing CPS RETS 3.11.2.2.

3.5.2 Radioiodines, Particulates and Tritium Dose

The dose to an individual at or beyond the site boundary due to radioiodines (I-131, I-133), tritium and particulates with half-lives >8 days, will be determined using the following equation:

for any calendar quarter or calendar year,

$$D_p = 3.17 \times 10^{-8} \sum_i R_{aij} \left[W_m \dot{Q}_{im} + w_m \dot{q}_{im} \right] \quad (6)$$

where

$\dot{Q}_{im}$ = The releases of radionuclide i (I-131, I-133, tritium and particulates) for long-term (> 500 hrs/yr) releases from mixed-mode release points, μCi. Releases shall be cumulative over the calendar quarter or year, as appropriate.

$\dot{q}_{im}$ = The releases of radionuclide i (I-131, I-133, tritium and particulates) for short-term (≤500 hrs/yr) releases from mixed-mode release points, μCi. Releases shall be cumulative over the calendar quarter or year, as appropriate.

$(\overline{D/Q})_m$ = The relative deposition from mixed-mode release points for areas at or beyond the site boundary for long-term (>500 hr/yr releases, m^{-2}.

$(d/q)_m$ = The relative deposition from mixed-mode release points for areas at or beyond the site boundary for short-term (≤500 hr/yr) releases, m^{-2}.

W_m = The dispersion parameter for estimating the dose to an individual at a controlling location for long-term mixed-mode releases.

= $(\overline{X/Q})_m$, sec/m^3, for the inhalation pathway

= $(\overline{D/Q})_m$, m^{-2}, for the food and ground plane pathways

w_m = The dispersion parameter for estimating the dose to an individual at a controlling location for short-term mixed-mode releases.

= $(x/q)_m$, sec/m^3, for the inhalation pathway

= $(d/q)_m$, m^{-2} for the food and ground plane pathways

3.17×10^{-8} = The inverse of the number of seconds in a year.

R_{aij} = The dose factor for each identified radionuclide i, age group (a) and organ j, m^2-mrem/year per µCi/sec or mrem/year per µCi/m^3

CPS RETS 3.11.2.3. is applicable to the location at or beyond the site boundary where the combination of existing pathways and receptor age groups indicates the maximum potential exposure. The inhalation and ground plane exposure pathways exist at all locations; other pathways exist as determined by the most current land use census.

Table 7.2-5 lists site boundary dispersion and deposition parameters for implementing CPS RETS 3.11.2.3

3.5.2.1 Dose Factor For Radionuclide i (R_{aij})

The R_{aij} values used to calculate D_p in equation (6) are determined separately for each of the potential exposure pathways, namely:

- Inhalation (I)
- Ground Plane Contamination (G)
- Grass-Cow/Goat-Milk (C)
- Grass-Cow-Meat (M)
- Vegetation (V)

The R_{aij} parameter is independent of the duration of gaseous releases and is calculated using the methodology discussed in the remainder of this section.

3.5.2.1.1 Calculation of the Inhalation Pathway Factor, R^I_{aij}

$$R^I_{aij} = K'(BR)_a\ (DFA_i)_a,\ \text{mrem/year per } \mu\text{Ci/m}^3 \quad (7)$$

where

K' = A units conversion constant, 10^6 pCi/μCi

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

= 1400 (infant)
= 3700 (child)
= 8000 (teen and adult)

Values for $(BR)_a$ are obtained from NUREG-0133, p.32.

$(DFA_i)_a$ = The organ inhalation dose factor for receptor of age group (a) for radionuclide i, mrem/pCi. Values for $(DFA_i)_a$ were obtained from Tables E-7 through E-10 of Regulatory Guide 1.109 and are presented in Tables 3.5-1 through 3.5-4 of this Manual.

3.5.2.1.2 Calculation of the Ground Plane Pathway Factor, R^G_i

$$R^G_i = K'K''(SF)(DFG_i)(1-e^{-\lambda_i t})/\lambda_i, \quad (8)$$

m^2-mrem/year per μCi/sec

where

K' = A units conversion constant, 10^6 pCi/μCi

K'' = A units conversion constant, 8760 hour/year

SF = The shielding factor, dimensionless

= 0.7 as suggested in Table E-15 of Regulatory Guide 1.109

DFG_i = The ground plane dose conversion factor for radionuclide i, mrem/hour per pCi/m^2. Values for DFG_i were obtained from Table E-6 of Regulatory Guide 1.109 and are presented in Table 3.5-5 of this Manual.

λ_i = The decay constant for radionuclide i, sec^{-1}

t = The exposure time, sec

= 6.31E+08 sec (20 years)

3.5.2.1.3 Calculation of The Grass-Cow/Goat-Milk Pathway Factor, R^C_{aij}

$$R^C_{aij} = K' \frac{Q_F(U_{ap})}{\lambda_i + \lambda_w} F_m(r) (DFL_i)_a \left[\frac{f_p f_s}{Y_p} + \frac{(1-f_p f_s) e^{-\lambda_i t_h}}{Y_s}\right] e^{-\lambda_i t_f}, \quad (9)$$

m^2-mrem/yr per µCi/sec

where

K' = A units conversion constant, 10^6 pCi/µCi

Q_F = The cow/goat feed consumption rate, kg(wet)/day

U_{ap} = The receptor's milk consumption rate for age group (a), liters/year

Y_p = The agricultural productivity by unit area of pasture feed grass, kg/m^2

F_m = The stable element transfer coefficients, days/liter

r = Fraction of deposited activity retained on feed grass, dimensionless

$(DFL_i)_a$ = The organ ingestion dose factor for radionuclide i and the receptor in age group (a), mrem/pCi. Values for $(DFL_i)_a$ were obtained from Tables E-11 through E-14 of Regulatory Guide 1.109 and are presented in Table 3.5-6 through 3.5-9 of this Manual.

λ_i = The decay constant for radionuclide i, sec^{-1}

λ_w = The decay constant for removal of activity on leaf and plant surfaces by weathering, sec^{-1}

= 5.73×10^{-7} sec^{-1} (corresponding to a 14-day half-time)

t_f = The transport time from pasture to animal, to milk, to receptor, sec

t_h = The transport time from pasture to harvest, to animal, to receptor, sec

f_p = Fraction of the year that the cow/goat is on pasture, dimensionless

f_s = Fraction of the cow/goat feed that is pasture grass while the cow/goat is on pasture, dimensionless

The input parameters for calculating R^C_{aij} are listed in Table 3.5-10.

Tritium

The concentration of tritium in milk is based on its airborne concentration rather than the deposition.

$$R^C_T = K'K''F_m Q_F U_{ap} (DFL_i)_a \ [0.75(0.5/H)], \quad \text{mrem/yr per } \mu Ci/m^3 \qquad (10)$$

where

K" = A units conversion constant, 10^3 gm/kg

H = The absolute atmospheric humidity

= 8 gm/m³ (NUREG-0133, p. 34)

0.75 = The fraction of total feed that is water, dimensionless

0.5 = The ratio of the specific activity of the feed grass water to the atmospheric water, dimensionless

The other parameters are as defined in the calculation of R^C_{aij}

Carbon - 14

Following the development of equation C-8 on page 1.109-26 of Regulatory Guide 1.109, carbon-14 is assumed to be released as an oxide, either $C^{14}O$ or $C^{14}O_2$. The concentration of carbon-14 in milk is therefore based upon its airborne concentration assuming that the vegetation C^{14}/C ratio is the same as the local atmospheric C^{14}/C ratio.

$$R^C_{14} = K'K''F_m Q_f U_{ap} (DFL_i)_a \; p(0.11/0.16), \text{ mrem/yr per } \mu Ci/m^3 \quad (11)$$

where

p = Fractional equilibrium ratio, dimensionless

= Ratio of the total annual C-14 atmospheric release time to the total annual photosynthesis time (4400 hours) not to exceed unity

= 1.0

0.11 = Natural carbon fraction of total plant mass, dimensionless

0.16 = Atmospheric natural carbon concentration, gm/m^3

The other parameters are as defined in the calculation of R^C_T.

3.5.2.1.4 Calculation of The Grass-Cow-Meat Pathway Factor, R^M_{aij}

$$R^M_{aij} = \frac{K' Q_F (U_{ap})}{\lambda_i + \lambda_w} F_f(r)(DFL_i)_a \left[\frac{f_p f_s}{Y_p} + \frac{(1-f_p f_s)}{Y_s} e^{-\lambda_i t_h}\right] [e^{-\lambda_i t_s}],$$

m^2-mrem/yr per µCi/sec (12)

where

K' = A units conversion constant, 10^6 pCi/µCi

U_{ap} = The receptor's meat consumption rate for age group (a), kg/year

F_f = The stable element transfer coefficient, days/kg

t_s = The transport time from slaughter of meat animal to receptor, seconds

t_h = The transport time from crop field to receptor, seconds

$(DFL_i)_a$ = The organ ingestion dose factor for radionuclide i and the receptor in age group (a), mrem per pCi. Values are tabulated in Table 3.5-6 through 3.5-9 of this Manual.

The input parameters necessary for calculating R^M_{aij} are listed in Table 3.5-11. All other terms are as defined for equations (9) and (10).

Tritium:

The concentration of tritium in meat is based on its airborne concentration rather than the deposition.

$$R^M_T = K'K''F_f Q_F U_{ap} (DFL_i)_a [0.75(0.5/H)] \text{ , mrem/yr per } \mu Ci/m^3 \quad (13)$$

The terms in equation (13) are as defined in equations (10) and (12).

Carbon - 14

Following the development of equation C-8 on page 1.109-26 of Regulatory Guide 1.109, carbon-14 is assumed to be released as an oxide, either $C^{14}O$ or $C^{14}O_2$. The concentration of carbon-14 in meat is therefore based upon its airborne concentration assuming that the vegetation C^{14}/C ratio is the same as the local atmospheric C^{14}/C ratio.

$$R_{14}^{M} = K'K''F_f Q_f U_{ap} (DFL_i)_a \; p(0.11/0.16), \text{ mrem/yr per } \mu Ci/m^3 \qquad (14)$$

The terms in equation (14) are as defined in equations (11) and (13).

3.5.2.1.5 Calculation of the Vegetation Pathway Factor, R_{aij}^{V}

$$R_{aij}^{V} = K' \left[\frac{(r)}{Y_v(\lambda_i + \lambda_w)} (DFL_i)_a\right] \left[U_a^L f_L e^{-\lambda_i t_L} + U_a^S f_g e^{-\lambda_i t_h}\right],$$

m^2-mrem/yr per μCi/sec (15)

where

K' = A units conversion constant, 10^6 pCi/μCi

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

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

f_L = The fraction of the annual intake of fresh leafy vegetation grown locally, dimensionless

f_g = The fraction of the annual intake of stored vegetation grown locally, dimensionless

t_L = The average time between harvest of leafy vegetation and its consumption, seconds

t_h = The average time between harvest of stored vegetation and its consumption, seconds

Y_v = The vegetation areal density, kg/m^2

$(DFL_i)_a$ = The organ ingestion dose factor for radionuclide i and the receptor in age group (a), mrem per pCi. Values are tabulated in Table 3.5-6 through 3.5-9 of this Manual.

The input parameters necessary for calculating R^V_{aij} are listed in Table 3.5-12. All other terms are as defined for equations (9) through (14).

Tritium:

The concentration of tritium in vegetation is based on its airborne concentration rather than the deposition.

$$R_T^V = K'K''(U_a^L f_L + U_a^S f_g)\ (DFL_i)_a\ [0.75(0.5/H)]\ ,\ \text{mrem/yr per Ci/m}^3 \qquad (16)$$

The terms in equation (16) are as defined in equations (10) and (15).

Carbon-14

Following the development of equation C-8 on page 1.109-26 of Regulatory Guide 1.109, carbon-14 is assumed to be released as an oxide, either $C^{14}O$ or $C^{14}O_2$. The concentration of carbon-14 in vegetation is therefore based upon its airborne concentration assuming that the vegetation C^{14}/C ratio is the same as the local atmospheric C^{14}/C ratio.

$$R_{14}^V = K'K''(U_a^L f_L + U_a^S f_g)\ (DFL_i)_a\ p(0.11/0.16), \qquad (17)$$

mrem/yr per Ci/m^3

The terms in equation (17) are as defined in equations (11) and (15).

The pathway dose rate factors (R^I_{aij}, R^C_{aij}, R^V_{aij}, R^M_{aij}, R^G_i), by age group, are listed in Table 3.5-13 through 3.5-31.

3.6 Compliance With CPS-RETS 3.11.2.4/3.11.2.5

CPS RETS 3.11.2.4 requires that the Offgas Treatment System shall not be used in the charcoal bypass mode unless the Post-Treatment Air Ejector Offgas radiation monitor is operable per CPS RETS 3.3.7.12. Prior to placing the Offgas Treatment System in the charcoal bypass mode, the alarm setpoints for the Station HVAC Exhaust and the Post-Treatment Offgas radiation monitors shall be calculated to account for the increased fraction of short-lived noble gases. The noble gas release fractions shall be based either on actual measured values or on design basis noble gas concentration fractions (30 minute decay) in the primary coolant offgas.

CPS RETS 3.11.2.5 requires that the Ventilation Exhaust Treatment System (VETS) shall be used when the projected doses due to VETS releases to areas at and beyond the Site Boundary would exceed 0.3 mrem to any organ in a 31 day period. The projected doses resulting from such releases will be calculated using ODCM section 3.5.2 methodology. If the dose impact resulting from the projected 31 day release exceeds 0.3 mrem and the VETS is capable of reducing the projected impact to less than 0.3 mrem, the VETS shall be used.

3.7 Effluent Monitor Setpoint Calculations

Gaseous effluent Process Radiation Monitor (PRM) alarm setpoints shall be calculated to ensure that the dose rate in unrestricted areas due to noble gases released do not exceed 500 mrem/year to the total body and 3000 mrem/year to the skin. The initial setpoints will be calculated using the BWR-GALE code radionuclide mix obtained for CPS; once CPS becomes operational, the actual radionuclide mix will be used. The PRM setpoints are based on the instantaneous noble gas dose rates and are applied at the point of which the effluent enters an unrestricted area. Further, the bases for each setpoint consider the type of release at the PRM location (long or short term using the appropriate atmospheric dispersion conditions).

Both total body and skin dose setpoints will be calculated and the more restrictive limit applied to the respective PRM. The actual setpoint used may be lower than the restrictive limit since the two release points will be partitioned such that their sum does not exceed 100 percent of the restrictive limit. The percentages used to partition the release points could vary at plant discretion to accommodate plant operational conditions. In no case will the combined releases due to variations in the PRM setpoints result in RETS limits being exceeded.

3.7.1 Total Body Dose Rate Setpoint

The fraction of the total gaseous radioactivity in each gaseous effluent release path j for each noble gas radionuclide i shall be determined using the following relationship:

$$f_{ij} = \frac{C_{ij}}{\sum_i C_{ij}} \text{, dimensionless} \qquad (18)$$

where

C_{ij} = The measured concentration of identified noble gas radionuclide i in gaseous effluent release path j, μCi/cc

The maximum acceptable release rate of all noble gases in release path j to comply with CPS RETS 3.11.2.1 is calculated by using the equation:

$$Q_{Tj} = \frac{500\ F_j}{(X/Q)_j \sum_i (K_i f_{ij})}, \ \mu Ci/sec \qquad (19)$$

where

Q_{Tj} = The maximum acceptable release rate of all noble gases in release path j, μCi/sec

F_j = Total dose rate allocation factor assigned to release path j (varying between 0.0 and 1.0), dimensionless

500 = Total body dose rate limit specified in CPS RETS 3.11.2.1a, mrem/year

$(X/Q)_j$ = The highest relative concentration of release path j at the site boundary

= $(\overline{X/Q})_m$ or $(x/q)_m$, depending on duration of release, sec/m^3 (reference section 3.5.1)

K_i = The total body dose factor due to gamma emissions of noble gas radionuclide i as listed in Table B-1 of Regulatory Guide 1.109 and Table 3.4-1 of this Manual, mrem/yr per $\mu Ci/m^3$

f_{ij} = The fraction as defined by equation (18), dimensionless

The total maximum acceptable concentration of noble gas radionuclides in release path j is calculated using the following equation:

$$C_{Tj} = \frac{Q_{Tj}}{R_j}, \ \mu Ci/cc \qquad (20)$$

where

C_{Tj} = The total maximum acceptable concentration of all noble gases in release path j, $\mu Ci/cc$

Q_{Tj} = The maximum acceptable release rate of all noble gases in release path j determined from equation (19), $\mu Ci/sec$

R_j = The effluent release rate of release point j, cc/sec

The maximum acceptable concentration of noble gas radionuclide i in the gaseous effluent pathway j for each individual noble gas in the effluent pathway j, C^A_{ij} will be determined as follows:

$$C^A_{ij} = f_{ij} C_{Tj}, \ \mu Ci/cc \qquad (21)$$

where the terms f_{ij} and C_{Tj} are defined in equations (18) and (20).

The gaseous effluent PRM noble gas channel alarm setpoint can now be calculated using the equation below:

$$CAS_j = \sum_i C^A_{ij} E_j, \ cpm \qquad (22)$$

where:

CAS_j = The channel alarm setpoint above background for gaseous release pathway j, cpm

C^A_{ij} = The maximum acceptable concentration of noble gas radionuclide i in the gaseous release pathway j (determined by equation (21)), μ Ci/cc

E_j = Noble gas detector efficiency of the PRM monitoring gaseous release pathway j, cpm per μCi/cc

3.7.2 Skin Dose Rate Setpoint

To ensure compliance with the CPS RETS 3.11.2.1a skin dose rate limit, PRM setpoints shall be calculated using the methodology presented in section 3.7.1 and by substituting the following equation for equation (19):

$$Q_{Tj} = \frac{3000\ F_j}{(X/Q)_j \sum_i (L_i + 1.1 M_i) f_{ij}}, \ \mu Ci/sec \quad (23)$$

where

Q_{Tj} = The maximum acceptable release rate of all noble gases in release path j, μCi/sec

F_j = Total dose rate allocation factor assigned to release path j (varying between 0.0 and 1.0), dimensionless

3000= Skin dose rate limit specified in CPS RETS 3.11.2.1a, mrem/year

$(X/Q)_j$ = The highest relative concentration of release path j at the site boundary

= $(\overline{X/Q})_m$ or $(x/q)_m$ depending on duration of release, sec/m^3 (reference section 3.5.1)

L_i = The skin dose factor due to gamma emissions for each identified noble gas radionuclide i, mrad/yr per $\mu Ci/m^3$, as listed in Table 3.4-1 of this Manual.

1.1 = An air dose to skin dose equivalent conversion factor, mrem/mrad

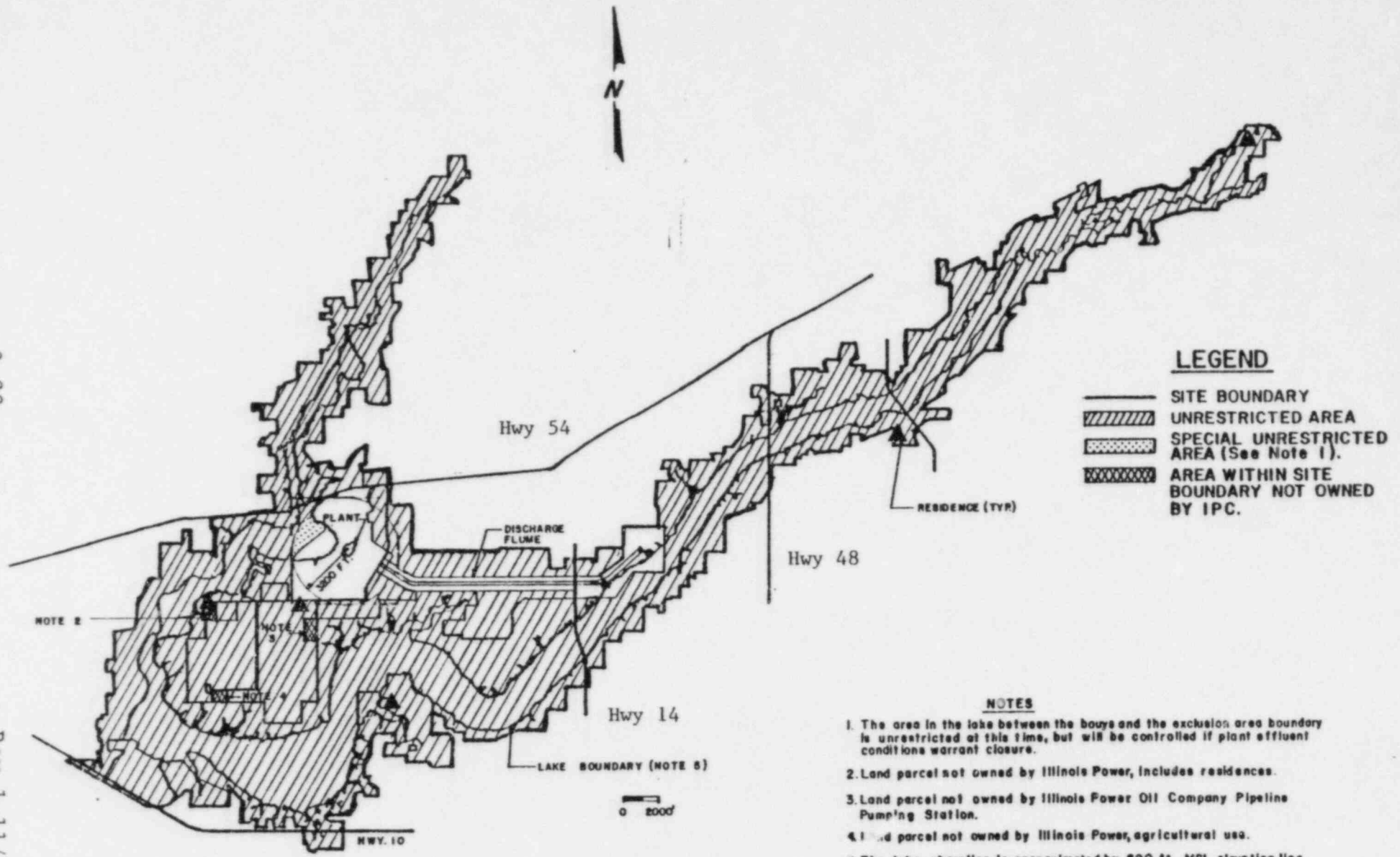
M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide i, mrad/yr per $\mu Ci/m^3$, as listed in Table 3.4-1 of this Manual

f_{ij} = The fraction defined by equation (18)

The calculated total body and skin dose rate channel alarm setpoints shall be compared and the more restrictive setpoint used. A safety factor may also be applied to the setpoint calculated by equation (22) to compensate for statistical fluctuations and measurement errors.

Figure 3.1-1

CPS SITE BOUNDARY FOR GASEOUS EFFLUENTS

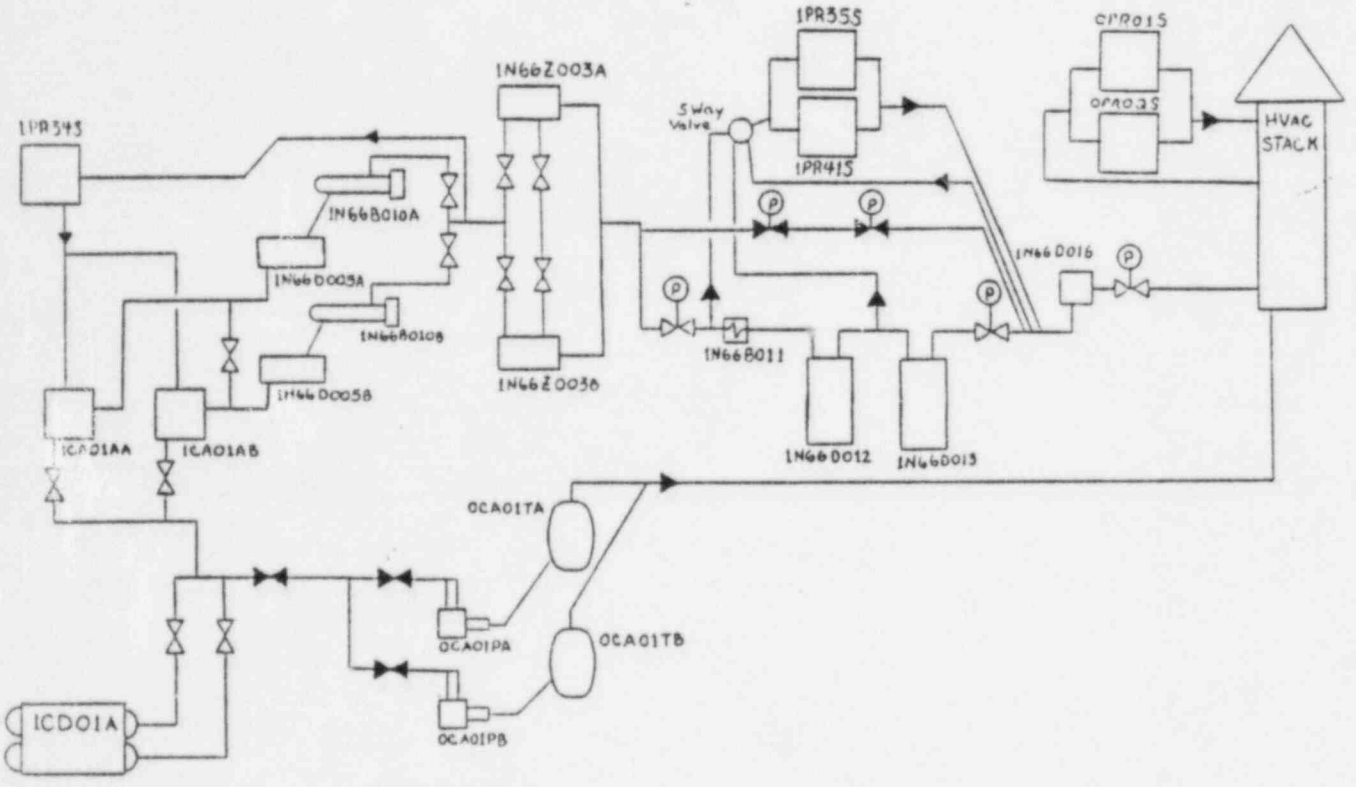


NOTES

1. The area in the lake between the bouys and the exclusion area boundary is unrestricted at this time, but will be controlled if plant effluent conditions warrant closure.
2. Land parcel not owned by Illinois Power, includes residences.
3. Land parcel not owned by Illinois Power Oil Company Pipeline Pumping Station.
4. Land parcel not owned by Illinois Power, agricultural use.
5. The lake shoreline is approximated by 690 ft. MSL elevation line.

FIGURE 3.3-1

MAIN CONDENSER OFF-GAS TREATMENT SYSTEM



1CD01A Main Condenser	OCA01TA CV Separator Tank A	1N66B010B Cooler Condenser B	1N66D013 Charcoal Adsorber	1PR35S Off-Gas Post Treatment PRM
1CA01AA Steam Jet Air Ejector A	OCA01TB CV Separator Tank B	1N66Z003A Dessicant Dryer A	1N66D016 HEPA Filter	1PR41S Off-Gas Post Treatment PRM
1CA01AB Steam Jet Air Ejector B	1N66D005A Recombiner A	1N66Z003B Dessicant Dryer B	OPR01S HVAC Stack PRM #1	
OCA01PA Condenser Vacuum (CV) Pump A	1N66D005B Recombiner B	1N66B011 Gas Cooler	OPR02S HVAC Stack PRM #2	
OCA01PB CV Pump B	1N66B010A Cooler Condenser A	1N66D012 Charcoal Adsorber	1PR34S Off-Gas Pretreatment PRM	

Table 3.5-1

INHALATION DOSE FACTORS FOR INFANT - $(DFA_i)_a$

(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-05	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

Table 3.5-1 (continued)

INHALATION DOSE FACTORS FOR INFANT - $(DFA_i)_a$

(mrem per pCi inhaled)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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
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-05	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	7.29E-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	1.87E-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

Table 3.5-1 (continued)

INHALATION DOSE FACTORS FOR INFANT - $(DFA_i)_a$

(mrem per pCi inhaled)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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-05	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	6.26F-07
BA-139	1.06E-09	7.03E-13	3.07E-11	NO DATA	4.73E-13	4.25E-06	3.64E-05
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

* 1.89×10^{-05}
** Less than 10^{-24}

Table 3.5-2

INHALATION DOSE FACTORS FOR CHILD - $(DFA_i)_a$

(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	2.81E-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

Table 3.5-2 (continued)

INHALATION DOSE FACTORS FOR CHILD - $(DFA_i)_a$

(mrem per pCi inhaled)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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
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
AC-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	8.18E-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

Table 3.5-2 (continued)

INHALATION DOSE FACTORS FOR CHILD - $(DFA_i)_a$

(mrem per pCi inhaled)

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

* 9.70×10^{-06}

** Less than 10^{-24}

Table 3.5-3

INHALATION DOSE FACTORS FOR TEEN - $(DFA_i)_a$

(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

Table 3.5-3 (continued)

INHALATION DOSE FACTORS FOR TEEN - $(DFA_i)_a$

(mrem per pCi inhaled)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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
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	9.35E-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
AG1-10m	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

Table 3.5-3 (continued)

INHALATION DOSE FACTORS FOR TEEN - $(DFA_i)_a$

(mrem per pCi inhaled)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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
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-05	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	6.51E-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

* 3.52×10^{-06}
** Less than 10^{-24}

Table 3.5-4

INHALATION DOSE FACTORS FOR ADULT - $(DFA_i)_a$

(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	NO DATA	2.04E-09
BR-83	NO DATA	NO DATA	3.01E-08	NO DATA	NO DATA	NO DATA	2.90E-08
BR-84	NO DATA	NO DATA	3.91E-08	NO DATA	NO DATA	NO DATA	2.05E-13
BR-85	NO DATA	NO DATA	1.60E-09	NO DATA	NO DATA	NO DATA	LT E-24**
RB-86	NO DATA	1.69E-05	7.37E-06	NO DATA	NO DATA	NO DATA	2.08E-06
RB-88	NO DATA	4.84E-08	2.41E-08	NO DATA	NO DATA	NO DATA	4.18E-19
RB-89	NO DATA	3.20E-08	2.12E-08	NO DATA	NO DATA	NO DATA	1.16E-21
SR-89	3.80E-05	NO DATA	1.09E-06	NO DATA	NO DATA	1.75E-04	4.37E-05
SR-90	1.24E-02	NO DATA	7.62E-04	NO DATA	NO DATA	1.20E-03	9.02E-05

Table 3.5-4 (continued)

INHALATION DOSE FACTORS FOR ADULT - $(DFA_i)_a$

(mrem per pCi inhaled)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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
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-07
I-131	3.15E-06	4.47E-06	2.56E-06	1.49E-03	7.66E-06	NO DATA	7.85E-07

Table 3.5-4 (continued)

INHALATION DOSE FACTORS FOR ADULT - $(DFA_i)_a$

(mrem per pCi inhaled)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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
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	4.20E-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

* 2.27×10^{-06}
** Less than 10^{-24}

TABLE 3.5-5

GROUND PLANE DOSE FACTORS - DFG_i

(mrem/hr per pCi/m²)

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-6	1.70E-08	2.00E-08
NI-63	0.0	0.0
NI-65	3.70E-09	4.30E-09
CU-64	1.50E-09	1.70E-09
ZN-65	4.00E-09	4.60E-09
ZN-69	0.0	0.0
BR-83	6.40E-11	9.30E-11
BR-84	1.20E-08	1.40E-08
BR-85	0.0	0.0
RB-86	6.30E-10	7.20E-10
RB-88	3.50E-09	4.00E-09
RB-89	1.50E-08	1.80E-08
SR-89	5.60E-13	6.50E-13
SR-91	7.10E-09	8.30E-09
SR-92	9.00E-09	1.00E-08
Y-90	2.20E-12	2.60E-12
Y-91m	3.80E-09	4.40E-09
Y-91	2.40E-11	2.70E-11
Y-92	1.60E-09	1.90E-09
Y-93	5.70E-10	7.80E-10
ZR-95	5.00E-09	5.80E-09
ZR-97	5.50E-09	6.40E-09
NB-95	5.10E-09	6.00E-09
MO-99	1.90E-09	2.20E-09
TC-99m	9.60E-10	1.10E-09
TC-101	2.70E-09	3.00E-09
RU-103	3.60E-09	4.20E-09
RU-105	4.50E-09	5.10E-09
RU-106	1.50E-09	1.80E-09
AG-110m	1.80E-08	2.10E-08

Table 3.5-5 (Continued)

GROUND PLANE DOSE FACTORS - DFG_i

(mrem/hr per pCi/m²)

ELEMENT	TOTAL BODY	SKIN
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
TE-131m	8.40E-09	9.90E-09
TE-131	2.20E-09	2.60E-09
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

*2.50×10^{-08}

TABLE 3.5-6

INGESTION DOSE FACTORS FOR INFANT - $(DFL_i)_a$

(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	4.34E-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

TABLE 3.5-6 (continued)

INGESTION DOSE FACTORS FOR INFANT - $(DFL_i)_a$

(mrem per pCi ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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
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	2.04E-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

TABLE 3.5-6 (continued)

INGESTION DOSE FACTORS FOR INFANT - $(DFL_i)_a$

(mrem per pCi ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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
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

* 2.37×10^{-05}
** Less than 10^{-24}

TABLE 3.5-7

INGESTION DOSE FACTORS FOR CHILD - $(DFL_i)_a$

(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-06	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

TABLE 3.5-7 (continued)

INGESTION DOSE FACTORS FOR CHILD - $(DFL_i)_a$

(mrem per pCi ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	3.82E-10	NO DATA	1.30E-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
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-04	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

TABLE 3.5-7 (continued)

INGESTION DOSE FACTORS FOR CHILD - $(DFL_i)_a$

(mrem per pCi ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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
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	1.10E-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	8.97E-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

*1.21 X 10^{-05}
** Less than 10^{-24}

TABLE 3.5-8

INGESTION DOSE FACTORS FOR TEEN - $(DFL_i)_a$

(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

TABLE 3.5-8 (continued)

INGESTION DOSE FACTORS FOR TEEN - $(DFL_i)_a$

(mrem per pCi ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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
Y-93	3.83E-09	NO DATA	1.05E-10	NO DATA	NO DATA	NO DATA	1.17E-04
ZR-95	4.12E-08	1.80E-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	6.4-E-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-06	NO DATA	3.18E-07
I-133	2.01E-06	3.41E-06	1.04E-06	4.76E-04	5.98E-06	NO DATA	2.58E-06
I-134	1.46E-07	3.87E-07	1.39E-07	6.45E-06	6.10E-07	NO DATA	5.10E-09

TABLE 3.5-8 (continued)

INGESTION DOSE FACTORS FOR TEEN - $(DFL_i)_a$

(mrem per pCi ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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
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

* 4.06×10^{-06}
** Less than 10^{-24}

TABLE 3.5-9

INGESTION DOSE FACTORS FOR ADULT - $(DFL_i)_a$

(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

TABLE 3.5-9 (continued)

INGESTION DOSE FACTORS FOR ADULT - $(DFL_i)_a$

(mrem per pCi ingested)

UCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	9.09E-11	NO DATA	3.52E-12	NO DATA	NO DATA	NO DATA	2.67E-10
Y-91	1.41E-07	NO DATA	3.77E-09	NO DATA	NO DATA	NO DATA	7.76E-05
Y-92	8.45E-10	NO DATA	2.47E-11	NO DATA	NO DATA	NO DATA	1.48E-05
Y-93	2.68E-09	NO DATA	6.40E-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

TABLE 3.5-9 (continued)

INGESTION DOSE FACTORS FOR ADULT - $(DFL_i)_a$

(mrem per pCi ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	4.43E-07	1.16E-06	4.28E-07	7.65E-05	1.86E-06	NO DATA	1.31E-06
CS-134	6.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E-06
CS-136	6.51E-06	2.57E-05	1.85E-05	NO DATA	1.43E-05	1.96E-06	2.92E-06
CS-137	7.97E-05	1.09E-04	7.14E-05	NO DATA	3.70E-05	1.23E-05	2.11E-06
CS-138	5.52E-08	1.09E-07	5.40E-08	NO DATA	8.01E-08	7.91E-09	4.65E-13
BA-139	9.70E-08	6.91E-11	2.84E-09	NO DATA	6.46E-11	3.92E-11	1.72E-07
BA-140	2.03E-05	2.55E-08	1.33E-06	NO DATA	8.67E-09	1.46E-08	4.18E-05
BA-141	4.71E-08	3.56E-11	1.59E-09	NO DATA	3.31E-11	2.02E-11	2.22E-17
BA-142	2.13E-08	2.19E-11	1.34E-09	NO DATA	1.85E-11	1.24E-11	3.00E-26
LA-140	2.50E-09	1.26E-09	3.33E-10	NO DATA	NO DATA	NO DATA	9.25E-05
LA-142	1.28E-10	5.82E-11	1.45E-11	NO DATA	NO DATA	NO DATA	4.25E-07
CE-141	9.36E-09	6.33E-09	7.18E-10	NO DATA	2.94E-09	NO DATA	2.42E-05
CE-143	1.65E-09	1.22E-06	1.35E-10	NO DATA	5.37E-10	NO DTA	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

* 2.84×10^{-06}
** Less than 10^{-24}

TABLE 3.5-10

INPUT PARAMETERS FOR CALCULATING R_{aij}^{C}

Parameter		Value	Table*
Q_F (kg/day)		50 for cow 6 for goat	E-3 E-3
U_{ap} (liters/yr)	- Infant	330	E-5
	- Child	330	E-5
	- Teen	400	E-5
	- Adult	310	E-5
Y_p (kg/m²)		0.7	E-15
Y_s (kg/m²)		2.0	E-15
F_m (days/liter)		Each stable element for cow Each stable element for goat	E-1 E-2
r (dimensionless)		1.0 for radioiodine 0.2 for particulates	E-15 E-15
t_f (seconds)		1.73×10^5 (2 days)	E-15
t_h (seconds)		7.78×10^6 (90 days)	E-15
f_s (dimensionless)		1.0 for cow 1.0 for goat	NUREG -0133 Section 5.3.1.3
f_p (dimensionless)		1.0 for cow 1.0 for goat	NUREG -0133 Section 5.3.1.3

*of Regulatory Guide 1.109 unless otherwise stated

TABLE 3.5-11

INPUT PARAMETERS FOR CALCULATING R_{aij}^{M}

Parameter	Value	Table *
U_{ap} (kg/yr) - Infant	0	E-5
- Child	41	E-5
- Teen	65	E-5
- Adult	110	E-5
F_f (days/kg)	Each stable element	E-1
t_s (seconds)	1.73E+06 (20 days)	E-15
t_h (seconds)	7.78E+06 (90 days)	E-15
Y_p (kg/m²)	0.7	E-15
Y_s (kg/m²)	2.0	E-15
r (dimensionless)	1.0 for radioiodine 0.2 for particulates	E-15 E-15
Q_f (kg/day)	50	E-3

*of Regulatory Guide 1.109

TABLE 3.5-12

INPUT PARAMETERS FOR CALCULATING R_{aij}^{V}

Parameter		Value	Table*
U_a^L (kg/yr)	- Infant	0	E-5
	- Child	26	E-5
	- Teen	42	E-5
	- Adult	64	E-5
U_a^S (kg/yr)	- Infant	0	E-5
	- Child	520	E-5
	- Teen	630	E-5
	- Adult	520	E-5
f_L (dimensionless)		1.0	E-15
f_g (dimensionless)		0.76	E-15
t_L (seconds		8.6×10^4 (1 day)	E-15
t_h (seconds)		5.18×10^6 (60 days)	E-15
Y_v (kg/m²)		2.0	E-15

* of Regulatory Guide 1.109

TABLE 3.5-13

INHALATION PATHWAY DOSE RATE FACTORS - R^{I}_{aij} (INFANT)

(mrem/yr per μCi/m³)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	6.47E+02*	6.47E+02*	6.47E+02*	6.47E+02*	6.47E+02*	6.47E+02*
C-14	2.65E+04	5.31E+03	5.32E+03	5.31E+03	5.31E+03	5.31E+03	5.31E+03
NA-24	1.06E+04	1.06E+04	1.06E+04	1.06E+04	1.06E+04	1.06E+04	1.06E+04
P-32	2.03E+06	1.12E+05	7.74E+04	NO DATA	NO DATA	NO DATA	1.61E+04
CR-51	NO DATA	NO DATA	8.95E+01	5.75E+01	1.32E+01	1.28E+04	3.57E+02
MN-54	NO DATA	2.53E+04	4.98E+03	NO DATA	4.98E+03	1.00E+06	7.06E+03
MN-56	NO DATA	1.54E+00	2.21E-01	NO DATA	1.10E+00	1.25E+04	7.17E+04
FE-55	1.97E+04	1.17E+04	3.33E+03	NO DATA	NO DATA	8.69E+04	1.09E+03
FE-59	1.36E+04	2.35E+04	9.48E+03	NO DATA	NO DATA	1.02E+06	2.48E+04
CO-58	NO DATA	1.22E+03	1.82E+03	NO DATA	NO DATA	7.77E+05	1.11E+04
CO-60	NO DATA	8.02E+03	1.18E+04	NO DATA	NO DATA	4.51E+06	3.19E+04
NI-63	3.39E+05	2.04E+04	1.16E+04	NO DATA	NO DATA	2.09E+05	2.42E+03
NI-65	2.39E+00	2.84E-01	1.23E-01	NO DATA	NO DATA	8.12E+03	5.01E+04
CU-64	NO DATA	1.88E+00	7.74E-01	NO DATA	3.98E+00	9.30E+03	1.50E+04
ZN-65	1.93E+04	6.26E+04	3.11E+04	NO DATA	3.25E+04	6.47E+05	5.14E+04
ZN-69	5.39E-02	9.67E-02	7.18E-03	NO DATA	4.02E-02	1.47E+03	1.32E+04
BR-83	NO DATA	NO DATA	3.81E+02	NO DATA	NO DATA	NO DATA	LT1.4E-15**
BR-84	NO DATA	NO DATA	4.00E+02	NO DATA	NO DATA	NO DATA	LT1.4E-15
BR-85	NO DATA	NO DATA	2.04E+01	NO DATA	NO DATA	NO DATA	LT1.4E-15
RB-86	NO DATA	1.90E+05	8.82E+04	NO DATA	NO DATA	NO DATA	3.04E+03
RB-88	NO DATA	5.57E+02	2.87E+02	NO DATA	NO DATA	NO DATA	3.39E+02
RB-89	NO DATA	3.21E+02	2.06E+02	NO DATA	NO DATA	NO DATA	6.82E+01
SR-89	3.98E+05	NO DATA	1.14E+04	NO DATA	NO DATA	2.03E+06	6.40E+04
SR-90	4.09E+07	NO DATA	2.59E+06	NO DATA	NO DATA	1.12E+07	1.31E+05

TABLE 3.5-13 (continued)

INHALATION PATHWAY DOSE RATE FACTORS - R^{I}_{aij} (INFANT)

(mrem/yr per μCi/m³)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
SR-91	9.56E+01	NO DATA	3.46E+00	NO DATA	NO DATA	5.26E+04	7.34E+04
SR-92	1.05E+01	NO DATA	3.91E-01	NO DATA	NO DATA	2.38E+04	1.40E+05
Y-90	3.29E+03	NO DATA	8.82E+01	NO DATA	NO DATA	2.69E+05	1.04E+05
Y-91m	4.07E-01	NO DATA	1.39E-02	NO DATA	NO DATA	2.79E+03	2.35E+03
Y-91	5.88E+05	NO DATA	1.57E+04	NO DATA	NO DATA	2.45E+06	7.03E+04
Y-92	1.64E+01	NO DATA	4.61E-01	NO DATA	NO DATA	2.45E+04	1.27E+05
Y-93	1.50E+02	NO DATA	4.07E+00	NO DATA	NO DATA	7.64E+04	1.67E+05
ZR-95	1.15E+05	2.79E+04	2.03E+04	NO DATA	3.11E+04	1.75E+06	2.17E+04
ZR-97	1.50E+02	2.56E+01	1.17E+01	NO DATA	2.59E+01	1.10E+05	1.40E+05
NB-95	1.57E+04	6.43E+03	3.78E+03	NO DATA	4.72E+03	4.79E+05	1.27E+04
MO-99	NO DATA	1.65E+02	3.23E+01	NO DATA	2.65E+02	1.35E+05	4.87E+04
TC-99m	1.40E-03	2.88E-03	3.72E-02	NO DATA	3.11E-02	8.11E+02	2.03E+03
TC-101	6.51E-05	8.23E-05	8.12E-04	NO DATA	9.79E-04	5.84E+02	8.44E+02
RU-103	2.02E+03	NO DATA	6.97E+02	NO DATA	4.24E+03	5.52E+05	1.61E+04
RU-105	1.22E+00	NO DATA	4.10E-01	NO DATA	8.99E-01	1.57E+04	4.84E+04
RU-106	8.68E+04	NO DATA	1.09E+04	NO DATA	1.07E+05	1.16E+07	1.64E+05
AG-110m	9.98E+03	7.22E+03	5.00E+03	NO DATA	1.09E+04	3.67E+06	3.30E+04
TE-125m	4.76E+03	1.99E+03	6.58E+02	1.62E+03	NO DATA	4.47E+05	1.29E+04
TE-127m	1.67E+04	6.90E+03	2.07E+03	4.87E+03	3.75E+04	1.31E+06	2.73E+04
TE-127	2.23E+00	9.53E-01	4.89E-01	1.85E+00	4.86E+00	1.03E+04	2.44E+04
TE-129m	1.41E+04	6.09E+03	2.23E+03	5.47E+03	3.18E+04	1.68E+06	6.90E+04
TE-129	7.88E-02	3.47E+02	1.88E-02	6.75E-02	1.75E-01	3.00E+03	2.63E+04
TE-131m	1.07E+02	5.50E+01	3.63E+01	8.93E+01	2.65E+02	1.99E+05	1.19E+05
TE-131	1.74E-02	8.22E-03	5.00E-03	1.58E-02	3.99E-02	2.06E+03	8.22E+03
TE-132	3.72E+02	2.37E+02	1.76E+02	2.79E+02	1.03E+03	3.40E+05	4.41E+04
I-130	6.36E+03	1.39E+04	5.57E+03	1.60E+06	1.53E+04	NO DATA	1.99E+03
I-131	3.79E+04	4.44E+04	1.96E+04	1.48E+07	5.18E+04	NO DATA	1.06E+03

TABLE 3.5-13 (continued)

INHALATION PATHWAY DOSE RATE FACTORS - R^{I}_{aij}(INFANT)

(mrem/yr per μCi/m³)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-132	1.69E+03	3.54E+03	1.26E+03	1.69E+05	3.95E+03	NO DATA	1.90E+03
I-133	1.32E+04	1.92E+04	5.60E+03	3.56E+06	2.24E+04	NO DATA	2.16E+03
I-134	9.21E+02	1.88E+03	6.65E+04	4.45E+04	2.09E+03	NO DATA	1.29E+03
I-135	3.86E+03	7.60E+03	2.77E+03	6.96E+05	8.47E+03	NO DATA	1.83E+03
CS-134	3.96E+05	7.03E+05	7.45E+04	NO DATA	1.90E+05	7.97E+04	1.33E+03
CS-136	4.83E+04	1.35E+05	5.29E+04	NO DATA	5.64E+04	1.18E+04	1.43E+03
CS-137	5.49E+05	6.12E+05	4.55E+04	NO DATA	1.72E+05	7.13E+04	1.33E+03
CS-138	5.05E+02	7.81E+02	3.98E+02	NO DATA	4.10E+02	6.54E+01	8.76E+02
BA-139	1.48E+00	9.84E-04	4.30E-02	NO DATA	5.92E-04	5.95E+03	5.10E+04
BA-140	5.60E+04	5.60E+01	2.90E+03	NO DATA	1.34E+01	1.60E+06	3.84E+04
BA-141	1.57E-01	1.08E-14	4.97E-03	NO DATA	6.50E-05	2.97E+03	4.75E+03
BA-142	3.98E-02	3.30E-05	1.96E-03	NO DATA	1.90E-05	1.55E+03	6.93E+02
LA-140	5.05E+02	2.00E+02	5.15E+01	NO DATA	NO DATA	1.68E+05	8.48E+04
LA-142	1.03E+00	3.77E-01	9.04E-02	NO DATA	NO DATA	8.22E+03	5.95E+04
CE-141	2.77E+04	1.67E+04	1.99E+03	NO DATA	5.25E+03	5.17E+05	2.16E+04
CE-143	2.93E+02	1.93E+02	2.21E+01	NO DATA	5.64E+01	1.16E+05	4.97E+04
CE-144	3.19E+06	1.21E+06	1.76E+05	NO DATA	5.38E+05	9.84E+06	1.48E+05
PR-143	1.40E+04	5.24E+03	6.99E+02	NO DATA	1.97E+03	4.33E+05	3.72E+04
PR-144	4.79E-02	1.85E-02	2.41E-03	NO DATA	6.72E-03	1.61E+03	4.28E+03
ND-147	7.94E+03	8.13E+03	5.00E+02	NO DATA	3.15E+03	3.22E+05	3.12E+04
W-187	1.30E+01	9.02E+00	3.12E+00	NO DATA	NO DATA	3.96E+04	3.56E+04
NP-239	3.71E+02	3.32E+01	1.88E+01	NO DATA	6.62E+01	5.95E+04	2.49E+04

* 6.47×10^{2}
** Less than 1.40×10^{-15}

TABLE 3.5-14

INHALATION PATHWAY DOSE RATE FACTORS - R^{I}_{aij}(CHILD)

(mrem/yr per μCi/m³)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	1.12E+03*	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03
C-14	3.58E+04	6.73E+03	6.73E+03	6.73E+03	6.73E+03	6.73E+03	6.73E+03
NA-24	1.61E+04	1.61E+04	1.61E+04	1.61E+04	1.61E+04	1.61E+04	1.61E+04
P-32	2.60E+06	1.14E+05	9.87E+04	NO DATA	NO DATA	NO DATA	4.21E+04
CR-51	NO DATA	NO DATA	1.54E+02	8.54E+01	2.43E+01	1.70E+04	1.08E+03
MN-54	NO DATA	4.29E+04	9.51E+03	NO DATA	1.00E+04	1.58E+06	2.29E+04
MN-56	NO DATA	1.66E+00	3.12E-01	NO DATA	1.67E+00	1.31E+04	1.23E+05
FE-55	4.74E+04	2.52E+04	7.77E+03	NO DATA	NO DATA	1.11E+05	2.87E+03
FE-59	2.07E+04	3.34E+04	1.67E+04	NO DATA	NO DATA	1.27E+06	7.07E+04
CO-58	NO DATA	1.77E+03	3.16E+03	NO DATA	NO DATA	1.11E+06	3.44E+04
CO-60	NO DATA	1.31E+04	2.26E+04	NO DATA	NO DATA	7.07E+06	9.62E+04
NI-63	8.21E+05	4.63E+04	2.80E+04	NO DATA	NO DATA	2.75E+05	6.33E+03
NI-65	2.99E+00	2.96E-01	1.64E-01	NO DATA	NO DATA	8.18E+03	8.40E+04
CU-64	NO DATA	1.99E+00	1.07E+00	NO DATA	6.03E+00	9.58E+03	3.67E+04
ZN-65	4.26E+04	1.13E+05	7.03E+04	NO DATA	7.14E+04	9.95E+05	1.63E+04
ZN-69	6.70E-02	9.66E-02	8.92E-03	NO DATA	5.85E-02	1.42E+03	1.02E+04
BR-83	NO DATA	NO DATA	4.74E+02	NO DATA	NO DATA	NO DATA	LT3.70E-15**
BR-84	NO DATA	NO DATA	2.19E-14	NO DATA	NO DATA	NO DATA	LT3.70E-15
BR-85	NO DATA	NO DATA	2.53E+01	NO DATA	NO DATA	NO DATA	LT3.70E-15
RB-86	NO DATA	1.98E+05	1.14E+05	NO DATA	NO DATA	NO DATA	7.99E+03
RB-88	NO DATA	5.62E+02	3.66E+02	NO DATA	NO DATA	NO DATA	1.72E+01
RB-89	NO DATA	2.90E+02	2.89E+02	NO DATA	NO DATA	NO DATA	1.89E+00
SR-89	5.99E+05	NO DATA	1.72E+04	NO DATA	NO DATA	2.16E+06	1.67E+05
SR-90	1.01E+08	NO DATA	6.44E+06	NO DATA	NO DATA	1.48E+07	3.43E+05
SR-91	1.21E+02	NO DATA	4.59E+00	NO DATA	NO DATA	5.33E+04	1.74E+05
SR-92	1.31E+01	NO DATA	5.25E-01	NO DATA	NO DATA	2.40E+04	2.42E+05
Y-90	4.11E+03	NO DATA	1.11E+02	NO DATA	NO DATA	2.62E+05	2.66E+05

TABLE 3.5-14 (continued)

INHALATION PATHWAY DOSE RATE FACTORS - R^{I}_{aij}(CHILD)

(mrem/yr per μCi/m³)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	5.07E-01	NO DATA	1.84E-02	NO DATA	NO DATA	2.81E+03	1.72E+03
Y-91	9.14E+05	NO DATA	2.44E+04	NO DATA	NO DATA	2.63E+06	1.84E+05
Y-92	2.04E+01	NO DATA	5.81E-01	NO DATA	NO DATA	2.39E+04	2.39E+05
Y-93	1.86E+02	NO DATA	5.11E+00	NO DATA	NO DATA	7.44E+04	3.89E+05
ZR-95	1.90E+05	4.18E+04	3.70E+04	NO DATA	5.96E+04	2.23E+06	6.11E+04
ZR-97	1.88E+02	2.72E+01	1.60E+01	NO DATA	3.89E+01	1.13E+05	3.51E+05
NB-95	2.35E+04	9.18E+03	6.55E+03	NO DATA	8.62E+03	6.14E+05	3.70E+04
MO-99	NO DATA	1.72E+02	4.26E+01	NO DATA	3.92E+02	1.35E+05	1.27E+05
TC-99m	1.78E-03	3.48E-03	5.77E-02	NO DATA	5.07E-02	9.51E+02	4.81E+03
TC-101	8.10E-05	8.51E-05	1.08E-03	NO DATA	1.45E-03	5.84E+02	1.63E+01
RU-103	2.79E+03	NO DATA	1.07E+03	NO DATA	7.03E+03	6.62E+05	4.48E+04
RU-105	1.53E+00	NO DATA	5.55E-01	NO DATA	1.34E+00	1.59E+04	9.95E+04
RU-106	1.36E+05	NO DATA	1.69E+04	NO DATA	1.84E+05	1.43E+07	4.29E+05
AG-110m	1.69E+04	1.14E+04	9.14E+03	NO DATA	2.12E+04	5.48E+06	1.00E+05
TE-125m	6.73E+03	2.33E+03	9.14E+02	1.92E+03	NO DATA	4.77E+05	3.38E+04
TE-127m	2.49E+04	8.55E+03	3.02E+03	6.07E+03	6.36E+04	1.48E+06	7.14E+04
TE-127	2.77E+00	9.51E-01	6.11E-01	1.96E+00	7.07E+00	1.00E+04	5.62E+04
TE-129m	1.92E+04	6.85E+03	3.04E+03	6.33E+03	5.03E+04	1.76E+06	1.82E+05
TE-129	9.77E-02	3.50E-02	2.38E-02	7.14E-02	2.57E-01	2.93E+03	2.55E+04
TE-131m	1.34E+02	5.92E+01	5.07E+01	9.77E+01	4.00E+02	2.06E+05	3.08E+05
TE-131	2.17E-02	8.44E-03	6.59E-03	1.70E-02	5.88E-02	2.05E+03	1.33E+03
TE-132	4.81E+02	2.72E+02	2.63E+02	3.17E+02	1.77E+03	3.77E+05	1.38E+05
I-130	8.18E+03	1.64E+04	8.44E+03	1.85E+06	2.45E+04	NO DATA	5.11E+03
I-131	4.81E+04	4.81E+04	2.73E+04	1.62E+07	7.88E+04	NO DATA	2.84E+03
I-132	2.12E+03	4.07E+03	1.88E+03	1.94E+05	6.25E+03	NO DATA	3.20E+03
I-133	1.66E+04	2.03E+04	7.70E+03	3.85E+06	3.38E+04	NO DATA	5.48E+03
I-134	1.17E+03	2.16E+03	9.95E+02	5.07E+04	3.30E+03	NO DATA	9.54E+02

TABLE 3.5-14 (continued)

INHALATION PATHWAY DOSE RATE FACTORS - R^{I}_{aij} (CHILD)

(mrem/yr per $\mu Ci/m^3$)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	4.92E+03	8.73E+03	4.14E+03	7.92E+05	1.34E+04	NO DATA	4.44E+03
CS-134	6.51E+05	1.01E+06	2.25E+05	NO DATA	3.30E+05	1.21E+05	3.85E+03
CS-136	6.51E+04	1.71E+05	1.16E+05	NO DATA	9.55E+04	1.45E+04	4.18E+03
CS-137	9.07E+05	8.25E+05	1.28E+05	NO DATA	2.82E+05	1.04E+05	3.62E+03
CS-138	6.33E+02	8.40E+02	5.55E+02	NO DATA	6.22E+02	6.81E+01	2.70E+02
BA-139	1.84E+00	9.84E-04	5.37E-02	NO DATA	8.62E-04	5.77E+03	5.77E+04
BA-140	7.40E+04	6.48E+01	4.33E+03	NO DATA	2.11E+01	1.74E+06	1.02E+05
BA-141	1.96E-01	1.09E-04	6.36E-03	NO DATA	9.47E-05	2.92E+03	2.75E+02
BA-142	5.00E-02	3.60E-05	2.79E-03	NO DATA	2.91E-05	1.64E+03	2.74E+00
LA-140	6.44E+02	2.25E+02	7.55E+01	NO DATA	NO DATA	1.83E+05	2.26E+05
LA-142	1.30E+00	4.11E-01	1.29E-01	NO DATA	NO DATA	8.70E+03	7.59E+04
CE-141	3.92E+04	1.95E+04	2.90E+03	NO DATA	8.55E+03	5.44E+05	5.66E+04
CE-143	3.66E+02	1.99E+02	2.87E+01	NO DATA	8.36E+01	1.15E+05	1.27E+05
CE-144	6.77E+06	2.12E+06	3.61E+05	NO DATA	1.17E+06	1.20E+07	3.89E+05
PR-143	1.85E+04	5.55E+03	9.14E+02	NO DATA	3.00E+03	4.33E+05	9.73E+04
PR-144	5.96E-02	1.85E-02	3.00E-03	NO DATA	9.77E-03	1.57E+03	1.97E+02
ND-147	1.08E+04	8.73E+03	6.81E+02	NO DATA	4.81E+03	3.28E+05	8.21E+04
W-187	1.63E+01	9.66E+00	4.33E+00	NO DATA	NO DATA	4.11E+04	9.10E+04
NP-239	4.66E+02	3.34E+01	2.35E+01	NO DATA	9.73E+01	5.81E+04	6.40E+04

* 1.12×10^{3}
** Less than 3.70×10^{-15}

TABLE 3.5-15

INHALATION PATHWAY DOSE RATE FACTORS - R^{I}_{aij}(TEEN)

(mrem/yr per μCi/m³)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	1.27E+03*	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03
C-14	2.60E+04	4.87E+03	4.87E+03	4.87E+03	4.87E+03	4.87E+03	4.87E+03
NA-24	1.38E+04	1.38E+04	1.38E+04	1.38E+04	1.38E+04	1.38E+04	1.38E+04
P-32	1.89E+06	1.10E+05	7.16E+04	NO DATA	NO DATA	NO DATA	9.28E+04
CR-51	NO DATA	NO DATA	1.35E+02	7.50E+01	3.07E+01	2.10E+04	3.00E+03
MN-54	NO DATA	5.11E+04	8.40E+03	NO DATA	1.27E+04	1.98E+06	6.68E+04
MN-56	NO DATA	1.70E+00	2.52E-01	NO DATA	1.79E+00	1.52E+04	5.74E+04
FE-55	3.34E+04	2.38E+04	5.54E+03	NO DATA	NO DATA	1.24E+05	6.39E+03
FE-59	1.59E+04	3.70E+04	1.43E+04	NO DATA	NO DATA	1.53E+06	1.78E+05
CO-58	NO DATA	2.07E+03	2.78E+03	NO DATA	NO DATA	1.34E+06	9.52E+04
CO-60	NO DATA	1.51E+04	1.98E+04	NO DATA	NO DATA	8.72E+06	2.59E+05
NI-63	5.80E+05	4.34E+04	1.98E+04	NO DATA	NO DATA	3.07E+05	1.42E+04
NI-65	2.18E+00	2.93E-01	1.27E-01	NO DATA	NO DATA	9.36E+03	3.67E+04
CU-64	NO DATA	2.03E+00	8.48E-01	NO DATA	6.41E+00	1.11E+04	6.14E+04
ZN-65	3.86E+04	1.34E+05	6.24E+04	NO DATA	8.64E+04	1.24E+06	4.66E+04
ZN-69	4.83E-02	9.20E-02	6.46E-03	NO DATA	6.02E-02	1.58E+03	2.85E+02
BR-83	NO DATA	NO DATA	3.44E+02	NO DATA	NO DATA	NO DATA	LT8E-15**
BR-84	NO DATA	NO DATA	4.33E+02	NO DATA	NO DATA	NO DATA	LT8E-15
BR-85	NO DATA	NO DATA	1.83E+01	NO DATA	NO DATA	NO DATA	LT8E-15
RB-86	NO DATA	1.90E-05	8.40E+04	NO DATA	NO DATA	NO DATA	1.77E+04
RB-88	NO DATA	5.46E+02	2.72E+02	NO DATA	NO DATA	NO DATA	2.92E-05
RB-89	NO DATA	3.52E+02	2.33E+02	NO DATA	NO DATA	NO DATA	3.38E-07
SR-89	4.34E-05	NO DATA	1.25E+04	NO DATA	NO DATA	2.42E+06	3.71E+05
SR-90	1.08E+08	NO DATA	6.68E+06	NO DATA	NO DATA	1.65E+07	7.65E+05
SR-91	8.80E+01	NO DATA	3.51E+00	NO DATA	NO DATA	6.07E+04	2.59E+05
SR-92	9.52E+00	NO DATA	4.06E-01	NO DATA	NO DATA	2.74E+04	1.19E+05
Y-90	2.98E+03	NO DATA	8.00E+01	NO DATA	NO DATA	2.93E+05	5.59E+05

TABLE 3.5-15 (continued)

INHALATION PATHWAY DOSE RATE FACTORS - R^{I}_{aij}(TEEN)

(mrem/yr per μCi/m³)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	3.70E-01	NO DATA	1.42E-02	NO DATA	NO DATA	3.20E+03	3.02E+01
Y-91	6.61E+05	NO DATA	1.77E+04	NO DATA	NO DATA	2.94E+06	4.09E+05
Y-92	1.47E+01	NO DATA	4.29E-01	NO DATA	NO DATA	2.68E+04	1.65E+05
Y-93	1.35E+02	NO DATA	3.72E+00	NO DATA	NO DATA	8.32E+04	5.79E+05
ZR-95	1.46E+05	4.58E+04	3.15E+04	NO DATA	6.74E+04	2.69E+06	1.49E+05
ZR-97	1.38E+02	2.72E+01	1.26E+01	NO DATA	4.12E+01	1.30E+05	6.30E+05
NB-95	1.86E+04	1.03E+04	5.66E+03	NO DATA	1.00E+04	7.51E+05	9.68E+04
MO-99	NO DATA	1.69E+02	3.22E+01	NO DATA	4.11E+02	1.54E+05	2.69E+05
TC-99m	1.38E-03	3.86E-03	4.99E-02	NO DATA	5.76E-02	1.15E+03	6.13E+03
TC-101	5.92E-05	8.40E-05	8.24E-04	NO DATA	1.52E-03	6.67E+02	8.72E-07
RU-103	2.10E+03	NO DATA	8.96E+02	NO DATA	7.43E+03	7.83E+05	1.09E+05
RU-105	1.12E+00	NO DATA	4.34E-01	NO DATA	1.41E+00	1.82E+04	9.04E+04
RU-106	9.84E+04	NO DATA	1.24E+04	NO DATA	1.90E+05	1.61E+07	9.60E+05
AG-110m	1.38E+04	1.31E+04	7.99E+03	NO DATA	2.50E+04	6.75E+06	2.73E+05
TE-125m	4.88E+03	2.24E+03	6.67E+02	1.40E+03	NO DATA	5.36E+05	7.50E+04
TE-127m	1.80E+04	8.16E+03	2.18E+03	4.38E+03	6.54E+04	1.66E+06	1.59E+05
TE-127	2.01E+00	9.12E-01	4.42E-01	1.42E+00	7.28E+00	1.12E+04	8.88E+04
TE-129m	1.39E+04	6.58E+03	2.25E+03	4.58E+03	5.19E+04	1.98E+06	4.05E+05
TE-129	7.10E-02	3.38E-02	1.76E-02	5.18E-02	2.66E-01	3.30E+03	1.62E+03
TE-131m	9.84E+01	6.01E+01	4.02E+01	7.25E+01	4.39E+02	2.38E+05	6.21E+05
TE-131	1.58E-02	8.32E-03	5.04E-03	1.24E-02	6.18E-02	2.34E+03	1.51E+01
TE-132	3.60E+02	2.90E+02	2.19E+02	2.46E+02	1.95E+03	4.49E+05	4.63E+05
I-130	6.24E+03	1.59E+04	7.17E+03	1.49E+06	2.75E+04	NO DATA	9.12E+03
I-131	3.54E+04	4.91E+04	2.64E+04	1.46E+07	8.40E+04	NO DATA	6.49E+03
I-132	1.59E+03	4.38E+03	1.58E+03	1.51E+05	6.92E+03	NO DATA	1.27E+03
I-133	1.22E+04	2.05E+04	6.22E+03	2.92E+06	3.59E+04	NO DATA	1.03E+04
I-134	8.88E+02	2.32E+03	8.40E+02	3.95E+04	3.66E+03	NO DATA	2.04E+01

TABLE 3.5-15 (continued)

INHALATION PATHWAY DOSE RATE FACTORS - R^{I}_{aij}(TEEN)

(mrem/yr per μCi/m³)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	3.70E+03	9.44E+03	3.49E+03	6.21E+05	1.49E+04	NO DATA	6.95E+03
CS-134	5.02E+05	1.12E+06	5.49E+05	NO DATA	3.75E+05	1.46E+05	9.76E+03
CS-136	5.15E+04	1.94E+05	1.37E+05	NO DATA	1.10E+05	1.78E+04	1.09E+04
CS-137	6.70E+05	8.48E+05	3.11E+05	NO DATA	3.04E+05	1.21E+05	8.48E+03
CS-138	4.66E+02	8.56E+02	4.46E+02	NO DATA	6.62E+02	7.87E+01	2.70E-01
BA-139	1.34E+00	9.44E-04	3.90E-02	NO DATA	8.88E-04	6.46E+03	6.45E+03
BA-140	5.47E+04	6.70E+01	3.52E+03	NO DATA	2.28E+01	2.03E+06	2.29E+05
BA-141	1.42E-01	1.06E-04	4.74E-03	NO DATA	9.84E-05	3.29E+03	7.46E-04
BA-142	3.70E-02	3.70E-05	2.27E-03	NO DATA	3.14E-05	1.91E+03	4.79E-10
LA-140	4.79E+02	2.36E+02	6.26E+01	NO DATA	NO DATA	2.14E+05	4.87E+05
LA-142	9.60E-01	4.25E-01	1.05E-01	NO DATA	NO DATA	1.02E+04	1.20E+04
CE-141	2.84E+04	1.90E+04	2.17E+03	NO DATA	8.88E+03	6.14E+05	1.26E+05
CE-143	2.66E+02	1.94E+02	2.16E+01	NO DATA	8.64E+01	1.30E+05	2.55E+05
CE-144	4.89E+06	2.02E+06	2.62E+05	NO DATA	1.21E+06	1.34E+07	8.64E+05
PR-143	1.34E+04	5.31E+03	6.62E+02	NO DATA	3.09E+03	4.83E+05	2.14E+05
PR-144	4.30E-02	1.76E-02	2.18E-03	NO DATA	1.01E-02	1.75E+03	2.35E-04
ND-147	7.86E+03	8.56E+03	5.13E+02	NO DATA	5.02E+03	3.72E+05	1.82E+05
W-187	1.20E+01	9.76E+00	3.43E+00	NO DATA	NO DATA	4.74E+04	1.77E+05
NP-239	3.38E+02	3.19E+01	1.77E+01	NO DATA	1.00E+02	6.49E+04	1.32E+05

* 1.27×10^{3}
** Less than 8.00×10^{-15}

TABLE 3.5-16

INHALATION PATHWAY DOSE RATE FACTORS - R^{I}_{aij}(ADULT)

(mrem/yr per μCi/m³)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	1.26E+03*	1.26E+03	1.26E+03	1.26E+03	1.26E+03	1.26E+03
C-14	1.82E+04	3.41E+03	3.41E+03	3.41E+03	3.41E+03	3.41E+03	3.41E+03
NA-24	1.02E+04	1.02E+04	1.02E+04	1.02E+04	1.02E+04	1.02E+04	1.02E+04
P-32	1.32E+06	7.71E+04	5.01E+04	NO DATA	NO DATA	NO DATA	8.64E+04
CR-51	NO DATA	NO DATA	1.00E+02	5.95E+01	2.28E+01	1.44E+04	3.32E+03
MN-54	NO DATA	3.96E+04	6.30E+03	NO DATA	9.84E+03	1.40E+06	7.74E+04
MN-56	NO DATA	1.24E+00	1.83E-01	NO DATA	1.30E+00	9.44E+03	2.02E+04
FE-55	2.46E+04	1.70E+04	3.94E+03	NO DATA	NO DATA	7.21E+04	6.03E+03
FE-59	1.18E+04	2.78E+04	1.06E+04	NO DATA	NO DATA	1.02E+06	1.88E+05
CO-58	NO DATA	1.58E+03	2.07E+03	NO DATA	NO DATA	9.28E+05	1.06E+05
CO-60	NO DATA	1.15E+04	1.48E+04	NO DATA	NO DATA	5.97E+06	2.85E+05
NI-63	4.32E+05	3.14E+04	1.45E+04	NO DATA	NO DATA	1.78E+05	1.34E+04
NI-65	1.54E+00	2.10E-01	9.12E-02	NO DATA	NO DATA	5.60E+03	1.23E+04
CU-64	NO DATA	1.46E+00	6.15E-01	NO DATA	4.62E+00	6.78E+03	4.90E+04
ZN-65	3.24E+04	1.03E+05	4.66E+04	NO DATA	6.90E+04	8.64E+05	5.34E+04
ZN-69	3.38E-02	6.51E-02	4.52E-03	NO DATA	4.22E-02	9.20E+02	1.63E+01
BR-83	NO DATA	NO DATA	2.41E+02	NO DATA	NO DATA	NO DATA	2.32E+02
BR-84	NO DATA	NO DATA	3.13E+02	NO DATA	NO DATA	NO DATA	1.64E-03
BR-85	NO DATA	NO DATA	1.28E+01	NO DATA	NO DATA	NO DATA	LT8E-15**
RB-86	NO DATA	1.35E+05	5.90E+04	NO DATA	NO DATA	NO DATA	1.66E+04
RB-88	NO DATA	3.87E+02	1.93E+02	NO DATA	NO DATA	NO DATA	3.34E-09
RB-89	NO DATA	2.56E+02	1.70E+02	NO DATA	NO DATA	NO DATA	9.28E-12
SR-89	3.04E+05	NO DATA	8.72E+03	NO DATA	NO DATA	1.40E+06	3.50E+05
SR-90	9.92E+07	NO DATA	6.10E+06	NO DATA	NO DATA	9.60E+06	7.22E+05
SR-91	6.19E+01	NO DATA	2.50E+00	NO DATA	NO DATA	3.65E+04	1.91E+05
SR-92	6.74E+00	NO DATA	2.91E-01	NO DATA	NO DATA	1.65E+04	4.30E+04
Y-90	2.09E+03	NO DATA	5.61E+01	NO DATA	NO DATA	1.70E+05	5.06E+05

TABLE 3.5-16 (continued)

INHALATION PATHWAY DOSE RATE FACTORS - R^{I}_{aij} (ADULT)

(mrem/yr per μCi/m³)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	2.61E-01	NO DATA	1.02E-02	NO DATA	NO DATA	1.92E+03	1.33E+00
Y-91	4.62E+05	NO DATA	1.24E+04	NO DATA	NO DATA	1.70E+06	3.85E+05
Y-92	1.03E+01	NO DATA	3.02E-01	NO DATA	NO DATA	1.57E+04	7.35E+04
Y-93	9.44E+01	NO DATA	2.61E+00	NO DATA	NO DATA	4.85E+04	4.22E+05
ZR-95	1.07E+05	3.44E+04	2.33E+04	NO DATA	5.42E+04	1.77E+06	1.50E+05
ZR-97	9.68E+01	1.96E+01	9.04E+00	NO DATA	2.97E+01	7.87E+04	5.23E+05
NB-95	1.41E+04	7.82E+03	4.21E+03	NO DATA	7.74E+03	5.05E+05	1.04E+05
MO-99	NO DATA	1.21E+02	2.30E+01	NO DATA	2.91E+02	9.12E+04	2.48E+05
TC-99m	1.03E-03	2.91E-03	3.70E-02	NO DATA	4.42E-02	7.64E+02	4.16E+03
TC-101	4.18E-05	6.02E-05	5.90E-04	NO DATA	1.08E-13	3.99E+02	1.09E-11
RU-103	1.53E+03	NO DATA	6.58E+02	NO DATA	5.83E+03	5.05E+05	1.10E+05
RU-105	7.90E-01	NO DATA	3.11E-01	NO DATA	1.02E+00	1.10E+04	4.82E+04
RU-106	6.91E+04	NO DATA	8.72E+03	NO DATA	1.34E+05	9.36E+06	9.12E+05
AG-110m	1.08E+04	1.00E+04	5.94E+03	NO DATA	1.97E+04	4.63E+06	3.02E+05
TE-125m	3.42E+03	1.58E+03	4.67E+02	1.05E+03	1.24E+04	3.14E+05	7.06E+04
TE-127m	1.26E+04	5.77E+03	1.57E+03	3.29E+03	4.58E+04	9.60E+05	1.50E+05
TE-127	1.40E+00	6.42E-01	3.10E-01	1.06E+00	5.10E+00	6.51E+03	5.74E+04
TE-129m	9.76E+03	4.67E+03	1.58E+03	3.44E+03	3.66E+04	1.16E+06	3.83E+05
TE-129	4.98E-02	2.39E-02	1.24E-02	3.90E-02	1.87E-01	1.94E+03	1.57E+02
TE-131m	6.99E+01	4.36E+01	2.90E+01	5.50E+01	3.09E+02	1.46E+05	5.56E+05
TE-131	1.11E-02	5.95E-03	3.59E-03	9.36E-03	4.37E-02	1.39E+03	1.84E+01
TE-132	2.60E+02	2.15E+02	1.62E+02	1.90E+02	1.46E+03	2.88E+05	5.10E+05
I-130	4.58E+03	1.34E+04	5.28E+03	1.14E+06	2.09E+04	NO DATA	7.69E+03
I-131	2.52E+04	3.58E+04	2.05E+04	1.19E+07	6.13E+04	NO DATA	6.28E+03
I-132	1.16E+03	3.26E+03	1.16E+03	1.14E+05	5.18E+03	NO DATA	4.06E+02
I-133	8.64E+03	1.48E+04	4.52E+03	2.15E+06	2.58E+04	NO DATA	8.88E+03
I-134	6.44E+02	1.73E+03	6.13E+02	2.98E+04	2.75E+03	NO DATA	1.01E+00

TABLE 3.5-16 (continued)

INHALATION PATHWAY DOSE RATE FACTORS - R^{I}_{aij} (ADULT)

(mrem/yr per uCi/m^3)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	2.68E+03	6.98E+03	2.57E+03	4.48E+05	1.11E+04	NO DATA	5.25E+03
CS-134	3.73E+05	8.48E+05	7.28E+05	NO DATA	2.87E+05	9.76E+04	1.04E+04
CS-136	3.90E+04	1.46E+05	1.10E+05	NO DATA	8.56E+04	1.20E+04	1.17E+04
CS-137	4.78E+05	6.21E+05	4.28E+05	NO DATA	2.22E+05	7.52E+04	8.40E+03
CS-138	3.31E+02	6.21E+02	3.24E+02	NO DATA	4.80E+02	4.86E+01	1.86E-03
BA-139	9.36E-01	6.66E-04	2.74E-02	NO DATA	6.22E-04	3.76E+03	8.96E+02
BA-140	3.90E+04	4.90E+01	2.57E+03	NO DATA	1.67E+01	1.27E+06	2.18E+05
BA-141	1.00E-01	7.53E-05	3.36E-03	NO DATA	7.00E-05	1.94E+03	1.16E-07
BA-142	2.63E-02	2.70E-05	1.66E-03	NO DATA	2.29E-05	1.19E+03	1.57E-16
LA-140	3.44E+02	1.74E+02	4.58E+01	NO DATA	NO DATA	1.36E+05	4.58E+05
LA-142	6.83E-01	3.10E-01	7.72E-02	NO DATA	NO DATA	6.33E+03	2.11E+03
CE-141	1.99E+04	1.35E+04	1.53E+03	NO DATA	6.26E+03	3.62E+05	1.20E+05
CE-143	1.86E+02	1.38E+02	1.53E+01	NO DATA	6.08E+01	7.98E+04	2.26E+05
CE-144	3.43E+06	1.43E+06	1.84E+05	NO DATA	8.48E+05	7.78E+06	8.16E+05
PR-143	9.36E+03	3.75E+03	4.64E+02	NO DATA	2.16E+03	2.81E+05	2.00E+05
PR-144	3.01E-02	1.25E-02	1.53E-03	NO DATA	7.05E-03	1.02E+03	2.15E-08
ND-147	5.27E+03	6.10E+03	3.65E+02	NO DATA	3.56E+03	2.21E+05	1.73E+05
W-187	8.48E+00	7.08E+00	2.48E+00	NO DATA	NO DATA	2.90E+04	1.55E+05
NP-239	2.30E+02	2.26E+01	1.24E+01	NO DATA	7.00E+01	3.76E+04	1.19E+05

* 1.26×10^{3}

** Less than 8.00×10^{-15}

TABLE 3.5-17

COW MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (INFANT)

(m²mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	2.38E+03*	2.38E+03*	2.38E+03*	2.38E+03*	2.38E+03*	2.38E+03*
C-14	2.69E+06*	5.73E+05*	5.73E+05*	5.73E+05*	5.73E+05*	5.73E+05*	5.73E+05*
NA-24	1.55E+07**	1.55E+07	1.55E+07	1.55E+07	1.55E+07	1.55E+07	1.55E+07
P-32	1.60E+11	9.41E+09	6.20E+09	NO DATA	NO DATA	NO DATA	2.16E+09
CR-51	NO DATA	NO DATA	1.61E+05	1.05E+05	2.29E+04	2.04E+05	4.69E+06
MN-54	NO DATA	3.90E+07	8.84E+06	NO DATA	8.64E+06	NO DATA	1.43E+07
MN-56	NO DATA	3.12E-02	5.39E-03	NO DATA	2.69E-02	NO DATA	2.84E+00
FE-55	1.35E+08	8.72E+07	2.33E+07	NO DATA	NO DATA	4.26E+07	1.11E+07
FE-59	2.25E+08	3.92E+08	1.55E+08	NO DATA	NO DATA	1.16E+08	1.87E+08
CO-58	NO DATA	2.43E+07	6.06E+07	NO DATA	NO DATA	NO DATA	6.05E+07
CO-60	NO DATA	8.82E+07	2.08E+08	NO DATA	NO DATA	NO DATA	2.10E+08
NI-63	3.50E+10	2.16E+09	1.21E+09	NO DATA	NO DATA	NO DATA	1.08E+08
NI-65	3.52E+00	3.98E-01	1.81E-01	NO DATA	NO DATA	NO DATA	3.03E+01
CU-64	NO DATA	1.84E+05	8.52E+04	NO DATA	3.11E+05	NO DATA	3.78E+06
ZN-65	5.58E+09	1.91E+10	8.82E+09	NO DATA	9.27E+09	NO DATA	1.61E+10
ZN-69	1.94E-11	3.49E-11	2.60E-12	NO DATA	1.45E-11	NO DATA	2.85E-09
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	2.23E+10	1.10E+10	NO DATA	NO DATA	NO DATA	5.70E+08
RB-88	NO DATA	1.88E-44	1.03E-44	NO DATA	NO DATA	NO DATA	1.83E-44
RB-89	NO DATA	3.43E-52	2.36E-52	NO DATA	NO DATA	NO DATA	1.17E-52
SR-89	1.26E+10	NO DATA	3.61E+08	NO DATA	NO DATA	NO DATA	2.59E+08
SR-90	1.22E+11	NO DATA	3.10E+10	NO DATA	NO DATA	NO DATA	1.52E+09
SR-91	2.71E+05	NO DATA	9.79E+03	NO DATA	NO DATA	NO DATA	3.20E+05
SR-92	4.68E+00	NO DATA	1.74E-01	NO DATA	NO DATA	NO DATA	5.05E+01
Y-90	6.83E+02	NO DATA	1.83E+01	NO DATA	NO DATA	NO DATA	9.43E+05

TABLE 3.5-17 (continued)

COW MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (INFANT)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	6.09E-19	NO DATA	2.08E-20	NO DATA	NO DATA	NO DATA	2.03E-15
Y-91	7.33E+04	NO DATA	1.95E+03	NO DATA	NO DATA	NO DATA	5.26E+06
Y-92	5.35E-04	NO DATA	1.50E-05	NO DATA	NO DATA	NO DATA	1.02E+01
Y-93	2.14E+00	NO DATA	5.83E-02	NO DATA	NO DATA	NO DATA	1.69E+04
ZR-95	6.82E+03	1.66E+03	1.18E+03	NO DATA	1.79E+03	NO DATA	8.28E+05
ZR-97	4.03E+00	6.91E-01	3.16E-01	NO DATA	6.96E-01	NO DATA	4.41E+04
NB-95	1.35E+04	5.57E+03	3.22E+03	NO DATA	3.99E+03	NO DATA	4.70E+06
MO-99	NO DATA	2.07E+08	4.04E+07	NO DATA	3.10E+08	NO DATA	6.83E+07
TC-99m	2.75E+01	5.66E+01	7.29E+02	NO DATA	6.09E+02	2.96E+01	1.64E+04
TC-101	2.29E-59	2.89E-59	2.86E-58	NO DATA	3.43E-58	1.58E-59	4.91E-57
RU-103	8.72E+03	NO DATA	2.92E+03	NO DATA	1.81E+04	NO DATA	1.06E+05
RU-105	8.00E-03	NO DATA	2.70E-03	NO DATA	5.88E-02	NO DATA	3.18E+00
RU-106	1.91E+05	NO DATA	2.38E+04	NO DATA	2.26E+05	NO DATA	1.45E+06
AG-110m	3.85E+08	2.81E+08	1.86E+08	NO DATA	4.02E+08	NO DATA	1.46E+10
TE-125m	1.51E+08	5.05E+07	2.04E+07	5.08E+07	NO DATA	NO DATA	7.19E+07
TE-127m	4.22E+08	1.40E+08	5.10E+07	1.22E+08	1.04E+09	NO DATA	1.70E+08
TE-127	6.48E+03	2.17E+03	1.39E+03	5.27E+03	1.58E+04	NO DATA	1.36E+05
TE-129m	5.56E+08	1.91E+08	8.56E+07	2.14E+08	1.39E+09	NO DATA	3.32E+08
TE-129	3.24E-09	1.12E-09	7.56E-10	2.71E-09	8.06E-09	NO DATA	2.59E-07
TE-131m	3.37E+06	1.36E+06	1.12E+06	2.75E+06	9.35E+06	NO DATA	2.29E+07
TE-131	3.48E-32	1.29E-32	9.78E-33	3.11E-32	8.91E-32	NO DATA	1.41E-30
TE-132	2.12E+07	1.05E+07	9.80E+06	1.55E+07	6.57E+07	NO DATA	3.89E+07
I-130	3.53E+06	7.76E+06	3.12E+06	8.70E+08	8.53E+06	NO DATA	1.66E+06
I-131	2.71E+09	3.19E+09	1.40E+09	1.05E+12	3.73E+09	NO DATA	1.14E+08
I-132	1.43E+00	2.90E+00	1.03E+00	1.36E+02	3.24E+00	NO DATA	2.35E+00
I-133	3.63E+07	5.28E+07	1.55E+07	9.60E+09	6.21E+07	NO DATA	8.93E+06
I-134	1.64E-11	3.36E-11	1.20E-11	7.86E-10	3.76E-11	NO DATA	3.48E-11

TABLE 3.5-17 (continued)

COW MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (INFANT)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	1.13E+05	2.24E+05	8.18E+04	2.01E+07	2.50E+05	NO DATA	8.12E+04
CS-134	3.65E+10	6.81E+10	6.88E+09	NO DATA	1.75E+10	7.19E+09	1.85E+08
CS-136	1.97E+09	5.81E+09	2.17E+09	NO DATA	2.31E+09	4.73E+08	8.82E+07
CS-137	5.15E+10	6.03E+10	4.27E+09	NO DATA	1.62E+10	6.55E+09	1.89E+08
CS-138	4.46E+07	7.26E+07	3.52E+07	NO DATA	3.62E+07	5.65E+06	1.16E+08
BA-139	3.15E-05	2.09E-08	9.13E-07	NO DATA	1.26E-08	1.27E-08	2.00E-03
BA-140	2.45E+08	2.45E+05	1.26E+07	NO DATA	5.81E+04	1.50E+05	6.01E+07
BA-141	4.16E-45	2.85E-48	1.31E-46	NO DATA	1.71E-48	1.73E-48	5.08E-44
BA-142	2.32E-79	1.93E-82	1.14E-80	NO DATA	1.11E-82	1.17E-82	9.56E-79
LA-140	4.05E+01	1.60E+01	4.11E+00	NO DATA	NO DATA	NO DATA	1.88E+05
LA-142	1.73E-10	6.34E-11	1.52E-11	NO DATA	NO DATA	NO DATA	1.08E-05
CE-141	4.34E+04	2.65E+04	3.12E+03	NO DATA	8.17E+03	NO DATA	1.37E+07
CE-143	3.98E+02	2.64E+05	3.01E+01	NO DATA	7.69E+01	NO DATA	1.54E+06
CE-144	2.34E+06	9.56E+05	1.31E+05	NO DATA	3.87E+05	NO DATA	1.34E+08
PR-143	1.49E+03	5.56E+02	7.37E+01	NO DATA	2.07E+02	NO DATA	7.85E+05
PR-144	6.27E-53	2.43E-53	3.16E-54	NO DATA	8.79E-54	NO DATA	1.13E-48
ND-147	8.79E+02	9.03E+02	5.53E+01	NO DATA	3.48E+02	NO DATA	5.72E+05
W-187	6.10E+04	4.24E+04	1.46E+04	NO DATA	NO DATA	NO DATA	2.49E+06
NP-239	3.64E+01	3.26E+00	1.84E+00	NO DATA	6.49E+00	NO DATA	9.41E+04

* mrem/yr per μCi/m^3

** 1.55×10^7

TABLE 3.5-18

COW MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij}(CHILD)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	1.57E+03*	1.57E+03*	1.57E+03*	1.57E+03*	1.57E+03*	1.57E+03*
C-14	1.37E+06*	2.75E+05*	2.75E+05*	2.75E+05*	2.75E+05*	2.75E+05*	2.75E+05*
NA-24	8.93E+06**	8.93E+06	8.93E+06	8.93E+06	8.93E+06	8.93E+06	8.93E+06
P-32	7.79E+10	3.64E+09	3.00E+09	NO DATA	NO DATA	NO DATA	2.15E+09
CR-51	NO DATA	NO DATA	1.01E+05	5.63E+04	1.54E+04	1.03E+05	5.38E+06
MN-54	NO DATA	2.10E+07	5.59E+06	NO DATA	5.88E+06	NO DATA	1.76E+07
MN-56	NO DATA	1.28E-02	2.88E-03	NO DATA	1.54E-02	NO DATA	1.85E+00
FE-55	1.12E+08	5.94E+07	1.84E+07	NO DATA	NO DATA	3.36E+07	1.10E+07
FE-59	1.20E+08	1.95E+08	9.71E+07	NO DATA	NO DATA	5.65E+07	2.03E+08
CO-58	NO DATA	1.21E+07	3.71E+07	NO DATA	NO DATA	NO DATA	7.08E+07
CO-60	NO DATA	4.32E+07	1.27E+08	NO DATA	NO DATA	NO DATA	2.39E+08
NI-63	2.97E+10	1.59E+09	1.01E+09	NO DATA	NO DATA	NO DATA	1.07E+08
NI-65	1.65E+00	1.56E-01	9.10E-02	NO DATA	NO DATA	NO DATA	1.91E+01
CU-64	NO DATA	7.40E+04	4.47E+04	NO DATA	1.79E+05	NO DATA	3.47E+06
ZN-65	4.12E+08	1.10E+10	6.83E+09	NO DATA	6.92E+09	NO DATA	1.93E+09
ZN-69	9.11E-12	1.32E-11	1.22E-12	NO DATA	7.99E-12	NO DATA	8.30E-10
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	8.78E+09	5.40E+09	NO DATA	NO DATA	NO DATA	5.65E+08
RB-88	NO DATA	7.16E-45	4.98E-45	NO DATA	NO DATA	NO DATA	3.51E-46
RB-89	NO DATA	1.40E-52	1.25E-52	NO DATA	NO DATA	NO DATA	1.22E-54
SR-89	6.63E+09	NO DATA	1.89E+08	NO DATA	NO DATA	NO DATA	2.57E+08
SR-90	1.12E+11	NO DATA	2.84E+10	NO DATA	NO DATA	NO DATA	1.59E+09

TABLE 3.5-18 (continued)

COW MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij}(CHILD)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
SR-91	1.30E+05	NO DATA	4.89E+03	NO DATA	NO DATA	NO DATA	2.86E+05
SR-92	2.20E+00	NO DATA	8.83E-02	NO DATA	NO DATA	NO DATA	4.17E+01
Y-90	3.23E+02	NO DATA	8.65E+00	NO DATA	NO DATA	NO DATA	9.20E+05
Y-91m	2.88E-19	NO DATA	1.05E-20	NO DATA	NO DATA	NO DATA	5.63E-16
Y-91	3.90E+04	NO DATA	1.04E+03	NO DATA	NO DATA	NO DATA	5.20E+06
Y-92	2.53E-04	NO DATA	7.23E-06	NO DATA	NO DATA	NO DATA	7.30E+00
Y-93	1.01E+00	NO DATA	2.76E-02	NO DATA	NO DATA	NO DATA	1.50E+04
ZR-95	3.84E+03	8.44E+02	7.51E+02	NO DATA	1.21E+03	NO DATA	8.80E+05
ZR-97	1.92E+00	2.78E-01	1.64E-01	NO DATA	3.99E-01	NO DATA	4.21E+04
NB-95	7.25E+03	2.82E+03	2.02E+03	NO DATA	2.65E+03	NO DATA	5.22E+06
MO-99	NO DATA	8.15E+07	2.02E+07	NO DATA	1.74E+08	NO DATA	6.74E+07
TC-99m	5.66E+03	1.11E+04	1.84E+05	NO DATA	1.61E+05	5.63E+03	6.31E+06
TC-101	1.08E-59	1.13E-59	1.43E-58	NO DATA	1.93E-58	5.98E-60	3.60E-59
RU-103	4.29E+03	NO DATA	1.65E+03	NO DATA	1.08E+04	NO DATA	1.11E+05
RU-105	3.80E-03	NO DATA	1.38E-03	NO DATA	3.34E-02	NO DATA	2.48E+00
RU-106	9.25E+04	NO DATA	1.15E+04	NO DATA	1.25E+05	NO DATA	1.44E+06
AG-110m	2.09E+08	1.41E+08	1.13E+08	NO DATA	2.63E+08	NO DATA	1.68E+10
TE-125m	7.39E+07	2.00E+07	9.85E+06	2.07E+07	NO DATA	NO DATA	7.13E+07
TE-127m	2.08E+08	5.61E+07	2.47E+07	4.98E+07	5.94E+08	NO DATA	1.69E+08
TE-127	3.05E+03	8.22E+02	6.53E+02	2.11E+03	8.67E+05	NO DATA	1.19E+05
TE-129m	2.71E+08	7.58E+07	4.21E+07	8.74E+07	7.97E+08	NO DATA	3.31E+08
TE-129	1.53E-09	4.26E-10	3.63E-10	1.09E-09	4.47E-09	NO DATA	9.51E-08
TE-131m	1.60E+06	5.53E+05	5.88E+05	1.14E+06	5.35E+06	NO DATA	2.24E+07
TE-131	1.64E-32	5.01E-33	4.89E-33	1.26E-32	4.97E-32	NO DATA	8.63E-32
TE-132	1.03E+07	4.56E+06	5.51E+06	6.64E+06	4.23E+07	NO DATA	4.59E+07
I-130	1.72E+06	3.47E+06	1.79E+06	3.82E+08	5.19E+06	NO DATA	1.62E+06
I-131	1.30E+09	1.31E+09	7.44E+08	4.33E+11	2.15E+08	NO DATA	1.17E+08

TABLE 3.5-18 (continued)

COW MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (CHILD)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-132	6.91E-01	1.27E+00	5.84E-01	5.89E+01	1.94E+00	NO DATA	1.49E+00
I-133	1.72E+07	2.12E+07	8.03E+06	3.94E+09	3.54E+07	NO DATA	8.56E+06
I-134	7.92E-12	1.47E-11	6.77E-12	3.38E-10	2.25E-11	NO DATA	9.75E-12
I-135	5.43E+06	9.77E+04	4.62E+04	8.65E+06	1.50E+05	NO DATA	7.44E+04
CS-134	2.27E+10	3.72E+10	7.85E+09	NO DATA	1.15E+10	4.14E+09	2.01E+08
CS-136	1.01E+09	2.78E+09	1.80E+09	NO DATA	1.48E+09	2.21E+08	9.76E+07
CS-137	3.23E+10	3.09E+10	4.56E+09	NO DATA	1.01E+10	3.63E+09	1.94E+08
CS-138	2.11E+07	2.93E+07	1.86E+07	NO DATA	2.06E+07	2.22E+06	1.35E+07
BA-139	5.51E-05	2.94E-08	1.60E-06	NO DATA	2.57E-08	1.73E-08	3.18E-03
BA-140	1.18E+08	1.03E+05	6.89E+06	NO DATA	3.37E+04	6.16E+04	5.98E+07
BA-141	1.96E-45	1.10E-48	6.38E-47	NO DATA	9.50E-49	6.45E-48	1.12E-45
BA-142	1.10E-79	7.93E-83	6.15E-81	NO DATA	6.41E-83	4.66E-83	1.44E-81
LA-140	1.94E+01	6.78E+00	2.28E+00	NO DATA	NO DATA	NO DATA	1.89E+05
LA-142	8.23E-11	2.62E-11	8.21E-12	NO DATA	NO DATA	NO DATA	5.20E-06
CE-141	2.19E+04	1.09E+04	1.62E+03	NO DATA	4.78E+03	NO DATA	1.36E+07
CE-143	1.87E+02	1.02E+05	1.47E+01	NO DATA	4.26E+01	NO DATA	1.49E+06
CE-144	1.63E+06	5.10E+05	8.68E+04	NO DATA	2.82E+05	NO DATA	1.33E+08
PR-143	7.19E+02	2.16E+02	3.57E+01	NO DATA	1.17E+02	NO DATA	7.76E+05
PR-144	2.94E-53	9.10E-54	1.48E-54	NO DATA	4.81E-54	NO DATA	1.96E-50
ND-147	4.44E+02	3.59E+02	2.78E+01	NO DATA	1.97E+02	NO DATA	5.69E+05
W-187	2.88E+04	1.71E+04	7.66E+03	NO DATA	NO DATA	NO DATA	2.40E+06
NP-239	1.72E+01	1.24E+00	8.69E-01	NO DATA	3.58E+00	NO DATA	9.15E+04

* mrem/yr per μCi/m^3

** 8.93×10^6

TABLE 3.5-19

COW MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij}(TEEN)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	9.92E+02*	9.92E+02*	9.92E+02*	9.92E+02*	9.92E+02*	9.92E+02*
C-14	5.57E+05*	1.11E+05*	1.11E+05*	1.11E+05*	1.11E+05*	1.11E+05*	1.11E+05*
NA-24	4.29E+06**	4.29E+06	4.29E+06	4.29E+06	4.29E+06	4.29E+06	4.29E+06
P-32	3.15E+10	1.95E+09	1.22E+09	NO DATA	NO DATA	NO DATA	2.64E+09
CR-51	NO DATA	NO DATA	5.00E+04	2.78E+04	1.10E+04	7.14E+04	8.41E+06
MN-54	NO DATA	1.40E+07	2.78E+06	NO DATA	4.19E+06	NO DATA	2.88E+07
MN-56	NO DATA	7.32E-03	1.30E-03	NO DATA	9.26E-03	NO DATA	4.82E-01
FE-55	4.46E+07	3.16E+07	7.38E+06	NO DATA	NO DATA	2.01E+07	1.37E+07
FE-59	4.84E+08	1.13E+09	4.36E+08	NO DATA	NO DATA	3.56E+08	2.67E+09
CO-58	NO DATA	7.98E+06	1.84E+07	NO DATA	NO DATA	NO DATA	1.10E+08
CO-60	NO DATA	2.78E+07	6.26E+07	NO DATA	NO DATA	NO DATA	3.62E+08
NI-63	1.18E+10	8.34E+08	4.00E+08	NO DATA	NO DATA	NO DATA	1.33E+08
NI-65	6.79E-01	8.67E-02	3.95E-02	NO DATA	NO DATA	NO DATA	4.70E+00
CU-64	NO DATA	4.20E+04	1.97E+04	NO DATA	1.06E+05	NO DATA	3.26E+06
ZN-65	2.11E+09	7.32E+09	3.41E+09	NO DATA	4.68E+09	NO DATA	3.10E+09
ZN-69	3.70E-12	7.06E-12	4.94E-13	NO DATA	4.61E-12	NO DATA	1.30E-11
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	4.74E+09	2.23E+09	NO DATA	NO DATA	NO DATA	7.01E+08
RB-88	NO DATA	3.90E-45	2.08E-45	NO DATA	NO DATA	NO DATA	3.34E-52
RB-89	NO DATA	7.98E-53	5.64E-53	NO DATA	NO DATA	NO DATA	1.22E-61
SR-89	2.68E+09	NO DATA	7.67E+07	NO DATA	NO DATA	NO DATA	3.19E+08
SR-90	6.62E+10	NO DATA	1.64E+10	NO DATA	NO DATA	NO DATA	1.86E+09
SR-91	5.27E+04	NO DATA	2.10E+03	NO DATA	NO DATA	NO DATA	2.39E+05
SR-92	9.03E-01	NO DATA	3.85E-02	NO DATA	NO DATA	NO DATA	2.30E+01
Y-90	1.31E+02	NO DATA	3.53E+00	NO DATA	NO DATA	NO DATA	1.08E+06

TABLE 3.5-19 (continued)

COW MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij}(TEEN)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	1.18E-19	NO DATA	4.49E-21	NO DATA	NO DATA	NO DATA	5.55E-18
Y-91	1.58E+04	NO DATA	4.24E+02	NO DATA	NO DATA	NO DATA	6.48E+06
Y-92	1.03E-04	NO DATA	2.97E-06	NO DATA	NO DATA	NO DATA	2.82E+00
Y-93	4.10E-01	NO DATA	1.12E-02	NO DATA	NO DATA	NO DATA	1.25E+04
ZR-95	1.65E+03	5.20E+02	3.58E+02	NO DATA	7.64E+02	NO DATA	1.20E+06
ZR-97	7.87E-01	1.56E-01	7.17E-02	NO DATA	2.36E-01	NO DATA	4.22E+04
NB-95	3.21E+03	1.78E+03	9.79E+02	NO DATA	1.72E+03	NO DATA	7.61E+06
MO-99	NO DATA	4.46E+07	8.50E+06	NO DATA	1.02E+08	NO DATA	7.98E+07
TC-99m	5.74E+00	1.60E+01	2.08E+02	NO DATA	2.39E+02	8.89E+00	1.05E+04
TC-101	4.39E-60	6.25E-60	6.14E-59	NO DATA	1.13E-58	3.81E-60	1.07E-66
RU-103	1.81E+03	NO DATA	7.73E+02	NO DATA	6.37E+03	NO DATA	1.51E+05
RU-105	1.56E-03	NO DATA	6.06E-04	NO DATA	1.97E-02	NO DATA	1.26E+00
RU-106	3.75E+04	NO DATA	4.73E+03	NO DATA	7.23E+04	NO DATA	1.80E+06
AG-110m	9.64E+07	9.12E+07	5.55E+07	NO DATA	1.74E+08	NO DATA	2.56E+10
TE-125m	3.01E+07	1.08E+07	4.02E+06	8.41E+06	NO DATA	NO DATA	8.88E+07
TE-127m	8.43E+07	2.99E+07	1.00E+07	2.01E+07	3.42E+08	NO DATA	2.10E+08
TE-127	1.24E+03	4.38E+02	2.66E+02	8.52E+02	5.00E+03	NO DATA	9.54E+04
TE-129m	1.10E+08	4.09E+07	1.74E+07	3.56E+07	4.61E+08	NO DATA	4.14E+08
TE-129	6.18E-10	2.30E-10	1.50E-10	4.42E-10	2.59E-09	NO DATA	3.38E-09
TE-131m	6.56E+05	3.15E+05	2.63E+05	4.73E+05	3.28E+06	NO DATA	2.53E+07
TE-131	1.17E-35	4.82E-36	3.65E-36	9.01E-36	5.11E-35	NO DATA	9.60E-37
TE-132	4.29E+06	2.72E+06	2.56E+06	2.87E+06	2.61E+07	NO DATA	8.61E+07
I-130	7.33E+05	2.12E+06	8.47E+05	1.73E+08	3.27E+06	NO DATA	1.63E+06
I-131	5.36E+08	7.50E+08	4.03E+08	2.19E+11	1.29E+09	NO DATA	1.48E+08
I-132	2.90E-01	7.59E-01	2.72E-01	2.56E+01	1.20E+00	NO DATA	3.31E-01
I-133	7.06E+06	1.20E+07	3.65E+06	1.67E+09	2.10E+07	NO DATA	9.06E+06
I-134	3.34E-12	8.86E-12	3.18E-12	1.48E-10	1.40E-11	NO DATA	1.17E-13

TABLE 3.5-19 (continued)

COW MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij}(TEEN)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	2.29E+04	5.90E+04	2.19E+04	3.80E+06	9.32E+04	NO DATA	6.54E+04
CS-134	9.79E+09	2.30E+10	1.07E+10	NO DATA	7.32E+09	2.80E+09	2.87E+08
CS-136	4.48E+08	1.76E+09	1.18E+09	NO DATA	9.59E+08	1.51E+08	1.42E+08
CS-137	1.33E+10	1.77E+10	6.18E+09	NO DATA	6.03E+09	2.34E+09	2.52E+08
CS-138	8.69E+06	1.67E+07	8.34E+06	NO DATA	1.23E+07	1.43E+06	7.57E+03
BA-139	3.41E-06	2.40E-09	9.92E-08	NO DATA	2.26E-09	1.65E-09	3.04E-05
BA-140	4.91E+07	6.02E+04	3.17E+06	NO DATA	2.04E+04	4.05E+04	7.58E+07
BA-141	7.98E-46	5.96E-49	2.67E-47	NO DATA	5.53E-49	4.08E-49	1.70E-51
BA-142	4.54E-80	4.54E-83	2.80E-81	NO DATA	3.85E-83	3.02E-83	1.40E-91
LA-140	8.11E+00	3.98E+00	1.06E+00	NO DATA	NO DATA	NO DATA	2.29E+05
LA-142	3.42E-11	1.52E-11	3.78E-12	NO DATA	NO DATA	NO DATA	4.62E-07
CE-141	9.23E+03	6.16E+03	7.08E+02	NO DATA	2.90E+03	NO DATA	1.76E+07
CE-143	7.64E+01	5.55E+04	6.21E+00	NO DATA	2.49E+01	NO DATA	1.67E+06
CE-144	6.61E+05	2.73E+05	3.55E+04	NO DATA	1.63E+05	NO DATA	1.66E+08
PR-143	2.91E+02	1.16E+02	1.45E+01	NO DATA	6.75E+01	NO DATA	9.57E+05
PR-144	1.19E-53	4.88E-54	6.04E-55	NO DATA	2.80E-54	NO DATA	1.31E-56
ND-147	1.81E+02	1.97E+02	1.18E+01	NO DATA	1.16E+02	NO DATA	7.10E+05
W-187	1.19E+04	9.72E+03	3.41E+03	NO DATA	NO DATA	NO DATA	2.63E+06
NP-239	6.99E+00	6.59E-01	3.66E-01	NO DATA	2.07E+00	NO DATA	1.06E+05

* mrem/yr per μCi/m^3

** 4.29×10^6

TABLE 3.5-20

COW MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (ADULT)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	7.62E+02*	7.62E+02*	7.62E+02*	7.62E+02*	7.62E+02*	7.62E+02*
C-14	3.02E+03*	6.05E+04*	6.05E+04*	6.05E+04*	6.05E+04*	6.05E+04*	6.05E+04*
NA-24	2.46E+06**	2.46E+06	2.46E+06	2.46E+06	2.46E+06	2.46E+06	2.46E+06
P-32	1.71E+10	1.06E+09	6.61E+08	NO DATA	NO DATA	NO DATA	1.92E+09
CR-51	NO DATA	NO DATA	2.85E+04	1.70E+04	6.27E+03	3.78E+04	7.16E+06
MN-54	NO DATA	8.41E+06	1.60E+06	NO DATA	2.50E+06	NO DATA	2.58E+07
MN-56	NO DATA	4.14E-03	7.34E-04	NO DATA	5.26E-03	NO DATA	1.32E-01
FE-55	2.51E+07	1.73E+07	4.04E+06	NO DATA	NO DATA	9.68E+06	9.95E+06
FE-59	2.97E+07	6.99E+07	2.68E+07	NO DATA	NO DATA	1.95E+07	2.33E+08
CO-58	NO DATA	4.72E+06	1.06E+07	NO DATA	NO DATA	NO DATA	9.57E+07
CO-60	NO DATA	1.64E+07	3.62E+07	NO DATA	NO DATA	NO DATA	3.08E+08
NI-63	6.73E+09	4.67E+08	2.26E+08	NO DATA	NO DATA	NO DATA	9.74E+07
NI-65	3.70E-01	4.81E-02	2.19E-02	NO DATA	NO DATA	NO DATA	1.22E+00
CU-64	NO DATA	2.36E+04	1.11E+04	NO DATA	5.94E+04	NO DATA	2.01E+06
ZN-65	1.37E+09	4.37E+09	1.98E+09	NO DATA	2.93E+09	NO DATA	2.75E+09
ZN-69	2.01E-12	3.84E-12	2.67E-13	NO DATA	2.50E-12	NO DATA	5.77E-13
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	2.60E+09	1.21E+09	NO DATA	NO DATA	NO DATA	5.12E+08
RB-88	NO DATA	2.15E-45	1.14E-45	NO DATA	NO DATA	NO DATA	2.97E-56
RB-89	NO DATA	4.49E-53	3.16E-53	NO DATA	NO DATA	NO DATA	2.61E-66
SR-89	1.45E+09	NO DATA	4.16E+07	NO DATA	NO DATA	NO DATA	2.33E+08
SR-90	4.68E+10	NO DATA	1.15E+10	NO DATA	NO DATA	NO DATA	1.35E+09
SR-91	2.87E+04	NO DATA	1.16E+03	NO DATA	NO DATA	NO DATA	1.37E+05
SR-92	4.92E-01	NO DATA	2.13E-02	NO DATA	NO DATA	NO DATA	9.76E+00
Y-90	7.10E+01	NO DATA	1.90E+00	NO DATA	NO DATA	NO DATA	7.53E+05

TABLE 3.5-20 (continued)

COW MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (ADULT)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	9.44E-20	NO DATA	2.49E-21	NO DATA	NO DATA	NO DATA	1.89E-19
Y-91	8.60E+03	NO DATA	2.30E+02	NO DATA	NO DATA	NO DATA	4.73E+06
Y-92	5.57E-05	NO DATA	1.63E-06	NO DATA	NO DATA	NO DATA	9.75E-01
Y-93	2.22E-01	NO DATA	6.12E-03	NO DATA	NO DATA	NO DATA	7.03E+03
ZR-95	9.45E+02	3.03E+02	2.05E+02	NO DATA	4.76E+02	NO DATA	9.61E+05
ZR-97	4.32E-01	8.71E-02	3.98E-02	NO DATA	1.32E-01	NO DATA	2.70E-04
NB-95	1.88E+03	1.04E+03	5.62E+02	NO DATA	1.03E+03	NO DATA	6.34E+06
MO-99	NO DATA	2.48E+07	4.72E+06	NO DATA	5.61E+07	NO DATA	5.74E+07
TC-99m	3.31E+00	9.35E+00	1.19E+02	NO DATA	1.42E+02	4.58E+00	5.53E+03
TC-101	2.40E-60	3.46E-60	3.39E-59	NO DATA	6.23E-59	1.77E-60	1.04E-71
RU-103	1.02E+03	NO DATA	4.39E+02	NO DATA	3.89E+03	NO DATA	1.19E+05
RU-105	8.52E-04	NO DATA	3.36E-04	NO DATA	1.10E-02	NO DATA	5.21E-01
RU-106	2.04E+04	NO DATA	2.58E+03	NO DATA	3.94E+04	NO DATA	1.32E+06
AG-110m	5.82E+07	5.39E+07	3.20E+07	NO DATA	1.06E+08	NO DATA	2.20E+10
TE-125m	1.63E+07	5.91E+06	2.19E+06	4.91E+06	6.64E+07	NO DATA	6.52E+07
TE-127m	4.58E+07	1.64E+07	5.58E+06	1.17E+07	1.86E+08	NO DATA	1.53E+08
TE-127	6.67E+02	2.39E+02	1.44E+02	4.94E+02	2.71E+03	NO DATA	5.26E+04
TE-129m	6.01E+07	2.24E+07	9.52E+06	2.07E+07	2.51E+08	NO DATA	3.03E+08
TE-129	3.39E-10	1.27E-10	8.26E-11	2.60E-10	1.43E-09	NO DATA	2.56E-10
TE-131m	3.60E+05	1.76E+05	1.47E+05	2.79E+05	1.78E+06	NO DATA	1.75E+07
TE-131	3.68E-33	1.54E-33	1.16E-33	3.03E-33	1.61E-32	NO DATA	5.22E-34
TE-132	2.41E+06	1.56E+06	1.46E+06	1.72E+06	1.50E+07	NO DATA	7.36E+07
I-130	4.16E+05	1.23E+06	4.84E+05	1.04E+08	1.91E+06	NO DATA	1.06E+06
I-131	2.97E+08	4.24E+08	2.43E+08	1.39E+11	7.27E+08	NO DATA	1.12E+08
I-132	1.65E-01	4.40E-01	1.54E-01	1.54E+01	7.02E-01	NO DATA	8.27E-02
I-133	3.86E+06	6.72E+06	2.05E+06	9.87E+08	1.17E+07	NO DATA	6.04E+06
I-134	1.89E-12	5.13E-12	1.83E-12	8.88E-11	8.15E-12	NO DATA	4.47E-15

TABLE 3.5-20 (continued)

COW MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (ADULT)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	1.29E+04	3.39E+04	1.25E+04	2.23E+06	5.43E+04	NO DATA	3.83E+04
CS-134	5.67E+09	1.35E+10	1.10E+10	NO DATA	4.37E+09	1.45E+09	2.36E+08
CS-136	2.64E+08	1.04E+09	7.49E+08	NO DATA	5.79E+08	7.94E+07	1.18E+08
CS-137	7.39E+09	1.01E+10	6.62E+09	NO DATA	3.43E+09	1.14E+09	1.96E+08
CS-138	4.79E+06	9.46E+06	4.69E+06	NO DATA	6.95E+06	6.87E+05	4.04E+01
BA-139	3.58E-07	2.55E-10	1.05E-08	NO DATA	2.38E-10	1.45E-10	6.35E-07
BA-140	2.72E+07	3.42E+04	1.78E-06	NO DATA	1.16E+04	1.96E+04	5.60E+07
BA-141	4.33E-46	3.27E-49	1.46E-47	NO DATA	3.04E-49	1.86E-49	2.04E-55
BA-142	2.51E-80	2.58E-83	1.58E-81	NO DATA	2.18E-83	1.46E-83	3.54E-98
LA-140	4.53E+00	2.28E+00	6.03E-01	NO DATA	NO DATA	NO DATA	1.67E+05
LA-142	1.89E-11	8.61E-12	2.15E-12	NO DATA	NO DATA	NO DATA	6.29E-08
CE-141	4.84E+03	3.27E+03	3.71E+02	NO DATA	1.52E+03	NO DATA	1.25E+07
CE-143	4.16E+01	3.07E+04	3.40E+00	NO DATA	1.35E+01	NO DATA	1.15E+06
CE-144	3.58E+05	1.50E+05	1.92E+04	NO DATA	8.87E+04	NO DATA	1.21E+08
PR-143	1.58E+02	6.35E+01	7.84E+00	NO DATA	3.66E+01	NO DATA	6.93E+05
PR-144	6.47E-54	2.69E-54	3.29E-55	NO DATA	1.52E-54	NO DATA	9.31E-61
ND-147	9.44E+01	1.09E+02	6.53E+00	NO DATA	6.38E+01	NO DATA	5.24E+05
W-187	6.50E+03	5.43E+03	1.90E+03	NO DATA	NO DATA	NO DATA	1.73E+06
NP-239	3.67E+00	3.60E-01	1.99E-01	NO DATA	1.12E+00	NO DATA	7.39E+04

* mrem/yr per μCi/m^3

** 2.46×10^6

TABLE 3.5-21

GOAT MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (INFANT)

(m²mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	4.86E+03*	4.86E+03*	4.86E+03*	4.86E+03*	4.86E+03*	4.86E+03*
C-14	5.48E+06*	1.17E+06*	1.17E+06*	1.17E+06*	1.17E+06*	1.17E+06*	1.17E+06*
NA-24	1.87E+06**	1.87E+06	1.87E+06	1.87E+06	1.87E+06	1.87E+06	1.87E+06
P-32	1.90E+11	1.12E+10	7.38E+09	NO DATA	NO DATA	NO DATA	2.58E+09
CR-51	NO DATA	NO DATA	1.93E+04	1.26E+04	2.75E+03	2.45E+04	5.63E+05
MN-54	NO DATA	4.68E+06	1.06E+06	NO DATA	1.04E+06	NO DATA	1.72E+06
MN-56	NO DATA	3.75E-03	6.46E-04	NO DATA	3.22E-03	NO DATA	3.40E-01
FE-55	1.75E+06	1.13E+06	3.02E+05	NO DATA	NO DATA	5.53E+05	1.44E+05
FE-59	2.91E+06	5.08E+06	2.00E+06	NO DATA	NO DATA	1.50E+06	2.43E+06
CO-58	NO DATA	2.90E+06	7.24E+06	NO DATA	NO DATA	NO DATA	7.23E+06
CO-60	NO DATA	1.06E+07	2.49E+07	NO DATA	NO DATA	NO DATA	2.51E+07
NI-63	4.18E+10	2.58E+09	1.45E+09	NO DATA	NO DATA	NO DATA	1.29E+08
NI-65	4.20E-01	4.76E-02	2.16E-02	NO DATA	NO DATA	NO DATA	3.62E+00
CU-64	NO DATA	2.04E+04	9.45E+03	NO DATA	3.45E+04	NO DATA	4.19E+05
ZN-65	6.64E+08	2.28E+09	1.05E+09	NO DATA	1.10E+09	NO DATA	1.92E+09
ZN-69	2.32E-12	4.18E-12	3.11E-13	NO DATA	1.74E-12	NO DATA	3.41E-10
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	2.65E+09	1.31E+09	NO DATA	NO DATA	NO DATA	6.79E+07
RB-88	NO DATA	2.25E-45	1.23E-45	NO DATA	NO DATA	NO DATA	2.19E-45
RB-89	NO DATA	4.09E-53	2.82E-53	NO DATA	NO DATA	NO DATA	1.39E-53
SR-89	2.64E+10	NO DATA	7.56E+08	NO DATA	NO DATA	NO DATA	5.42E+08
SR-90	2.55E+11	NO DATA	6.50E+10	NO DATA	NO DATA	NO DATA	3.19E+09
SR-91	5.65E+05	NO DATA	2.05E+04	NO DATA	NO DATA	NO DATA	6.69E+05
SR-92	9.83E+00	NO DATA	3.65E-01	NO DATA	NO DATA	NO DATA	1.06E+02
Y-90	8.19E+01	NO DATA	2.19E+00	NO DATA	NO DATA	NO DATA	1.13E+05

TABLE 3.5-21 (continued)

GOAT MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (INFANT)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	7.29E-20	NO DATA	2.48E-21	NO DATA	NO DATA	NO DATA	2.43E-16
Y-91	8.78E+03	NO DATA	2.34E+02	NO DATA	NO DATA	NO DATA	6.29E+05
Y-92	6.40E-05	NO DATA	1.80E-06	NO DATA	NO DATA	NO DATA	1.22E+00
Y-93	2.55E-01	NO DATA	6.95E-03	NO DATA	NO DATA	NO DATA	2.02E+03
ZR-95	8.16E+02	1.99E+02	1.41E+02	NO DATA	2.14E+02	NO DATA	9.90E+04
ZR-97	4.85E-01	8.33E-02	3.80E-02	NO DATA	8.40E-02	NO DATA	5.31E+03
NB-95	1.62E+03	6.66E+02	3.85E+02	NO DATA	4.77E+02	NO DATA	5.62E+05
MO-99	NO DATA	2.48E+07	4.84E+06	NO DATA	3.71E+07	NO DATA	8.18E+06
TC-99m	3.26E+00	6.73E+00	8.67E+01	NO DATA	7.24E+01	3.52E+00	1.96E+03
TC-101	2.72E-60	3.43E-60	3.40E-59	NO DATA	4.08E-59	1.87E-60	5.83E-58
RU-103	1.04E+03	NO DATA	3.47E+02	NO DATA	2.16E+03	NO DATA	1.26E+04
RU-105	9.57E-02	NO DATA	3.22E-02	NO DATA	7.04E-01	NO DATA	3.81E+01
RU-106	2.28E+04	NO DATA	2.84E+03	NO DATA	2.69E+04	NO DATA	1.73E+05
AG-110m	4.62E+07	3.37E+07	2.23E+07	NO DATA	4.83E+07	NO DATA	1.75E+09
TE-125m	1.80E+07	6.02E+06	2.43E+06	6.06E+06	NO DATA	NO DATA	8.58E+06
TE-127m	5.04E+07	1.67E+07	6.10E+06	1.46E+07	1.24E+08	NO DATA	2.03E+07
TE-127	7.71E+02	2.58E+02	1.66E+02	6.28E+02	1.88E+03	NO DATA	1.62E+04
TE-129m	6.68E+07	2.29E+07	1.03E+07	2.57E+07	1.67E+08	NO DATA	3.99E+07
TE-129	3.89E-10	1.34E-10	9.08E-11	3.26E-10	9.69E-10	NO DATA	3.11E-08
TE-131m	4.04E+05	1.63E+05	1.34E+05	3.30E+05	1.12E+06	NO DATA	2.74E+06
TE-131	4.19E-33	1.55E-33	1.18E-33	3.74E-33	1.07E-32	NO DATA	1.69E-31
TE-132	2.54E+06	1.26E+06	1.17E+06	1.85E+06	7.86E+06	NO DATA	4.65E+06
I-130	4.22E+06	9.28E+06	3.73E+06	1.04E+09	1.02E+07	NO DATA	1.99E+06
I-131	3.25E+09	3.83E+09	1.69E+09	1.26E+12	4.48E+09	NO DATA	1.37E+08
I-132	1.73E+00	3.50E+00	1.25E+00	1.64E+02	3.91E+00	NO DATA	2.84E+00
I-133	4.34E+07	6.32E+07	1.85E+07	1.15E+10	7.43E+07	NO DATA	1.07E+07
I-134	1.97E-11	4.04E-11	1.44E-11	9.42E-10	4.52E-11	NO DATA	4.18E-11

TABLE 3.5-21 (continued)

GOAT MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (INFANT)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	1.36E+05	2.70E+05	9.85E+04	2.42E+07	3.01E+05	NO DATA	9.77E+04
CS-134	1.09E+11	2.04E-11	2.06E+10	NO DATA	5.25E+10	2.15E+10	5.54E+08
CS-136	5.92E+09	1.74E+10	6.50E+09	NO DATA	6.94E+09	1.42E+09	2.64E+08
CS-137	1.54E+11	1.80E+11	1.28E+10	NO DATA	4.84E+10	1.96E+10	5.63E+08
CS-138	1.33E+08	2.16E+08	1.05E+08	NO DATA	1.08E+08	1.68E+07	3.45E+08
BA-139	3.77E-06	2.50E-09	1.09E-07	NO DATA	1.50E-09	1.52E-09	2.39E-04
BA-140	2.87E+07	2.87E+04	1.48E+06	NO DATA	6.82E+03	1.76E+04	7.06E+06
BA-141	4.97E-46	3.40E-49	1.57E-47	NO DATA	2.05E-49	2.07E-49	6.07E-45
BA-142	2.76E-80	2.30E-83	1.36E-81	NO DATA	1.32E-83	1.39E-83	1.14E-79
LA-140	4.83E+00	1.91E+00	4.90E-01	NO DATA	NO DATA	NO DATA	2.24E+04
LA-142	2.07E-11	7.60E-12	1.82E-12	NO DATA	NO DATA	NO DATA	1.29E-06
CE-141	5.20E+03	3.17E+03	3.73E+02	NO DATA	9.78E+02	NO DATA	1.64E+06
CE-143	4.75E+01	3.15E+04	3.60E+00	NO DATA	9.18E+00	NO DATA	1.84E+05
CE-144	2.79E+05	1.14E+05	1.56E+04	NO DATA	4.61E+04	NO DATA	1.60E+07
PR-143	1.78E+02	6.66E+01	8.83E+00	NO DATA	2.47E+01	NO DATA	9.40E+04
PR-144	7.51E-54	2.90E-54	3.78E-55	NO DATA	1.05E-54	NO DATA	1.35E-47
ND-147	1.06E+02	1.08E+02	6.65E+00	NO DATA	4.18E+01	NO DATA	6.88E+04
W-187	7.27E+03	5.06E+03	1.75E+03	NO DATA	NO DATA	NO DATA	2.97E+05
NP-239	4.37E+00	3.91E-01	2.21E-01	NO DATA	7.80E-01	NO DATA	1.13E+04

* mrem/yr per μCi/m^3

** 1.87×10^6

TABLE 3.5-22

GOAT MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij}(CHILD)

(m²mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	3.20E+03*	3.20E+03*	3.20E+03*	3.20E+03*	3.20E+03*	3.20E+03*
C-14	2.80E+06*	5.60E+05*	5.60E+05*	5.60E+05*	5.60E+05*	5.60E+05*	5.60E+05*
NA-24	1.07E+06**	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06	1.07E+06
P-32	9.32E+10	4.36E+09	3.59E+09	NO DATA	NO DATA	NO DATA	2.58E+09
CR-51	NO DATA	NO DATA	1.22E+04	6.77E+03	1.85E+03	1.24E+04	6.47E+05
MN-54	NO DATA	2.51E+06	6.70E+05	NO DATA	7.05E+05	NO DATA	2.11E+06
MN-56	NO DATA	1.53E-03	3.45E-04	NO DATA	1.85E-03	NO DATA	2.21E-01
FE-55	1.45E+06	7.65E+05	2.38E+05	NO DATA	NO DATA	4.35E+05	1.42E+05
FE-59	1.55E+06	2.52E+06	1.25E+06	NO DATA	NO DATA	7.29E+05	2.62E+06
CO-58	NO DATA	1.46E+06	4.46E+06	NO DATA	NO DATA	NO DATA	8.49E+06
CO-60	NO DATA	5.16E+06	1.52E+07	NO DATA	NO DATA	NO DATA	2.86E+07
NI-63	3.55E+09	1.90E+08	1.21E+08	NO DATA	NO DATA	NO DATA	1.28E+07
NI-65	1.99E-01	1.87E-02	1.09E-02	NO DATA	NO DATA	NO DATA	2.29E+00
CU-64	NO DATA	8.23E+03	4.97E+03	NO DATA	1.99E+04	NO DATA	3.86E+05
ZN-65	4.96E+08	1.32E+09	8.22E+08	NO DATA	8.33E+08	NO DATA	2.32E+08
ZN-69	1.09E-12	1.58E-12	1.46E-13	NO DATA	9.56E-13	NO DATA	9.94E-11
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	1.05E+09	6.47E+08	NO DATA	NO DATA	NO DATA	6.77E+07
RB-88	NO DATA	8.59E-46	5.97E-46	NO DATA	NO DATA	NO DATA	4.21E-47
RB-89	NO DATA	1.67E-53	1.49E-53	NO DATA	NO DATA	NO DATA	1.46E-55
SR-89	1.39E+10	NO DATA	3.96E+08	NO DATA	NO DATA	NO DATA	5.37E+08
SR-90	2.35E+11	NO DATA	5.95E+10	NO DATA	NO DATA	NO DATA	3.16E+09
SR-91	2.71E+05	NO DATA	1.02E+04	NO DATA	NO DATA	NO DATA	5.99E+05
SR-92	4.61E+00	NO DATA	1.85E-01	NO DATA	NO DATA	NO DATA	8.74E+01
Y-90	3.86E+01	NO DATA	1.03E+00	NO DATA	NO DATA	NO DATA	1.10E+05

TABLE 3.5-22 (continued)

GOAT MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij}(CHILD)

(m^2mrem/yr per uCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	3.44E-20	NO DATA	1.25E-21	NO DATA	NO DATA	NO DATA	6.73E-17
Y-91	4.67E+03	NO DATA	1.25E+02	NO DATA	NO DATA	NO DATA	6.22E+05
Y-92	3.02E-05	NO DATA	8.64E-07	NO DATA	NO DATA	NO DATA	8.73E-01
Y-93	1.20E-01	NO DATA	3.29E-03	NO DATA	NO DATA	NO DATA	1.79E+03
ZR-95	4.58E+02	1.01E+02	8.97E+01	NO DATA	1.44E+02	NO DATA	1.05E+05
ZR-97	2.29E-01	3.31E-02	1.95E-02	NO DATA	4.76E-02	NO DATA	5.02E+03
NB-95	8.66E+02	3.37E+02	2.41E+02	NO DATA	3.17E+02	NO DATA	6.24E+05
MO-99	NO DATA	9.74E+06	2.41E+06	NO DATA	2.08E+07	NO DATA	8.05E+06
TC-99m	1.58E+00	3.10E+00	5.13E+01	NO DATA	4.50E+01	1.57E+00	1.76E+03
TC-101	1.28E-60	1.34E-60	1.70E-59	NO DATA	2.29E-59	7.10E-61	4.27E-60
RU-103	5.10E+02	NO DATA	1.96E+02	NO DATA	1.28E 03	NO DATA	1.32E+04
RU-105	4.53E-04	NO DATA	1.65E-04	NO DATA	3.99E-03	NO DATA	2.96E-01
RU-106	1.11E+04	NO DATA	1.38E+03	NO DATA	1.49E+04	NO DATA	1.72E+05
AG-110m	2.50E+07	1.69E+07	1.35E+07	NO DATA	3.15E+07	NO DATA	2.01E+09
TE-125m	8.84E+06	2.39E+06	1.18E+06	2.48E+06	NO DATA	NO DATA	8.53E+06
TE-127m	2.49E+07	6.71E+06	2.96E+06	5.96E+06	7.10E+07	NO DATA	2.02E+07
TE-127	3.64E+02	9.80E+01	7.80E+01	2.52E+02	1.03E+03	NO DATA	1.42E+04
TE-129m	3.24E+07	9.06E+06	5.03E+06	1.05E+07	9.52E+07	NO DATA	3.96E+07
TE-129	1.84E-10	5.12E-11	4.36E-11	1.31E-10	5.37E-10	NO DATA	1.14E-08
TE-131m	1.91E+05	6.60E+04	7.02E+04	1.36E+05	6.39E+05	NO DATA	2.68E+06
TE-131	1.96E-33	5.97E-34	5.83E-34	1.50E-33	5.92E-33	NO DATA	1.03E-32
TE-132	1.23E+06	5.45E+05	6.59E+05	7.94E+05	5.06E+06	NO DATA	5.49E+06
I-130	2.06E+06	4.17E+06	2.15E+06	4.59E+08	6.23E+06	NO DATA	1.95E+06
I-131	1.56E+09	1.57E+09	8.94E+08	5.20E+11	2.58E+09	NO DATA	1.40E+08
I-132	8.32E-01	2.16E-12	7.03E-01	7.09E+01	2.34E+00	NO DATA	1.80E+00
I-133	2.06E+07	2.55E+07	9.64E+06	4.73E+09	4.25E+07	NO DATA	1.03E+07
I-134	9.51E-12	1.77E-11	8.13E-12	4.06E-10	2.70E-11	NO DATA	1.17E-11

TABLE 3.5-22 (continued)

GOAT MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (CHILD)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	6.53E+04	1.17E+05	5.56E+04	1.04E+07	1.80E+05	NO DATA	8.95E+04
CS-134	6.76E+10	1.11E+11	2.34E+10	NO DATA	3.44E+10	1.23E+10	5.98E+08
CS-136	3.03E+09	8.33E+09	5.39E+09	NO DATA	4.44E+09	6.62E+08	2.93E+08
CS-137	9.65E+10	9.23E+10	1.36E+10	NO DATA	3.01E+10	1.08E+10	5.78E+08
CS-138	6.29E+07	8.75E+07	5.55E+07	NO DATA	6.15E+07	6.62E+06	4.03E+07
BA-139	6.58E-06	3.51E-09	1.91E-07	NO DATA	3.07E-09	2.07E-09	5.71E-10
BA-140	1.40E+07	1.22E+04	8.15E+05	NO DATA	3.98E+03	7.29E+03	7.07E+06
BA-141	2.34E-46	1.31E-49	7.62E-48	NO DATA	1.13E-49	7.70E-49	1.33E-46
BA-142	1.31E-80	9.44E-84	7.32E-82	NO DATA	7.64E-84	5.55E-84	1.71E-82
LA-140	2.32E+00	8.12E-01	2.74E-01	NO DATA	NO DATA	NO DATA	2.26E+04
LA-142	9.85E-12	3.14E-12	9.83E-13	NO DATA	NO DATA	NO DATA	6.22E-07
CE-141	2.62E+03	1.31E+03	1.94E+02	NO DATA	5.73E+02	NO DATA	1.63E+06
CE-143	2.24E+01	1.22E+04	1.76E+00	NO DATA	5.10E+00	NO DATA	1.78E+05
CE-144	1.94E+05	6.10E+04	1.04E+04	NO DATA	3.38E+04	NO DATA	1.59E+07
PR-143	8.61E+01	2.58E+01	4.27E+00	NO DATA	1.40E+01	NO DATA	9.29E+04
PR-144	3.53E-54	1.09E-54	1.78E-55	NO DATA	5.78E-55	NO DATA	2.35E-51
ND-147	5.33E+01	4.32E+01	3.34E+00	NO DATA	2.37E+01	NO DATA	6.84E+04
W-187	3.46E+03	2.05E+03	9.20E+02	NO DATA	NO DATA	NO DATA	2.88E+05
NP-239	2.07E+00	1.49E-01	1.04E-01	NO DATA	4.29E-01	NO DATA	1.10E+04

* mrem/yr per μCi/m^3

** 1.07×10^6

TABLE 3.5-23

GOAT MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij}(TEEN)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	2.02E+03*	2.02E+03*	2.02E+03*	2.02E+03*	2.02E+03*	2.02+03*
C-14	1.13E+06*	2.27E+05*	2.27E+05*	2.27E+05*	2.27E+05*	2.27E+05*	2.27E+05*
NA-24	5.15E+05**	5.15E+05	5.15E+05	5.15E+05	5.15E+05	5.15E+05	5.15E+05
P-32	3.78E+10	2.34E+09	1.47E+09	NO DATA	NO DATA	NO DATA	3.18E+09
CR-51	NO DATA	NO DATA	5.94E+03	3.30E+03	1.30E+03	8.48E+03	9.98E+05
MN-54	NO DATA	1.68E+06	3.32E+05	NO DATA	5.00E+05	NO DATA	3.44E+06
MN-56	NO DATA	8.77E-04	1.56E-04	NO DATA	1.11E-03	NO DATA	5.77E-02
FE-55	5.71E+05	4.05E+05	9.44E+04	NO DATA	NO DATA	2.57E+05	1.75E+05
FE-59	6.75E+05	1.58E+06	6.08E+05	NO DATA	NO DATA	4.97E+05	3.73E+06
CO-58	NO DATA	9.51E+05	2.19E+06	NO DATA	NO DATA	NO DATA	1.31E+07
CO-60	NO DATA	3.32E+06	7.47E+06	NO DATA	NO DATA	NO DATA	4.32E+07
NI-63	1.42E+09	1.00E+08	4.81E+07	NO DATA	NO DATA	NO DATA	1.60E+07
NI-65	8.09E-02	1.03E-02	4.71E-03	NO DATA	NO DATA	NO DATA	5.61E-01
CU-64	NO DATA	4.68E+03	2.20E+03	NO DATA	1.18E+04	NO DATA	3.63E+05
ZN-65	2.52E+08	8.76E+08	4.09E+08	NO DATA	5.61E+08	NO DATA	3.71E+08
ZN-69	4.44E-13	8.46E-13	5.92E-14	NO DATA	5.53E-13	NO DATA	1.56E-12
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	5.66E+08	2.66E+08	NO DATA	NO DATA	NO DATA	8.38E+07
RB-88	NO DATA	4.66E-46	2.48E-46	NO DATA	NO DATA	NO DATA	3.99E-53
RB-89	NO DATA	9.52E-54	6.73E-54	NO DATA	NO DATA	NO DATA	1.46E-62
SR-89	5.59E+09	NO DATA	1.60E+08	NO DATA	NO DATA	NO DATA	6.65E+08
SR-90	1.38E+11	NO DATA	3.40E+10	NO DATA	NO DATA	NO DATA	3.87E+09
SR-91	1.11E+05	NO DATA	4.40E+03	NO DATA	NO DATA	NO DATA	5.01E+05
SR-92	1.89E+00	NO DATA	8.05E-02	NO DATA	NO DATA	NO DATA	4.81E+01
Y-90	1.56E+01	NO DATA	4.21E-01	NO DATA	NO DATA	NO DATA	1.29E+05

TABLE 3.5-23 (continued)

GOAT MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij}(TEEN)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	1.41E-20	NO DATA	5.37E-22	NO DATA	NO DATA	NO DATA	6.64E-19
Y-91	1.89E+03	NO DATA	5.07E+01	NO DATA	NO DATA	NO DATA	7.75E+05
Y-92	1.23E-05	NO DATA	3.57E-07	NO DATA	NO DATA	NO DATA	3.39E-01
Y-93	4.86E-02	NO DATA	1.33E-03	NO DATA	NO DATA	NO DATA	1.49E+03
ZR-95	1.98E+02	6.24E+01	4.29E+01	NO DATA	9.17E+01	NO DATA	1.44E+05
ZR-97	9.43E-02	1.87E-02	8.60E-03	NO DATA	2.83E-02	NO DATA	5.05E+03
NB-95	3.84E+02	2.13E+02	1.17E+02	NO DATA	2.06E+02	NO DATA	9.11E+05
MO-99	NO DATA	5.33E+06	1.02E+06	NO DATA	1.22E+07	NO DATA	9.55E+06
TC-99m	6.87E-01	1.92E+00	2.48E+01	NO DATA	2.86E+01	1.06E+00	1.26E+03
TC-101	5.26E-61	7.48E-61	7.34E-60	NO DATA	1.35E-59	4.56E-61	1.28E-67
RU-103	2.17E+02	NO DATA	9.27E+01	NO DATA	7.64E+02	NO DATA	1.81E+04
RU-105	1.86E-04	NO DATA	7.21E-05	NO DATA	2.34E-01	NO DATA	1.50E-01
RU-106	4.47E+03	NO DATA	5.63E+02	NO DATA	8.62E+03	NO DATA	2.14E+05
AG-110m	1.15E+07	1.09E+07	6.62E+06	NO DATA	2.08E+07	NO DATA	3.06E+09
TE-125m	3.59E+06	1.29E+06	4.80E+05	1.00E+06	NO DATA	NO DATA	1.06E+07
TE-127m	1.01E+07	3.57E+06	1.20E+06	2.39E+06	4.08E+07	NO DATA	2.51E+07
TE-127	1.48E+02	5.23E+01	3.18E+01	1.02E+02	5.98E+02	NO DATA	1.14E+04
TE-129m	1.32E+07	4.89E+06	2.08E+06	4.25E+06	5.51E+07	NO DATA	4.94E+07
TE-129	7.44E-11	2.77E-11	1.81E-11	5.31E-11	3.12E-10	NO DATA	4.07E-10
TE-131m	7.86E+04	3.77E+04	3.14E+04	5.67E+04	3.93E+05	NO DATA	3.02E+06
TE-131	8.04E-34	3.31E-34	2.51E-34	6.19E-34	3.51E-33	NO DATA	6.60E-35
TE-132	5.13E+05	3.25E+05	3.06E+05	3.43E+05	3.12E+06	NO DATA	1.03E+07
I-130	8.82E+05	2.55E+06	1.02E+06	2.08E+08	3.93E+06	NO DATA	1.96E+06
I-131	6.44E+08	9.01E+08	4.84E+08	2.63E+11	1.55E+09	NO DATA	1.78E+08
I-132	3.52E-01	9.20E-01	3.30E-01	3.10E+01	1.45E+00	NO DATA	4.01E-01
I-133	8.48E+06	1.44E+07	4.39E+06	2.01E+09	2.52E+07	NO DATA	1.09E+07
I-134	4.03E-12	1.07E-11	3.84E-12	1.78E-10	1.68E-11	NO DATA	1.41E-13

TABLE 3.5-23 (continued)

GOAT MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij}(TEEN)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	2.75E+04	7.08E+04	2.62E+04	4.56E+06	1.12E+05	NO DATA	7.85E+04
CS-134	2.94E+10	6.91E+10	3.21E+10	NO DATA	2.20E+10	8.39E+09	8.60E+08
CS-136	1.34E+09	5.27E+09	3.54E+09	NO DATA	2.87E+09	4.52E+08	4.24E+08
CS-137	4.01E+10	5.33E+10	1.86E+10	NO DATA	1.82E+10	7.05E+09	7.59E+08
CS-138	2.60E+07	4.99E+07	2.50E+07	NO DATA	3.69E+07	4.29E+06	2.26E+04
BA-139	4.07E-07	2.87E-10	1.19E-08	NO DATA	2.70E-10	1.97E-10	3.63E-06
BA-140	5.82E+06	7.13E+03	3.75E+05	NO DATA	2.42E+03	4.80E+03	8.98E+06
BA-141	9.53E-47	7.11E-50	3.18E-48	NO DATA	6.60E-50	4.87E-50	2.03E-52
BA-142	5.44E-81	5.44E-84	3.35E-82	NO DATA	4.60E-84	3.62E-84	1.67E-92
LA-140	9.67E-01	4.75E-01	1.26E-01	NO DATA	NO DATA	NO DATA	2.73E+04
LA-142	4.08E-12	1.81E-12	4.51E-13	NO DATA	NO DATA	NO DATA	5.52E-08
CE-141	1.10E+03	7.36E+02	8.46E+01	NO DATA	3.47E+02	NO DATA	2.11E+06
CE-143	9.14E+00	6.65E+03	7.43E-01	NO DATA	2.98E+00	NO DATA	2.00E+05
CE-144	7.86E+04	3.25E+04	4.23E+03	NO DATA	1.94E+04	NO DATA	1.98E+07
PR-143	3.47E+01	1.39E+01	1.73E+00	NO DATA	8.06E+00	NO DATA	1.14E+05
PR-144	1.42E-54	5.81E-55	7.19E-56	NO DATA	3.33E-55	NO DATA	1.56E-57
ND-147	2.17E+01	2.36E+01	1.41E+00	NO DATA	1.38E+01	NO DATA	8.50E+04
W-187	1.43E+03	1.16E+03	4.08E+02	NO DATA	NO DATA	NO DATA	3.15E+05
NP-239	8.38E-01	7.90E-02	4.39E-02	NO DATA	2.48E-01	NO DATA	1.27E+04

* mrem/yr per μCi/m^3

** 5.15×10^5

TABLE 3.5-24

GOAT MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (ADULT)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	1.55E+03*	1.55E+03*	1.55E+03*	1.55E+03*	1.55E+03*	1.55E+03*
C-14	6.15E+05*	1.23E+05*	1.23E+05*	1.23E+05*	1.23E+05*	1.23E+05*	1.23E+05*
NA-24	2.95E+05**	2.95E+05	2.95E+05	2.95E+05	2.95E+05	2.95E+05	2.95E+05
P-32	2.05E+10	1.27E+09	7.91E+08	NO DATA	NO DATA	NO DATA	2.30E+09
CR-51	NO DATA	NO DATA	3.43E+03	2.05E+03	7.56E+02	4.55E+03	8.63E+05
MN-54	NO DATA	1.01E+06	1.92E+05	NO DATA	2.99E+05	NO DATA	3.08E+06
MN-56	NO DATA	4.96E-04	8.79E-05	NO DATA	6.29E-04	NO DATA	1.58E-02
FE-55	3.27E+05	2.26E+05	5.27E+04	NO DATA	NO DATA	1.26E+05	1.30E+05
FE-59	3.85E+05	9.06E+05	3.47E+05	NO DATA	NO DATA	2.53E+05	3.02E+06
CO-58	NO DATA	5.62E+05	1.26E+06	NO DATA	NO DATA	NO DATA	1.14E+07
CO-60	NO DATA	1.96E+06	4.33E+06	NO DATA	NO DATA	NO DATA	3.69E+07
NI-63	8.05E+08	5.58E+07	2.70E+07	NO DATA	NO DATA	NO DATA	1.16E+07
NI-65	4.43E-02	5.76E-03	2.63E-03	NO DATA	NO DATA	NO DATA	1.46E-01
CU-64	NO DATA	2.62E+03	1.23E+03	NO DATA	6.62E+03	NO DATA	2.24E+05
ZN-65	1.64E+08	5.22E+08	2.36E+08	NO DATA	3.49E+08	NO DATA	3.29E+08
ZN-69	2.41E-13	4.61E-13	3.21E-14	NO DATA	3.00E-13	NO DATA	6.93E-14
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	3.10E+08	1.45E+08	NO DATA	NO DATA	NO DATA	6.12E+07
RB-88	NO DATA	2.57E-46	1.36E-46	NO DATA	NO DATA	NO DATA	3.55E-57
RB-89	NO DATA	5.37E-54	3.78E-54	NO DATA	NO DATA	NO DATA	3.12E-67
SR-89	3.04E+09	NO DATA	8.73E+07	NO DATA	NO DATA	NO DATA	4.88E+08
SR-90	9.78E+10	NO DATA	2.40E+10	NO DATA	NO DATA	NO DATA	2.83E+09
SR-91	6.01E+04	NO DATA	2.43E+03	NO DATA	NO DATA	NO DATA	2.86E+05
SR-92	1.03E+00	NO DATA	4.45E-02	NO DATA	NO DATA	NO DATA	2.04E+01
Y-90	8.48E+00	NO DATA	2.28E-01	NO DATA	NO DATA	NO DATA	9.00E+04

TABLE 3.5-24 (continued)

GOAT MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (ADULT)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	7.69E-21	NO DATA	2.98E-22	NO DATA	NO DATA	NO DATA	2.26E-20
Y-91	1.03E+03	NO DATA	2.75E+01	NO DATA	NO DATA	NO DATA	5.66E+05
Y-92	6.68E-06	NO DATA	1.95E-07	NO DATA	NO DATA	NO DATA	1.17E-01
Y-93	2.65E-02	NO DATA	7.32E-04	NO DATA	NO DATA	NO DATA	8.41E+02
ZR-95	1.13E+02	3.63E+01	2.46E+01	NO DATA	5.69E+01	NO DATA	1.15E+05
ZR-97	5.17E-02	1.04E-02	4.77E-03	NO DATA	1.58E-02	NO DATA	3.23E+03
NB-95	2.25E+02	1.25E+02	6.71E+01	NO DATA	1.23E+02	NO DATA	7.58E+05
MO-99	NO DATA	2.96E+06	5.63E+05	NO DATA	6.71E+06	NO DATA	6.86E+06
TC-99m	3.95E-01	1.12E+00	1.42E+01	NO DATA	1.70E+01	5.47E-01	6.61E+02
TC-101	2.87E-61	4.14E-61	4.06E-60	NO DATA	7.45E-60	2.11E-61	1.24E-72
RU-103	1.22E+02	NO DATA	5.24E+01	NO DATA	4.64E+02	NO DATA	1.42E+04
RU-105	1.02E-04	NO DATA	4.02E-05	NO DATA	1.32E-03	NO DATA	6.23E-02
RU-106	2.44E+03	NO DATA	3.09E+02	NO DATA	4.72E+03	NO DATA	1.58E+05
AG-110m	6.96E+06	6.44E+06	3.82E+06	NO DATA	1.27E+07	NO DATA	2.63E+09
TE-125m	1.95E+06	7.07E+05	2.61E+05	5.87E+05	7.94E+06	NO DATA	7.79E+06
TE-127m	5.46E+06	1.95E+06	6.66E+05	1.40E+06	2.22E+07	NO DATA	1.83E+07
TE-127	7.98E+01	2.86E+01	1.73E+01	5.91E+01	3.25E+02	NO DATA	6.29E+03
TE-129m	7.21E+06	2.69E+06	1.14E+06	2.48E+06	3.01E+07	NO DATA	3.63E+07
TE-129	4.02E-11	1.51E-11	9.79E-12	3.08E-11	1.69E-10	NO DATA	3.03E-11
TE-131m	1.12E+05	5.50E+04	4.58E+04	8.71E+04	5.57E+05	NO DATA	5.46E+06
TE-131	4.37E-34	1.83E-34	1.38E-34	3.60E-34	1.92E-33	NO DATA	6.19E-33
TE-132	2.87E+05	1.86E+05	1.74E+05	2.05E+05	1.79E+06	NO DATA	8.79E+06
I-130	5.00E+05	1.47E+06	5.82E+05	1.25E+08	2.30E+06	NO DATA	1.27E+06
I-131	3.54E+08	5.06E+08	2.90E+08	1.66E+11	8.68E+08	NO DATA	1.34E+08
I-132	1.98E-01	5.29E-01	1.85E-01	1.85E-01	8.43E-01	NO DATA	9.93E-02
I-133	4.62E+06	8.03E+06	2.45E+06	1.18E+09	1.40E+07	NO DATA	7.22E+06
I-134	2.27E-12	6.16E-12	2.20E-12	1.07E-10	9.80E-12	NO DATA	5.37E-15

TABLE 3.5-24 (continued)

GOAT MILK PATHWAY DOSE RATE FACTORS - R^{C}_{aij} (ADULT)

(m^2mrem/yr per µCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	1.55E+04	4.06E+04	1.50E+04	2.68E+06	6.51E+04	NO DATA	4.59E+04
CS-134	1.69E+10	4.03E+10	3.29E+10	NO DATA	1.30E+10	4.32E+09	7.04E+08
CS-136	7.88E+08	3.11E+09	2.24E+09	NO DATA	1.73E+09	2.37E+08	3.53E+08
CS-137	2.21E+10	3.02E+12	1.98E+10	NO DATA	1.02E+10	3.41E+09	5.84E+08
CS-138	1.44E+07	2.83E+07	1.40E+07	NO DATA	2.08E+07	2.06E+06	1.21E+02
BA-139	4.29E-08	3.05E-11	1.26E-09	NO DATA	2.86E-11	1.73E-11	7.60E-08
BA-140	3.23E+06	4.05E+03	2.11E+05	NO DATA	1.38E+03	2.32E+03	6.65E+06
BA-141	5.18E-47	3.92E-50	1.75E-48	NO DATA	3.64E-50	2.22E-50	2.44E-56
BA-142	3.00E-81	3.09E-84	1.89E-82	NO DATA	2.61E-84	1.75E-84	4.23E-99
LA-140	5.40E-01	2.72E-01	7.19E-02	NO DATA	NO DATA	NO DATA	2.00E+04
LA-142	2.27E-12	1.03E-12	2.57E-13	NO DATA	NO DATA	NO DATA	7.52E-09
CE-141	5.80E+02	3.92E+02	4.45E+01	NO DATA	1.82E+02	NO DATA	1.50E+06
CE-143	5.00E+00	3.70E+03	4.09E-01	NO DATA	1.63E+00	NO DATA	1.38E+05
CE-144	4.29E+04	1.79E+04	2.30E+03	NO DATA	1.06E+04	NO DATA	1.45E+07
PR-143	1.89E+01	7.56E+00	9.35E-01	NO DATA	4.37E+00	NO DATA	8.26E+04
PR-144	7.71E-55	3.20E-55	3.92E-56	NO DATA	1.80E-55	NO DATA	1.11E-61
ND-147	1.13E+01	1.30E+01	7.79E-01	NO DATA	7.61E+01	NO DATA	6.25E+04
W-187	7.78E+02	6.50E+02	2.27E+02	NO DATA	NO DATA	NO DATA	2.13E+05
NP-239	4.39E-01	4.32E-02	2.38E-02	NO DATA	1.35E-01	NO DATA	8.86E+03

* mrem/yr per µCi/m^3

** 2.95×10^5

TABLE 3.5-25

MEAT PATHWAY DOSE RATE FACTORS - R^{M}_{aij}(CHILD)

(m²mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	2.33E+02*	2.33E+02*	2.33E+02*	2.33E+02*	2.33E+02*	2.33E+02*
C-14	2.04E+05*	4.07E+04*	4.07E+04*	4.07E+04*	4.07E+04*	4.07E+04	4.07E+04*
NA-24	1.84E-03**	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03	1.84E-03
P-32	7.43E+09	3.47E+08	2.86E+08	NO DATA	NO DATA	NO DATA	2.05E+08
CR-51	NO DATA	NO DATA	8.78E+03	4.88E+03	1.33E+03	8.90E+03	4.66E+05
MN-54	NO DATA	8.03E+06	2.14E+06	NO DATA	2.25E+06	NO DATA	6.74E+06
MN-56	NO DATA	1.56E-53	3.52E-54	NO DATA	1.89E-53	NO DATA	2.26E-51
FE-55	4.58E+08	2.43E+08	7.52E+07	NO DATA	NO DATA	1.37E+08	4.50E+07
FE-59	3.76E+08	6.09E+08	3.03E+08	NO DATA	NO DATA	1.76E+08	6.34E+08
CO-58	NO DATA	1.64E+07	5.03E+07	NO DATA	NO DATA	NO DATA	9.58E+07
CO-60	NO DATA	6.93E+07	2.04E+08	NO DATA	NO DATA	NO DATA	3.84E+08
NI-63	2.91E+10	1.56E+09	9.90E+08	NO DATA	NO DATA	NO DATA	1.05E+08
NI-65	3.55E-52	3.34E-53	1.92E-53	NO DATA	NO DATA	NO DATA	4.10E-51
CU-64	NO DATA	2.77E-07	1.67E-07	NO DATA	6.69E-07	NO DATA	1.30E-05
ZN-65	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	NO DATA	0.00E+00
ZN-69	7.18E+03	1.04E+04	9.59E+02	NO DATA	6.30E+03	NO DATA	6.54E+05
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	5.76E+08	3.54E+08	NO DATA	NO DATA	NO DATA	3.71E+07
RB-88	NO DATA	0.00E+00	0.00E+00	NO DATA	NO DATA	NO DATA	0.00E+00
RB-89	NO DATA	0.00E+00	0.00E+00	NO DATA	NO DATA	NO DATA	0.00E+00
SR-89	4.80E+08	NO DATA	1.37E+07	NO DATA	NO DATA	NO DATA	1.86E+07
SR-90	1.04E+10	NO DATA	2.64E+09	NO DATA	NO DATA	NO DATA	1.40E+08
SR-91	2.26E-10	NO DATA	8.53E-12	NO DATA	NO DATA	NO DATA	4.99E-10
SR-92	2.00E-49	NO DATA	8.04E-51	NO DATA	NO DATA	NO DATA	3.80E-48
Y-90	1.73E+02	NO DATA	4.62E+00	NO DATA	NO DATA	NO DATA	4.91E+05

TABLE 3.5-25 (continued)

MEAT PATHWAY DOSE RATE FACTORS - R^{M}_{aij}(CHILD)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	0.00E+00	NO DATA	0.00E+00	NO DATA	NO DATA	NO DATA	0.00E+00
Y-91	1.80E+06	NO DATA	4.81E+04	NO DATA	NO DATA	NO DATA	2.40E+08
Y-92	2.37E-39	NO DATA	6.78E-41	NO DATA	NO DATA	NO DATA	6.84E-35
Y-93	6.98E-12	NO DATA	1.92E-13	NO DATA	NO DATA	NO DATA	1.04E-07
ZR-95	2.67E+06	5.87E+05	5.22E+05	NO DATA	8.40E+05	NO DATA	6.12E+08
ZR-97	3.16E-05	4.57E-06	2.69E-06	NO DATA	6.55E-06	NO DATA	6.92E-01
NB-95	2.7E-01	1.05E-01	7.51E-02	NO DATA	9.88E-02	NO DATA	1.94E+02
MO-99	NO DATA	1.14E+05	2.83E+04	NO DATA	2.44E+05	NO DATA	9.45E+04
TC-99m	6.01E-21	1.18E-20	1.95E-19	NO DATA	1.71E-19	5.98E-21	6.71E-18
TC-101	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	0.00E+00	0.00E+00
RU-103	1.55E+08	NO DATA	5.96E+07	NO DATA	3.90E+08	NO DATA	4.01E+09
RU-105	8.45E-15	NO DATA	3.07E-15	NO DATA	7.43E-14	NO DATA	5.52E-12
RU-106	4.43E+09	NO DATA	5.53E+08	NO DATA	5.99E+09	NO DATA	6.90E+10
AG-110m	8.41E+06	5.68E+06	4.54E+06	NO DATA	1.06E+07	NO DATA	6.75E+08
TE-125m	5.69E+08	1.54E+08	7.58E+07	1.60E+08	NO DATA	NO DATA	5.49E+08
TE-127m	1.77E+09	4.78E+08	2.11E+08	4.24E+08	5.06E+09	NO DATA	1.44E+09
TE-127	3.99E+06	1.08E+06	8.56E+05	2.76E+06	1.14E+07	NO DATA	1.56E+08
TE-129m	1.79E+09	4.99E+08	2.77E+08	5.76E+08	5.25E+09	NO DATA	2.18E+09
TE-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00
TE-131m	8.42E+03	2.91E+03	3.10E+03	5.99E+03	2.82E+04	NO DATA	1.18E+05
TE-131	8.03E+00	2.45E+00	2.39E+00	6.14E+00	2.43E+01	NO DATA	4.22E+01
TE-132	2.13E+06	9.43E+05	1.14E+06	1.37E+06	8.76E+06	NO DATA	9.50E+06
I-130	2.91E-06	5.89E-06	3.03E-06	6.49E-04	8.80E-06	NO DATA	2.75E-06
I-131	1.65E+07	1.66E+07	9.46E+06	5.50E+09	2.73E+07	NO DATA	1.48E+06
I-132	1.05E-58	1.93E-58	8.86E-59	8.93E-57	2.95E-58	NO DATA	2.27E-58
I-133	5.66E-01	7.00E-01	2.65E-01	1.30E+02	1.17E+00	NO DATA	2.82E-01
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00

TABLE 3.5-25 (continued)

MEAT PATHWAY DOSE RATE FACTORS - R^{M}_{aij}(CHILD)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	6.48E-17	1.23E-16	5.83E-17	1.09E-14	1.89E-16	NO DATA	9.38E-17
CS-134	9.20E+08	1.51E+09	3.18E+08	NO DATA	4.68E+08	1.68E+08	8.14E+06
CS-136	1.62E+07	4.45E+07	2.88E+07	NO DATA	2.37E+07	3.53E+06	1.56E+06
CS-137	1.33E+09	1.27E+09	1.88E+08	NO DATA	4.15E+08	1.49E+08	7.98E+06
CS-138	8.21E+05	1.14E+06	7.24E+05	NO DATA	8.03E+05	8.64E+04	5.26E+05
BA-139	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	0.00E+00	0.00E+00
BA-140	4.38E+07	3.84E+04	2.56E+06	NO DATA	1.25E+04	2.29E+04	2.22E+07
BA-141	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	0.00E+00	0.00E+00
LA-140	5.56E-02	1.94E-02	6.55E-03	NO DATA	NO DATA	NO DATA	5.41E+02
LA-142	6.18E-92	1.97E-92	6.17E-93	NO DATA	NO DATA	NO DATA	3.91E-87
CE-141	2.20E+04	1.10E+04	1.63E+03	NO DATA	4.82E+03	NO DATA	1.37E+07
CE-143	3.20E-02	1.74E+01	2.51E-03	NO DATA	7.28E-03	NO DATA	2.54E+02
CE-144	2.31E+06	7.24E+05	1.23E+05	NO DATA	4.01E+05	NO DATA	1.89E+08
PR-143	3.34E+04	1.00E+04	1.66E+03	NO DATA	5.43E+03	NO DATA	3.60E+07
PR-144	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	NO DATA	0.00E+00
ND-147	1.17E+04	9.47E+03	7.33E+02	NO DATA	5.20E+03	NO DATA	1.50E+07
W-187	3.21E-02	1.90E-02	8.53E-03	NO DATA	NO DATA	NO DATA	2.77E+00
NP-239	4.23E-01	3.04E-02	2.14E-02	NO DATA	8.79E-02	NO DATA	2.25E+03

* mrem/yr per μCi/m^3

** 1.84×10^{-3}

TABLE 3.5-26

MEAT PATHWAY DOSE RATE FACTORS - R^{M}_{aij}(TEEN)

(m²mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	1.93E+02*	1.93E+02*	1.93E+02*	1.93E+02*	1.93E+02*	1.93+02*
C-14	1.08E+05*	2.17E+04*	2.17E+04*	2.17E+04*	2.17E+04*	2.17E+04*	2.17E+04*
NA-24	1.16E-03**	1.16E-03	1.16E-03	1.16E-03	1.16E-03	1.16E-03	1.16E-03
P-32	3.95E+09	2.45E+08	1.53E+08	NO DATA	NO DATA	NO DATA	3.32E+08
CR-51	NO DATA	NO DATA	5.65E+03	3.14E+03	1.24E+03	8.07E+03	9.50E+05
MN-54	NO DATA	7.02E+06	1.39E+06	NO DATA	2.09E+06	NO DATA	1.44E+07
MN-56	NO DATA	1.17E-53	2.09E-54	NO DATA	1.48E-53	NO DATA	7.72E-52
FE-55	2.38E+08	1.69E+08	3.94E+07	NO DATA	NO DATA	1.07E+08	7.31E+07
FE-59	2.12E+08	4.95E+08	1.91E+08	NO DATA	NO DATA	1.56E+08	1.17E+09
CO-58	NO DATA	1.41E+07	3.25E+07	NO DATA	NO DATA	NO DATA	1.94E+08
CO-60	NO DATA	5.84E+07	1.32E+08	NO DATA	NO DATA	NO DATA	7.61E+08
NI-63	1.52E+10	1.07E+09	5.15E+08	NO DATA	NO DATA	NO DATA	1.71E+08
NI-65	1.90E-62	2.43E-63	1.11E-63	NO DATA	NO DATA	NO DATA	1.32E-61
CU-64	NO DATA	2.06E-07	9.68E-08	NO DATA	5.21E-07	NO DATA	1.60E-05
ZN-65	1.50E+06	5.22E+06	2.44E+06	NO DATA	3.34E+06	NO DATA	2.21E+06
ZN-69	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	NO DATA	0.00E+00
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	4.05E+08	1.90E+08	NO DATA	NO DATA	NO DATA	6.00E+07
RB-88	NO DATA	0.00E+00	0.00E+00	NO DATA	NO DATA	NO DATA	0.00E+00
RB-89	NO DATA	0.00E+00	0.00E+00	NO DATA	NO DATA	NO DATA	0.00E+00
SR-89	2.54E+08	NO DATA	7.27E+06	NO DATA	NO DATA	NO DATA	3.02E+07
SR-90	8.04E+09	NO DATA	1.99E+09	NO DATA	NO DATA	NO DATA	2.26E+08
SR-91	1.20E-10	NO DATA	4.78E-12	NO DATA	NO DATA	NO DATA	5.45E-10
SR-92	1.08E-49	NO DATA	4.59E-51	NO DATA	NO DATA	NO DATA	2.74E-48
Y-90	9.11E+01	NO DATA	2.45E+00	NO DATA	NO DATA	NO DATA	7.51E+05

TABLE 3.5-26 (continued)

MEAT PATHWAY DOSE RATE FACTORS - R^{M}_{aij}(TEEN)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	0.00E+00	NO DATA	0.00E+00	NO DATA	NO DATA	NO DATA	0.00E+00
Y-91	9.55E+05	NO DATA	2.56E+04	NO DATA	NO DATA	NO DATA	3.91E+08
Y-92	1.26E-39	NO DATA	3.64E-41	NO DATA	NO DATA	NO DATA	3.45E-35
Y-93	3.70E-12	NO DATA	1.01E-13	NO DATA	NO DATA	NO DATA	1.13E-07
ZR-95	1.50E+06	9.72E+05	3.25E+05	NO DATA	6.93E+05	NO DATA	1.09E+09
ZR-97	1.70E-05	3.36E-06	1.55E-06	NO DATA	5.10E-06	NO DATA	9.11E-01
NB-95	1.56E-01	8.66E-02	4.77E-02	NO DATA	8.40E-02	NO DATA	3.71E+02
MO-99	NO DATA	8.20E+04	1.56E+04	NO DATA	1.88E+05	NO DATA	1.47E+05
TC-99m	3.42E-21	9.54E-21	1.24E-19	NO DATA	1.42E-19	5.29E-21	6.26E-18
TC-101	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	0.00E+00	0.00E+00
RU-103	8.57E+07	NO DATA	3.66E+07	NO DATA	3.02E+08	NO DATA	7.16E+09
RU-105	4.56E-28	NO DATA	1.77E-28	NO DATA	5.75E-27	NO DATA	3.68E-25
RU-106	2.36E+09	NO DATA	2.97E+08	NO DATA	4.54E+09	NO DATA	1.13E+11
AG-110m	5.04E+06	4.77E+06	2.90E+06	NO DATA	9.10E+06	NO DATA	1.34E+09
TE-125m	3.03E+08	1.09E+08	4.06E+07	8.47E+07	NO DATA	NO DATA	8.95E+08
TE-127m	9.40E+08	3.33E+08	1.12E+08	2.24E+08	3.81E+09	NO DATA	2.34E+09
TE-127	2.12E-10	7.50E-11	4.56E-11	1.46E-10	8.58E-10	NO DATA	1.63E-08
TE-129m	9.49E+08	3.52E+08	1.50E+08	3.06E+08	3.97E+09	NO DATA	3.56E+09
TE-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00
TE-131m	3.73E+02	1.79E+02	1.49E+02	2.69E+02	1.87E+03	NO DATA	1.44E+04
TE-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00
TE-132	1.17E+06	7.38E+05	6.95E+05	7.78E+05	7.08E+06	NO DATA	2.34E+07
I-130	1.63E-06	4.71E-06	1.88E-06	3.84E-04	7.25E-06	NO DATA	3.62E-06
I-131	8.89E+06	1.24E+07	6.69E+06	3.63E+09	2.14E+07	NO DATA	2.46E+06
I-132	5.78E-59	1.51E-58	5.42E-59	5.09E-57	2.38E-58	NO DATA	6.58E-59
I-133	3.04E-01	5.15E-01	1.57E-01	7.19E+01	9.03E-01	NO DATA	3.90E-01
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00

TABLE 3.5-26 (continued)

MEAT PATHWAY DOSE RATE FACTORS - R^{M}_{aij}(TEEN)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	3.79E-17	9.75E-17	3.61E-17	6.27E-15	1.54E-16	NO DATA	1.08E-16
CS-134	5.22E+08	1.23E+09	5.70E+08	NO DATA	3.91E+08	1.49E+08	1.53E+07
CS-136	9.36E+06	3.68E+07	2.47E+07	NO DATA	2.01E+07	3.16E+06	2.96E+06
CS-137	7.24E+08	9.63E+08	3.35E+08	NO DATA	3.28E+08	1.27E+08	1.37E+07
CS-138	4.45E+05	8.54E+05	4.27E+05	NO DATA	6.30E+05	7.33E+04	3.87E+02
BA-139	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	0.00E+00	0.00E+00
BA-140	2.37E+07	2.91E+04	1.53E+06	NO DATA	9.86E+03	1.96E+04	3.66E+07
BA-141	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	0.00E+00	0.00E+00
LA-140	3.03E-02	1.49E-02	3.97E-03	NO DATA	NO DATA	NO DATA	8.56E+02
LA-142	3.37E-92	1.49E-92	3.72E-93	NO DATA	NO DATA	NO DATA	4.55E-88
CE-141	1.17E+04	7.83E+03	9.00E+02	NO DATA	3.69E+03	NO DATA	2.24E+07
CE-143	1.70E-02	1.24E+01	1.38E-03	NO DATA	5.55E-03	NO DATA	3.72E+02
CE-144	1.23E+06	5.10E+05	6.62E+04	NO DATA	3.04E+05	NO DATA	3.10E+08
PR-143	1.77E+04	7.06E+03	8.80E+02	NO DATA	4.10E+03	NO DATA	5.82E+07
PR-144	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	NO DATA	0.00E+00
ND-147	6.22E+03	6.76E+03	4.05E+02	NO DATA	3.97E+03	NO DATA	2.44E+07
W-187	1.74E-02	1.42E-02	4.96E-03	NO DATA	NO DATA	NO DATA	3.83E+00
NP-239	2.25E-01	2.12E-02	1.18E-02	NO DATA	6.67E-02	NO DATA	3.42E+03

* mrem/yr per μCi/m^3

** 1.16×10^{-3}

TABLE 3.5-27

MEAT PATHWAY DOSE RATE FACTORS - R^{M}_{aij} (ADULT)

(m²mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	3.24E+02*	3.24E+02*	3.24E+02*	3.24E+02*	3.24E+02*	3.24E+02*
C-14	1.29E+05*	2.57E+04*	2.57E+04*	2.57E+04*	2.57E+04*	2.57E+04*	2.57E+04*
NA-24	1.45E-03**	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03	1.45E-03
P-32	4.65E+09	2.89E+08	1.80E+08	NO DATA	NO DATA	NO DATA	5.23E+08
CR-51	NO DATA	NO DATA	7.05E+03	4.21E+03	1.55E+03	9.35E+03	1.77E+06
MN-54	NO DATA	9.19E+06	1.75E+06	NO DATA	2.73E+06	NO DATA	2.81E+07
MN-56	NO DATA	1.45E-53	2.57E-54	NO DATA	1.84E-53	NO DATA	4.62E-52
FE-55	2.94E+08	2.03E+08	4.74E+07	NO DATA	NO DATA	1.13E+08	1.17E+08
FE-59	2.66E+08	6.24E+08	2.39E+08	NO DATA	NO DATA	1.74E+08	2.08E+09
CO-58	NO DATA	1.83E+07	4.09E+07	NO DATA	NO DATA	NO DATA	3.70E+08
CO-60	NO DATA	7.51E+07	1.66E+08	NO DATA	NO DATA	NO DATA	1.41E+09
NI-63	1.89E+10	1.31E+09	6.32E+08	NO DATA	NO DATA	NO DATA	2.73E+08
NI-65	2.27E-52	2.94E-53	1.34E-53	NO DATA	NO DATA	NO DATA	7.46E-52
CU-64	NO DATA	2.52E-07	1.18E-07	NO DATA	6.36E-07	NO DATA	2.15E-05
ZN-65	2.14E+06	6.81E+06	3.08E+06	NO DATA	4.55E+06	NO DATA	4.29E+06
ZN-69	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	NO DATA	0.00E+00
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	4.87E+08	2.27E+08	NO DATA	NO DATA	NO DATA	9.61E+07
RB-88	NO DATA	0.00E+00	0.00E+00	NO DATA	NO DATA	NO DATA	0.00E+00
RB-89	NO DATA	0.00E+00	0.00E+00	NO DATA	NO DATA	NO DATA	0.00E+00
SR-89	3.01E+08	NO DATA	8.64E+06	NO DATA	NO DATA	NO DATA	4.83E+07
SR-90	1.24E+10	NO DATA	3.05E+09	NO DATA	NO DATA	NO DATA	3.59E+08
SR-91	1.4[illegible]-10	NO DATA	5.79E-12	NO DATA	NO DATA	NO DATA	6.83E-10
SR-92	1.28E-49	NO DATA	5.54E-51	NO DATA	NO DATA	NO DATA	2.54E-48
Y-90	1.09E+02	NO DATA	2.92E+00	NO DATA	NO DATA	NO DATA	1.15E+06

TABLE 3.5-27 (continued)

MEAT PATHWAY DOSE RATE FACTORS - R^{M}_{aij} (ADULT)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	0.00E+00	NO DATA	0.00E+00	NO DATA	NO DATA	NO DATA	0.00E+00
Y-91	1.13E+06	NO DATA	3.03E+04	NO DATA	NO DATA	NO DATA	6.23E+08
Y-92	3.77E-10	NO DATA	1.10E-11	NO DATA	NO DATA	NO DATA	6.60E-06
Y-93	4.40E-12	NO DATA	1.21E-13	NO DATA	NO DATA	NO DATA	1.39E-07
ZR-95	1.87E+06	6.00E+05	4.06E+05	NO DATA	9.41E+05	NO DATA	1.90E+09
ZR-97	2.03E-05	4.10E-06	1.88E-06	NO DATA	6.17E-06	NO DATA	1.27E+00
NB-95	2.00E-01	1.11E-01	5.97E-02	NO DATA	1.10E-01	NO DATA	6.74E+02
MO-99	NO DATA	9.91E+04	1.89E+04	NO DATA	2.24E+05	NO DATA	2.30E+05
TC-99m	4.32E-21	1.22E-20	1.56E-19	NO DATA	1.86E-19	5.99E-21	7.23E-18
TC-101	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	0.00E+00	0.00E+00
RU-103	1.05E+08	NO DATA	4.53E+07	NO DATA	4.02E+08	NO DATA	1.23E+10
RU-105	5.42E-28	NO DATA	2.14E-28	NO DATA	7.00E-27	NO DATA	3.32E-25
RU-106	2.81E+09	NO DATA	3.55E+08	NO DATA	5.42E+09	NO DATA	1.82E+11
AG-110m	6.67E+06	6.17E+06	3.67E+06	NO DATA	1.21E+07	NO DATA	2.52E+09
TE-125m	3.59E+08	1.30E+08	4.81E+07	1.08E+08	1.46E+09	NO DATA	1.43E+09
TE-127m	1.12E+09	3.99E+08	1.36E+08	2.85E+08	4.54E+09	NO DATA	3.75E+09
TE-127	2.50E-10	8.97E-11	5.40E-11	1.85E-10	1.02E-09	NO DATA	1.97E-08
TE-129m	1.13E+09	4.22E+08	1.79E+08	3.89E+08	4.73E+09	NO DATA	5.70E+09
TE-129	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00
TE-131m	4.50E+02	2.20E+02	1.83E+02	3.48E+02	2.23E+03	NO DATA	2.18E+04
TE-131	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00
TE-132	1.42E+06	9.21E+05	8.64E+05	1.02E+06	8.87E+06	NO DATA	4.36E+07
I-130	2.03E-06	5.98E-06	2.36E-06	5.07E-04	9.33E-06	NO DATA	5.15E-06
I-131	1.07E+07	1.54E+07	8.80E+06	5.03E+09	2.63E+07	NO DATA	4.05E+06
I-132	7.13E-59	1.91E-58	6.67E-59	6.67E-57	3.04E-58	NO DATA	3.58E-59
I-133	3.64E-01	6.32E-01	1.93E-01	9.29E+01	1.10E+00	NO DATA	5.68E-01
I-134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00

TABLE 3.5-27 (continued)

MEAT PATHWAY DOSE RATE FACTORS - R^{M}_{aij} (ADULT)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	4.65E-17	1.22E-16	4.49E-17	8.03E-15	1.95E-16	NO DATA	1.38E-16
CS-134	6.53E+08	1.55E+09	1.27E+09	NO DATA	5.03E+08	1.67E+08	2.72E+07
CS-136	1.20E+07	4.75E+07	3.42E+07	NO DATA	2.65E+07	3.63E+06	5.40E+06
CS-137	8.69E+08	1.19E+09	7.78E+08	NO DATA	4.03E+08	1.34E+08	2.30E+07
CS-138	5.37E+05	1.06E+06	5.25E+05	NO DATA	7.79E+05	7.69E+04	4.52E+00
BA-139	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	0.00E+00	0.00E+00
BA-140	2.88E+07	3.62E+04	1.89E+06	NO DATA	1.23E+04	2.07E+04	5.94E+07
BA-141	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	0.00E+00	0.00E+00
BA-142	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	0.00E+00	0.00E+00
LA-140	3.68E-02	1.85E-02	4.90E-13	NO DATA	NO DATA	NO DATA	1.36E+03
LA-142	4.07E-92	1.85E-92	4.61E-93	NO DATA	NO DATA	NO DATA	1.35E-88
CE-141	1.39E+04	9.43E+03	1.07E+03	NO DATA	4.38E+03	NO DATA	3.61E+07
CE-143	2.03E-02	1.50E+01	1.66E-03	NO DATA	6.61E-03	NO DATA	5.61E+02
CE-144	1.46E+06	6.10E+05	7.83E+04	NO DATA	3.62E+05	NO DATA	4.93E+08
PR-143	2.10E+07	8.41E+06	1.04E+06	NO DATA	4.86E+06	NO DATA	9.19E+10
PR-144	0.00E+00	0.00E+00	0.00E+00	NO DATA	0.00E+00	NO DATA	0.00E+00
ND-147	7.04E+03	8.14E+03	4.87E+02	NO DATA	4.76E+03	NO DATA	3.91E+07
W-187	2.06E-02	1.72E-02	6.02E-03	NO DATA	NO DATA	NO DATA	5.64E+00
NP-239	2.57E-01	2.53E-02	1.39E-02	NO DATA	7.88E-02	NO DATA	5.18E+03

* mrem/yr per μCi/m^3

** 1.45×10^{-3}

TABLE 3.5-28

VEGETATION PATHWAY DOSE RATE FACTORS - R^{V}_{aij}(CHILD)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	4.01E+03*	4.01E+03*	4.01E+03*	4.01E+03*	4.01E+03*	4.01E+03*
C-14	3.51E+06*	7.01E+05*	7.01E+05*	7.01E+05*	7.01E+05*	7.01E+05*	7.01E+05*
NA-24	3.75E+05**	3.75E+05	3.75E+05	3.75E+05	3.75E+05	3.75E+05	3.75E-05
P-32	3.37E+09	1.57E+08	1.30E+08	NO DATA	NO DATA	NO DATA	9.30E+07
CR-51	NO DATA	NO DATA	1.17E+03	6.47E+02	1.77E+02	1.18E+03	6.18E+04
MN-54	NO DATA	6.64E+08	1.77E+08	NO DATA	1.86E+08	NO DATA	5.58E+08
MN-56	NO DATA	1.87E+01	4.22E+00	NO DATA	2.26E+01	NO DATA	2.71E+03
FE-55	8.02E+08	4.25E+08	1.32E+08	NO DATA	NO DATA	2.40E+08	7.88E+07
FE-59	3.98E+08	6.43E+08	3.21E+08	NO DATA	NO DATA	1.87E+08	6.70E+08
CO-58	NO DATA	6.44E+07	1.97E+08	NO DATA	NO DATA	NO DATA	3.76E+08
CO-60	NO DATA	3.79E+08	1.12E+09	NO DATA	NO DATA	NO DATA	2.10E+09
NI-63	3.95E+10	2.11E+09	1.34E+09	NO DATA	NO DATA	NO DATA	1.42E+08
NI-65	1.05E+02	9.89E+00	5.77E+00	NO DATA	NO DATA	NO DATA	1.21E+03
CU-64	NO DATA	1.09E+04	6.59E+03	NO DATA	2.63E-04	NO DATA	5.12E+05
ZN-65	8.11E+08	2.16E+09	1.34E+09	NO DATA	1.36E+09	NO DATA	3.79E+08
ZN-69	9.29E-06	1.34E-05	1.24E-06	NO DATA	8.14E-06	NO DATA	8.46E-04
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	4.53E+08	2.79E+08	NO DATA	NO DATA	NO DATA	2.91E+07
RB-88	NO DATA	4.39E-20	3.05E-20	NO DATA	NO DATA	NO DATA	2.15E-21
RB-89	NO DATA	4.69E-26	4.17E-26	NO DATA	NO DATA	NO DATA	4.09E-28
SR-89	3.59E+10	NO DATA	1.03E+09	NO DATA	NO DATA	NO DATA	1.39E+09
SR-90	1.24E+12	NO DATA	3.14E+11	NO DATA	NO DATA	NO DATA	1.67E+10
SR-91	5.21E+05	NO DATA	1.97E+04	NO DATA	NO DATA	NO DATA	1.15E+06
SR-92	7.29E+02	NO DATA	2.92E+01	NO DATA	NO DATA	NO DATA	1.38E+04
Y-90	2.31E+04	NO DATA	6.18E+02	NO DATA	NO DATA	NO DATA	6.58E+07

TABLE 3.5-28 (continued)

VEGETATION PATHWAY DOSE RATE FACTORS - R^{V}_{aij} (CHILD)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	9.24E-09	NO DATA	3.36E-10	NO DATA	NO DATA	NO DATA	1.81E-05
Y-91	1.86E+07	NO DATA	4.97E+05	NO DATA	NO DATA	NO DATA	2.48E+09
Y-92	1.58E+00	NO DATA	4.52E-02	NO DATA	NO DATA	NO DATA	4.57E+04
Y-93	2.92E+02	NO DATA	8.01E+00	NO DATA	NO DATA	NO DATA	4.35E+06
ZR-95	3.86E+06	8.49E+05	7.56E+05	NO DATA	1.22E+06	NO DATA	8.86E+08
ZR-97	5.66E+02	8.18E+01	4.83E+01	NO DATA	1.17E+02	NO DATA	1.24E+07
NB-95	3.26E+03	1.27E+03	9.08E+02	NO DATA	1.19E+03	NO DATA	2.35E+06
MO-99	NO DATA	7.67E+06	1.90E+06	NO DATA	1.64E+07	NO DATA	6.35E+06
TC-99m	4.70E+00	9.21E+00	1.53E+02	NO DATA	1.34E+02	4.68E+00	5.24E+03
TC-101	1.35E-30	1.41E-30	1.79E-29	NO DATA	2.41E-29	7.46E-31	4.49E-30
RU-103	1.54E+07	NO DATA	5.90E+06	NO DATA	3.86E+07	NO DATA	3.97E+08
RU-105	9.16E+01	NO DATA	3.32E+01	NO DATA	8.05E+02	NO DATA	5.98E+04
RU-106	7.45E+08	NO DATA	9.30E+07	NO DATA	1.01E+09	NO DATA	1.16E+10
AG-110m	3.21E+07	2.17E+07	1.73E+07	NO DATA	4.04E+07	NO DATA	2.58E+09
TE-125m	3.51E+08	9.52E+07	4.68E+07	9.86E+07	NO DATA	NO DATA	3.39E+08
TE-127m	1.32E+09	3.56E+08	1.57E+08	3.16E+08	3.77E+09	NO DATA	1.07E+09
TE-127	3.01E+06	8.12E+05	6.45E+05	2.08E+06	8.56E+06	NO DATA	1.18E+08
TE-129m	8.43E+08	2.35E+08	1.31E+08	2.72E+08	2.47E+09	NO DATA	1.03E+09
TE-129	1.45E-03	4.04E-04	3.43E-04	1.03E-03	4.23E-03	NO DATA	9.01E-02
TE-131m	1.54E+06	5.33E+05	5.67E+05	1.10E+06	5.16E+06	NO DATA	2.16E+07
TE-131	2.59E-15	7.89E-16	7.71E-16	1.98E-15	7.83E-15	NO DATA	1.36E-14
TE-132	7.00E+06	3.10E+06	3.74E+06	4.51E+06	2.88E+07	NO DATA	3.12E+07
I-130	6.10E+05	1.23E+06	6.35E+05	1.36E+08	1.84E+06	NO DATA	5.77E+05
I-131	1.43E+08	1.44E+08	8.16E+07	4.75E+10	2.36E+08	NO DATA	1.28E+07
I-132	9.20E+01	1.69E+02	7.77E+01	7.84E+03	2.59E+02	NO DATA	1.99E+02
I-133	3.53E+06	4.36E+06	1.65E+06	8.11E+08	7.27E+06	NO DATA	1.76E+06
I-134	1.50E-04	2.79E-04	1.28E-04	6.41E-03	4.26E-04	NO DATA	1.85E-04

TABLE 3.5-28 (continued)

VEGETATION PATHWAY DOSE RATE FACTORS - R^{M}_{aij}(CHILD)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	6.48E+04	1.17E+05	5.51E+04	1.03E+07	1.79E+05	NO DATA	8.88E+04
CS-134	1.60E+10	2.63E+10	5.55E+09	NO DATA	8.15E+09	2.92E+09	1.42E+08
CS-136	8.23E+07	2.26E+08	1.46E+08	NO DATA	1.20E+08	1.80E+07	7.95E+06
CS-137	2.39E+10	2.29E+10	3.38E+09	NO DATA	7.46E+09	2.68E+09	1.43E+08
CS-138	1.32E+07	1.84E+07	1.17E+07	NO DATA	1.29E+07	1.39E+06	8.47E+06
BA-139	4.97E-02	2.65E-05	1.44E-03	NO DATA	2.32E-05	1.56E-05	2.87E+00
BA-140	2.77E+08	2.42E+05	1.62E+07	NO DATA	7.89E+04	1.45E+05	1.40E+08
BA-141	2.04E-21	1.14E-24	6.64E-23	NO DATA	9.88E-25	6.71E-24	1.16E-21
BA-142	9.70E-39	6.98E-42	5.42E-40	NO DATA	5.65E-42	4.11E-42	1.27E-40
LA-140	3.24E+03	1.13E+03	3.82E+02	NO DATA	NO DATA	NO DATA	3.16E+07
LA-142	3.39E-04	1.08E-04	3.38E-05	NO DATA	NO DATA	NO DATA	2.14E+01
CE-141	6.55E+05	3.27E+05	4.85E+04	NO DATA	1.43E+05	NO DATA	4.08E+08
CE-143	1.71E+03	9.29E+05	1.35E+02	NO DATA	3.90E+02	NO DATA	1.36E+07
CE-144	1.27E+08	3.99E+07	6.79E+06	NO DATA	2.21E+07	NO DATA	1.04E+10
PR-143	1.45E+05	4.37E+04	7.22E+03	NO DATA	2.36E+04	NO DATA	1.57E+08
PR-144	5.64E-26	1.74E-26	2.84E-27	NO DATA	9.22E-27	NO DATA	3.75E-23
ND-147	5.41E+05	4.38E+05	3.40E+04	NO DATA	2.41E+05	NO DATA	6.95E+08
W-187	6.44E+04	3.81E+04	1.71E+04	NO DATA	NO DATA	NO DATA	5.36E+06
NP-239	2.56E+03	1.84E+02	1.29E+02	NO DATA	5.31E+02	NO DATA	1.36E+07

* mrem/yr per μCi/m^3

** 3.75×10^5

TABLE 3.5-29

VEGETATION PATHWAY DOSE RATE FACTORS - R^{V}_{aij}(TEEN)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	2.59E+03*	2.59E+03*	2.59E+03*	2.59E+03*	2.59E+03*	2.59E+03*
C-14	1.45E+06*	2.91E+05*	2.91E+05*	2.91E+05*	2.91E+05*	2.91E+05*	2.91E+05*
NA-24	2.40E+05**	2.40E+05	2.40E+05	2.40E+05	2.40E+05	2.40E+05	2.40E+05
P-32	1.61E+09	9.97E+07	6.24E+07	NO DATA	NO DATA	NO DATA	1.35E+08
CR-51	NO DATA	NO DATA	6.12E+04	3.40E+04	1.34E+04	8.74E+04	1.03E+07
MN-54	NO DATA	4.54E+08	9.01E+07	NO DATA	1.36E+08	NO DATA	9.32E+08
MN-56	NO DATA	1.43E+01	2.54E+00	NO DATA	1.81E+01	NO DATA	9.41E+02
FE-55	3.26E+08	2.31E+08	5.39E+07	NO DATA	NO DATA	1.46E+08	1.00E+08
FE-59	1.79E+08	4.18E+08	1.61E+08	NO DATA	NO DATA	1.32E+08	9.88E+08
CO-58	NO DATA	4.36E+07	1.01E+08	NO DATA	NO DATA	NO DATA	6.02E+08
CO-60	NO DATA	2.49E+08	5.60E+08	NO DATA	NO DATA	NO DATA	3.24E+09
NI-63	1.61E+10	1.14E+09	5.46E+08	NO DATA	NO DATA	NO DATA	1.81E+08
NI-65	5.73E+01	7.32E+00	3.34E+00	NO DATA	NO DATA	NO DATA	3.97E+02
CU-64	NO DATA	8.28E+03	3.90E+03	NO DATA	2.10E+04	NO DATA	6.42E+05
ZN-65	4.23E+08	1.47E+09	6.86E+08	NO DATA	9.41E+08	NO DATA	6.23E+08
ZN-69	5.04E+06	9.60E-06	6.72E-07	NO DATA	6.28E-06	NO DATA	1.77E-05
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	2.72E+08	1.28E+08	NO DATA	NO DATA	NO DATA	4.02E+07
RB-88	NO DATA	3.17E-22	1.69E-22	NO DATA	NO DATA	NO DATA	2.72E-29
RB-89	NO DATA	3.56E-26	2.52E-26	NO DATA	NO DATA	NO DATA	5.45E-35
SR-89	1.51E+10	NO DATA	4.32E+08	NO DATA	NO DATA	NO DATA	1.80E+09
SR-90	7.50E+11	NO DATA	1.85E+11	NO DATA	NO DATA	NO DATA	2.11E+10
SR-91	2.82E+05	NO DATA	1.12E+04	NO DATA	NO DATA	NO DATA	1.28E+06
SR-92	4.00E+02	NO DATA	1.70E+01	NO DATA	NO DATA	NO DATA	1.02E+04
Y-90	1.25E+04	NO DATA	3.37E+02	NO DATA	NO DATA	NO DATA	1.03E+08

TABLE 3.5-29 (continued)

VEGETATION PATHWAY DOSE RATE FACTORS - R^{V}_{aij}(TEEN)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	5.04E-09	NO DATA	1.93E-10	NO DATA	NO DATA	NO DATA	2.38E-07
Y-91	7.84E+06	NO DATA	2.10E+05	NO DATA	NO DATA	NO DATA	3.21E+09
Y-92	8.60E-01	NO DATA	2.49E-02	NO DATA	NO DATA	NO DATA	2.36E+04
Y-93	1.58E+02	NO DATA	4.34E+00	NO DATA	NO DATA	NO DATA	4.83E+06
ZR-95	1.73E+06	5.46E+05	3.75E+05	NO DATA	8.02E+05	NO DATA	1.26E+09
ZR-97	3.10E+02	6.14E+01	2.83E+01	NO DATA	9.31E+01	NO DATA	1.66E+07
NB-95	1.93E+03	1.07E+03	5.90E+02	NO DATA	1.04E+03	NO DATA	4.58E+06
MO-99	NO DATA	5.64E+06	1.08E+06	NO DATA	1.29E+07	NO DATA	1.01E+07
TC-99m	2.73E+00	7.61E+00	9.86E+01	NO DATA	1.13E+02	4.23E+00	5.00E+03
TC-101	7.34E-31	1.04E-30	1.03E-29	NO DATA	1.89E-29	6.36E-31	1.79E-37
RU-103	6.81E+06	NO DATA	2.91E+06	NO DATA	2.40E+07	NO DATA	5.69E+08
RU-105	4.97E+01	NO DATA	1.93E+01	NO DATA	6.27E+02	NO DATA	4.01E+04
RU-106	3.09E+08	NO DATA	3.89E+07	NO DATA	5.95E+08	NO DATA	1.48E+10
AG-110m	1.51E+07	1.43E+07	8.72E+06	NO DATA	2.73E+07	NO DATA	4.03E+09
TE-125m	1.49E+08	5.35E+07	1.99E+07	4.15E+07	NO DATA	NO DATA	4.38E+08
TE-127m	5.52E+08	1.96E+08	6.57E+07	1.31E+08	2.24E+09	NO DATA	1.38E+09
TE-127	5.40E+03	1.92E+03	1.16E+03	3.73E+03	2.19E+04	NO DATA	4.17E+05
TE-129m	3.60E+08	1.34E+08	5.70E+07	1.16E+08	1.51E+09	NO DATA	1.35E+09
TE-129	7.80E-04	2.91E-04	1.90E-04	5.57E-04	3.27E-03	NO DATA	4.26E-03
TE-131m	8.44E+05	4.05E+05	3.38E+05	6.09E+05	4.22E+06	NO DATA	3.25E+07
TE-131	1.41E-15	5.80E-16	4.39E-16	1.08E-15	6.15E-15	NO DATA	1.15E-16
TE-132	3.91E+06	2.48E+06	2.33E+06	2.61E+06	2.37E+07	NO DATA	7.84E+07
I-130	3.50E+05	1.01E+06	4.05E+05	8.26E+07	1.56E+06	NO DATA	7.79E+05
I-131	7.66E+07	1.07E+08	5.76E+07	3.13E+10	1.85E+08	NO DATA	2.12E+07
I-132	5.19E+01	1.36E+02	4.87E+01	4.58E+03	2.14E+02	NO DATA	5.91E+01
I-133	1.93E+06	3.28E+06	1.00E+06	4.58E+08	5.75E+06	NO DATA	2.48E+06
I-134	8.44E-05	2.24E-04	8.03E-05	3.73E-03	3.53E-04	NO DATA	2.95E-06

TABLE 3.5-29 (continued)

VEGETATION PATHWAY DOSE RATE FACTORS - R^{V}_{aij}(TEEN)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	3.53E+04	9.09E+04	3.37E+04	5.85E+06	1.44E+05	NO DATA	1.01E+05
CS-134	7.10E+09	1.67E+10	7.75E+09	NO DATA	5.31E+09	2.03E+09	2.08E+08
CS-136	4.37E+07	1.72E+08	1.16E+08	NO DATA	9.37E+07	1.48E+07	1.38E+07
CS-137	1.01E+10	1.35E+10	4.70E+09	NO DATA	4.59E+09	1.78E+09	1.92E+08
CS-138	5.63E+06	1.08E+07	5.40E+06	NO DATA	7.98E+06	9.28E+05	4.90E+03
BA-139	2.70E-02	1.90E-05	7.86E-04	NO DATA	1.79E-05	1.31E-05	2.41E-01
BA-140	1.38E+08	1.69E+05	8.89E+06	NO DATA	5.73E+04	1.14E+05	2.13E+08
BA-141	1.11E-21	8.27E-25	3.70E-23	NO DATA	7.67E-25	5.66E-25	2.36E-27
BA-142	5.35E-39	5.35E-42	3.29E-40	NO DATA	4.53E-42	3.56E-42	1.64E-50
LA-140	1.80E+03	8.86E+02	2.36E+02	NO DATA	NO DATA	NO DATA	5.09E+07
LA-142	1.88E-04	8.35E-05	2.08E-05	NO DATA	NO DATA	NO DATA	2.54E+00
CE-141	2.83E+05	1.89E+05	2.17E+04	NO DATA	8.90E+04	NO DATA	5.41E+08
CE-143	9.33E+02	6.79E+05	7.58E+01	NO DATA	3.04E+02	NO DATA	2.04E+07
CE-144	5.29E+07	2.19E+07	2.84E+06	NO DATA	1.31E+07	NO DATA	1.33E+10
PR-143	7.00E+04	2.79E+04	3.48E+03	NO DATA	1.62E+04	NO DATA	2.30E+08
PR-144	3.04E-26	1.24E-26	1.54E-27	NO DATA	7.14E-27	NO DATA	3.35E-29
ND-147	3.62E+04	3.94E+04	2.36E+03	NO DATA	2.31E+04	NO DATA	1.42E+08
W-187	3.53E+04	2.88E+04	1.01E+04	NO DATA	NO DATA	NO DATA	7.79E+06
NP-239	1.39E+03	1.31E+02	7.26E+01	NO DATA	4.10E+02	NO DATA	2.10E+07

* mrem/yr per μCi/m^3

** 2.40×10^5

TABLE 3.5-30

VEGETATION PATHWAY DOSE RATE FACTORS - R^{V}_{aij}(ADULT)

(m²mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	NO DATA	2.26E+03*	2.26E+03*	2.26E+03*	2.26E+03*	2.26E+03*	2.26E+03*
C-14	8.97E+05*	1.79E+05*	1.79E+05*	1.79E+05*	1.79E+05*	1.79E+05*	1.79E+05*
NA-24	2.71E+05**	2.71E+05	2.71E+05	2.71E+05	2.71E+05	2.71E+05	2.71E+05
P-32	1.40E+09	8.70E+07	5.41E+07	NO DATA	NO DATA	NO DATA	1.57E+08
CR-51	NO DATA	NO DATA	4.60E+04	2.75E+04	1.01E+04	6.11E+04	1.16E+07
MN-54	NO DATA	3.13E+08	5.96E+07	NO DATA	9.30E+07	NO DATA	9.58E+08
MN-56	NO DATA	1.59E+01	2.82E+00	NO DATA	2.01E+01	NO DATA	5.06E+02
FE-55	2.10E+08	1.45E+08	3.38E+07	NO DATA	NO DATA	8.10E+07	8.33E+07
FE-59	1.26E+08	2.96E+08	1.13E+08	NO DATA	NO DATA	8.27E+07	9.86E+08
CO-58	NO DATA	3.08E+07	6.90E+07	NO DATA	NO DATA	NO DATA	6.24E+08
CO-60	NO DATA	1.67E+08	3.69E+08	NO DATA	NO DATA	NO DATA	3.14E+09
NI-63	1.04E+10	7.21E+08	3.49E+08	NO DATA	NO DATA	NO DATA	1.50E+08
NI-65	6.18E+01	8.03E+00	3,66E+00	NO DATA	NO DATA	NO DATA	2.04E+02
CU-64	NO DATA	9.16E+03	4.30E+03	NO DATA	2.31E+04	NO DATA	7.81E+05
ZN-65	3.18E+08	1.01E+09	4.57E+08	NO DATA	6.76E+08	NO DATA	6.36E+08
ZN-69	5.39E-06	1.03E-05	7.17E-07	NO DATA	6.69E-06	NO DATA	1.55E-06
BR-83	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-84	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
BR-85	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
RB-86	NO DATA	2.19E+08	1.02E+08	NO DATA	NO DATA	NO DATA	4.33E+07
RB-88	NO DATA	3.43E-22	1.82E-22	NO DATA	NO DATA	NO DATA	4.74E-33
RB-89	NO DATA	3.96E-26	2.79E-26	NO DATA	NO DATA	NO DATA	2.30E-39
SR-89	9.95E+09	NO DATA	2.86E+08	NO DATA	NO DATA	NO DATA	1.60E+09
SR-90	6.04E+11	NO DATA	1.48E+11	NO DATA	NO DATA	NO DATA	2.18E+10
SR-91	3.02E+05	NO DATA	1.22E+04	NO DATA	NO DATA	NO DATA	1.44E+06
SR-92	4.28E+02	NO DATA	1.85E+01	NO DATA	NO DATA	NO DATA	8.48E+03
Y-90	1.33E+04	NO DATA	3.56E+02	NO DATA	NO DATA	NO DATA	1.41E+08

TABLE 3.5-30 (continued)

VEGETATION PATHWAY DOSE RATE FACTORS - R^{V}_{aij} (ADULT)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y-91m	5.42E-09	NO DATA	2.10E-10	NO DATA	NO DATA	NO DATA	1.59E-08
Y-91	5.12E+06	NO DATA	1.37E+05	NO DATA	NO DATA	NO DATA	2.82E+09
Y-92	9.13E-01	NO DATA	2.67E-02	NO DATA	NO DATA	NO DATA	1.60E+04
Y-93	1.69E+02	NO DATA	4.65E+00	NO DATA	NO DATA	NO DATA	5.35E+06
ZR-95	1.18E+06	3.79E+05	2.56E+05	NO DATA	5.94E+05	NO DATA	1.20E+09
ZR-97	3.36E+02	6.78E+01	3.10E+01	NO DATA	1.02E+02	NO DATA	2.10E+07
NB-95	2.23E+03	1.24E+03	6.66E+02	NO DATA	1.22E+03	NO DATA	7.52E+06
MO-99	NO DATA	6.12E+06	1.16E+06	NO DATA	1.39E+07	NO DATA	1.42E+07
TC-99m	3.09E+00	8.73E+00	1.11E+02	NO DATA	1.33E+02	4.28E+00	5.16E+03
TC-101	7.90E-31	1.14E-30	1.12E-29	NO DATA	2.05E-29	5.82E-31	3.42E-42
RU-103	4.77E+06	NO DATA	2.06E+06	NO DATA	1.82E+07	NO DATA	5.57E+08
RU-105	5.36E+01	NO DATA	2.12E+01	NO DATA	6.93E+02	NO DATA	3.28E+04
RU-106	1.93E+08	NO DATA	2.44E+07	NO DATA	3.73E+08	NO DATA	1.25E+10
AG-110m	1.05E+07	9.75E+0	5.79E+06	NO DATA	1.92E+07	NO DATA	3.98E+09
TE-125m	9.67E+07	3.51E+0	1.30E+07	2.91E+07	3.93E+08	NO DATA	3.86E+08
TE-127m	3.49E+08	1.25E+08	4.26E+07	8.93E+07	1.42E+09	NO DATA	1.17E+09
TE-127	5.73E+03	2.06E+03	1.24E+03	4.25E+03	2.33E+04	NO DATA	4.52E+05
TE-129m	2.51E+08	9.35E+07	3.97E+07	8.61E+07	1.05E+09	NO DATA	1.26E+09
TE-129	8.35E-04	3.14E-04	2.03E-04	6.41E-04	3.51E-03	NO DATA	6.30E-04
TE-131m	9.12E+05	4.46E+05	3.72E+05	7.06E+05	4.52E+06	NO DATA	4.43E+07
TE-131	1.51E-15	6.32E-16	4.78E-16	1.24E-15	6.63E-15	NO DATA	2.14E-16
TE-132	4.31E+06	2.79E+06	2.62E+06	3.08E+06	2.68E+07	NO DATA	1.32E+08
I-130	3.91E+05	1.15E+06	4.55E+05	9.77E+07	1.80E+06	NO DATA	9.93E+05
I-131	8.07E+07	1.15E+08	6.62E+07	3.78E+10	1.98E+08	NO DATA	3.05E+07
I-132	5.77E+01	1.54E+02	5.40E+01	5.40E+03	2.46E+02	NO DATA	2.90E+01
I-133	2.09E+06	3.63E+06	1.11E+06	5.34E+08	6.34E+06	NO DATA	3.26E+06
I-134	9.33E-05	2.53E-04	9.06E-05	4.39E-03	4.03E-04	NO DATA	2.21E-07

TABLE 3.5-30 (continued)

VEGETATION PATHWAY DOSE RATE FACTORS - R^{v}_{aij} (ADULT)

(m^2mrem/yr per μCi/sec)

ORGAN: ISOTOPE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
I-135	3.91E+04	1.02E+05	3.77E+04	6.75E+04	1.64E+05	NO DATA	1.16E+05
CS-134	4.67E+09	1.11E+10	9.08E+09	NO DATA	3.59E+09	1.19E+09	1.94E+08
CS-136	4.26E+07	1.68E+08	1.21E+08	NO DATA	9.35E+07	1.28E+07	1.91E+07
CS-137	6.36E+09	8.70E+09	5.70E+09	NO DATA	2.95E+09	9.82E+08	1.68E+08
CS-138	3.55E+06	7.02E+06	3.48E+06	NO DATA	5.16E+06	5.09E+05	2.99E+01
BA-139	2.86E-02	2.04E-05	8.38E-04	NO DATA	1.91E-05	1.16E-05	5.07E-02
BA-140	1.29E+08	1.62E+05	8.43E+06	NO DATA	5.50E+04	9.26E+04	2.65E+08
BA-141	1.18E-21	8.90E-25	3.98E-23	NO DATA	8.28E-25	5.05E-25	5.55E-31
BA-142	5.79E-39	5.96E-42	3.64E-40	NO DATA	5.03E-42	3.37E-42	8.16E-57
LA-140	1.98E+03	9.95E+02	2.63E+02	NO DATA	NO DATA	NO DATA	7.31E+07
LA-142	2.04E-04	9.25E-05	2.31E-05	NO DATA	NO DATA	NO DATA	6.76E-01
CE-141	1.97E-11	1.33E-11	1.51E-12	NO DATA	6.17E-12	NO DATA	5.08E-08
CE-143	9.98E+02	7.38E+05	8.17E+01	NO DATA	3.25E+02	NO DATA	2.76E+07
CE-144	3.28E+07	1.37E+07	1.76E+06	NO DATA	8.14E+06	NO DATA	1.11E+10
PR-143	6.26E+04	2.51E+04	3.10E+03	NO DATA	1.45E+04	NO DATA	2.74E+08
PR-144	3.25E-26	1.35E-26	1.65E-27	NO DATA	7.61E-27	NO DATA	4.68E-33
ND-147	3.33E+04	3.85E+04	2.31E+03	NO DATA	2.25E+04	NO DATA	1.85E+08
W-187	1.90E+04	1.58E+04	5.54E+03	NO DATA	NO DATA	NO DATA	5.19E+06
NP-239	1.43E+03	1.40E+02	7.74E+01	NO DATA	4.38E+02	NO DATA	2.88E+07

* mrem/yr per μCi/m^3

** 2.71×10^5

TABLE 3.5-31

GROUND PLANE PATHWAY DOSE RATE FACTORS - R_i^G

(m^2mrem/yr per μCi/sec)

Isotope	Total Body	Skin	Isotope	Total Body	Skin	Isotope	Total Body	Skin
H-3	0.00E+00	0.00E+00	Y-91	1.07E+06	1.21E+06	CS-136	1.51E+08	1.71E+08
C-14	0.00E+00	0.00E+00	Y-92	1.80E+05	2.14E+05	CS-137	1.30E+10	1.52E+10
NA-24	1.20E+07*	1.39E+07	Y-93	1.83E+05	2.50E+05	CS-138	3.59E+09	4.10E+09
P-32	0.00E+00	0.00E+00	ZR-95	2.45E+08	2.85E+08	BA-139	1.06E+05	1.19E+05
CR-51	4.65E+06	5.50E+06	ZR-97	2.96E+06	3.44E+06	BA-140	2.05E+07	2.35E+07
MN-54	1.38E+09	1.62E+09	NB-95	3.80E+06	4.47E+06	BA-141	4.17E+04	4.75E+04
MN-56	9.03E+05	1.07E+06	MO-99	3.99E+06	4.62E+06	BA-142	4.49E+04	5.11E+04
FE-55	0.00E+00	0.00E+00	TC-99m	1.84E+05	2.11E+05	LA-140	1.92E+07	2.18E+07
FE-59	2.73E+08	3.20E+08	TC-101	2.03E+04	2.26E+04	LA-142	7.60E+05	9.12E+05
CO-58	3.80E+08	4.45E+08	RU-103	1.08E+08	1.26E+08	CE-141	1.37E+07	1.54E+07
CO-60	2.32E+10	2.73E+10	RU-105	6.36E+05	7.21E+05	CE-143	2.31E+06	2.63E+06
NI-63	0.00E+00	0.00E+00	RU-106	4.22E+08	5.06E+08	CE-144	6.96E+07	8.05E+07
NI-65	2.97E+05	3.45E+05	AG-110m	3.44E+09	4.01E+09	PR-143	0.00E+00	0.00E+00
CU-64	6.05E+05	6.86E+05	TE-125m	1.56E+06	2.13E+06	PR-144	1.84E+03	2.11E+03
ZN-65	7.48E+08	8.60E+08	TE-127m	9.16E+04	1.08E+05	ND-147	8.39E+06	1.01E+07
ZN-69	0.00E+00	0.00E+00	TE-127	2.99E+03	3.29E+03	W-187	2.35E+06	2.73E+06
BR-83	4.87E+03	7.07E+03	TE-129m	1.98E+07	2.31E+07	NP-239	1.71E+06	1.98E+06
BR-84	2.03E+05	2.36E+05	TE-129	2.64E+04	3.12E+04			
BR-85	0.00E+00	0.00E+00	TE-131m	8.02E+06	9.46E+06			
RB-86	8.98E+06	1.03E+07	TE-131	2.92E+04	3.45E+04			
RB-88	3.31E+04	3.78E+04	TE-132	4.24E+06	4.99E+06			
RB-89	1.23E+05	1.48E+05	I-130	5.50E+06	6.68E+06			
SR-89	2.16E+04	2.50E+04	I-131	1.72E+07	2.09E+07			
SR-90	NO DATA	NO DATA	I-132	1.25E+06	1.47E+06			
SR-91	2.14E+06	2.51E+06	I-133	2.45E+06	2.98E+06			
SR-92	7.77E+05	8.64E+05	I-134	4.46E+05	5.30E+05			
Y-90	4.50E+03	5.31E+03	I-135	2.53E+06	2.95E+06			
Y-91m	1.00E+05	1.16E+05	CS-134	6.93E+09	8.09E+09			

*1.20×10^7

4.0 COMPLIANCE WITH 40CFR190

CPS RETS 3.11.4 specifies that when the calculated doses associated with the effluent releases exceed twice the limits of CPS RETS 3.11.1.2, 3.11.2.2 or 3.11.2.3, a Special Report shall be prepared and submitted to the Commission. In addition, subsequent releases shall be limited such that the dose or dose commitment to a real individual from all uranium fuel cycle sources is limited to 25 mrem to the total body or any organ (75 mrem to the thyroid) over 12 consecutive months. This Special Report is to include an analysis which demonstrates that radiation exposures to all real individuals from all uranium fuel cycle sources (including all liquid and gaseous effluent pathways and direct radiation) are less than the standards in 40CFR190, ENVIRONMENTAL RADIATION PROTECTION STANDARDS FOR NUCLEAR POWER OPERATIONS. If analysis indicates that releases resulting in doses that exceed the 40CFR190 standard could have occurred, and if the release condition resulting in violation of 40CFR190 has not been corrected, then a variance from the Commission to permit such releases will be requested.

The Special Report shall contain:

1. A determination of which uranium fuel cycle facilities or operations, in addition to CPS, contribute to the annual dose to the maximum exposed individual. Fuel cycle facilities located beyond the 5 mile radius from CPS need not be considered in this determination.

2. A determination of the maximum exposed individual.

3. A determination of the total annual dose to the maximum exposed individual from all existing pathways and sources of radioactivity and radiation (including direct radiation from N-16, the plant and storage facilities) using methodologies described in the CPS-ODCM. The direct radiation dose may be either calculated using NUREG-0133 methodology or measured.

The total body and organ doses resulting from liquid effluents will be summed with the doses resulting from gaseous effluents (including non-noble gases) and the doses to the maximum exposed individual from other operations of the uranium fuel cycle. The effluent doses will be based upon releases from PS during the previous three quarters and from the quarter in which CPS RETS 3.11.4 was exceeded.

5.0 RADIOLOGICAL ENVIRONMENTAL MONITORING

The Clinton Power Station (CPS) Radiological Environmental Monitoring Program (REMP) implements CPS Technical Specification 3/4.12.1. Table 5.0-1 and Figure 5.0-1, 5.0-2 and 5.0-3 describe the program required by the Technical Specification.

Supplemental REMP samples required by commitments in the Environmental Report - Operating License Stage (ER-OLS) are also described in Table 5.0-1 and Figure 5.0-1, 5.0-2 and 5.0-3.

In addition to the required sampling program, CPS will perform supplemental periodic and long term sampling and analyses in order to better monitor the environmental exposure pathways. These samples will not be listed in the ODCM, however, full sample descriptions and results will be included in the Annual Radiological Environmental Operating Report.

5.1 INTERLABORATORY COMPARISON PROGRAM

All analyses for CPS Radiological Environmental Monitoring Program are performed by Teledyne Isotopes Midwest Laboratories (TIML) located in Northbrook, Illinois.

Teledyne Isotopes Midwest Laboratory (formerly Hazleton Environmental Sciences) has participated in interlaboratory comparison (crosscheck) programs since the formulation of its quality control program in December 1971. These programs have been operated by agencies which supply environmental-type samples (e.g., milk or water) containing concentrations of radionuclides known to the issuing agency but not to the participant laboratories. The purpose of such a program is to provide an independent check on the laboratory's analytical procedures and to alert it to any possible problems.

Participant laboratories measure the concentrations of specified radionuclides and report them to the issuing agency. Several months later, the agency reports the known values to the participant laboratories and specifies the range the results should fall within. Results consistently higher or lower than the known values and results outside the specified ranges indicate a need to check the instruments or procedures used.

CPS has received results obtained through TIML's participation in the environmental sample crosscheck program for milk, water, air filters and food samples during the period 1980 through June 1985. This program has been conducted by the U.S. Environmental Protection Agency Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, Las Vegas, Nevada.

TIML has published results for thermoluminescent dosimeters (TLDs) during the period 1976, 1977, 1979, 1980, and 1981 through participation in the Second, Third, Fourth and Fifth International Intercomparison of Environmental Dosimeters.

If the results of a determination in the EPA crosscheck program are outside the control limits specified by the EPA, CPS will require TIML to investigate the cause of the problem and take steps to correct it. The results of this investigation and correction action shall be included in the Annual Radiological Environmental Operating Report.

Table 5.0-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
SAMPLING AND COLLECTION FREQUENCIES

EXPOSURE PATHWAY and/or SAMPLE TYPE	REQUIRED SAMPLING and COLLECTION FREQUENCY	REQUIRED TYPE and FREQUENCY of ANALYSIS
TECHNICAL SPECIFICATION TABLE 3.12-1 REQUIREMENTS		
1. DIRECT RADIATION	Quarterly	Gamma dose, quarterly

Required:

(1) An inner ring of stations, one in each meteorological sector in the general area of the SITE BOUNDARY;

SECTOR	CODE	DISTANCE from station (miles)
N	CL-36	0.6
NNE	CL-5	0.7
NE	CL-22	0.6
ENE	CL-23	0.5
E	CL-24	0.5
ESE	CL-42	2.8
SE	CL-43	2.8
SSE	CL-44	2.3
S	CL-45	2.8
SSW	CL-46	2.8
SW	CL-47	3.3
WSW	CL-48	2.3
W	CL-1	1.8
WNW	CL-34	0.8
NW	CL-35	0.7
NNW	CL-63	1.3

Table 5.0-1 (continued)

Required:

(2) An outer ring of stations, one in each sector in 6 to 8 km range (3.7 miles to 5.0 miles).

SECTOR	CODE	DISTANCE from station (miles)
N	CL-76	4.6
NNE	CL-77	4.5
NE	CL-78	4.8
ENE	CL-79	4.5
E	CL-53	4.3
ESE	CL-54	4.6
SE	CL-55	4.1
SSE	CL-56	4.1
S	CL-57	4.6
SSW	CL-58	4.3
SW	CL-60	4.5
WSW	CL-61	4.5
W	CL-80	4.1
WNW	CL-81	4.5
NW	CL-51	4.4
NNW	CL-52	4.3

(3) The balance of the stations to be placed in special interest areas such as population centers, nearby residents, schools, and in 1 or 2 areas to serve as control stations.

SECTOR	CODE	DISTANCE from station (miles)
N	CL-37	3.4
N	CL-75	0.94
ENE	CL-65	2.6
E	CL-41	2.4
S (control)	CL-11	16
W	CL-49	3.5
W	CL-74	1.9
WNW	CL-64	2.1

Table 5.0-1 (continued)

EXPOSURE PATHWAY and/or SAMPLE TYPE	REQUIRED NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS	REQUIRED SAMPLING AND COLLECTION FREQUENCY	REQUIRED TYPES AND FREQUENCY OF ANALYSIS
2. AIRBORNE			
Radioiodine and Particulates	Samples from 5 locations	Continuous sampler operation with sample collection weekly.	Radioiodine Cannister: I-131 analysis weekly.
	a) 3 samples from close to the 3 SITE BOUNDARY locations in different sectors of the highest calculated annual average ground - level D/Q.		Particulate Sampler: Gross beta radioactivity analysis following filter change; Gamma isotopic analysis of composite (by location, quarterly).

SECTOR	CODE	DISTANCE from station (miles)
NNE	CL-2	0.7
NE	CL-3	0.7
E	CL-94	0.6

b) 1 sample from the vicinity of a community having the highest calculated annual average ground level D/Q.

SECTOR	CODE	DISTANCE from station (miles)
E	CL-8	2.2

c) 1 sample from a control location, as for example 15-30 km distant and in the least prevalent wind direction.

SECTOR	CODE	DISTANCE from station (miles)
S (control)	CL-11	16

Table 5.0-1 (continued)

EXPOSURE PATHWAY and/or SAMPLE TYPE	REQUIRED NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS	REQUIRED SAMPLING AND COLLECTION FREQUENCY	REQUIRED TYPES AND FREQUENCY OF ANALYSIS
3. WATERBORNE			
a. Surface	1 sample upstream 1 sample downstream	Composite sample over 1-month period	Gamma isotopic analysis monthly. Composite for tritium analysis quarterly.

SECTOR	CODE	DISTANCE from station (miles)
ENE (upstream)	CL-92	Plant Screenhouse
ENE (downstream)	CL-90	0.4

b. Ground	Samples from 1 or 2 sources only if likely to be affected.	Quarterly	Gamma isotopic and tritium analysis quarterly.

SECTOR	CODE	DISTANCE from station (miles)
E	CL-12	1.6*
ESE	CL-7E	2.3

*Sample location is in pump station distant from well. Well located 1.0 mile S of plant on the edge of the lake.

c. Drinking	1 sample of each of 1 to 3 of the nearest water supplies that could be affected by its discharge.*	Composite sample over 2-week period when I-131 analysis is performed, monthly composite otherwise.	I-131 analysis on each composite for the dose calculated for the consumption of the water if greater than 1 mrem per year. Composite for gross beta and gamma isotopic analysis monthly. Composite for tritium analysis quarterly.

Table 5.0-1 (continued)

EXPOSURE PATHWAY and/or SAMPLE TYPE	REQUIRED NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS	REQUIRED SAMPLING AND COLLECTION FREQUENCY	REQUIRED TYPES AND FREQUENCY OF ANALYSIS
c. Continued			
*No municipal or public drinking water supplies are taken from Clinton Lake or downstream for 200 miles.			
	1 sample from a control location		
No control location necessary.			
d. Sediment from shoreline	1 sample from downstream area with existing or potential recreational value.	Semiannually	Gamma isotopic analysis semiannually.
SECTOR	CODE	DISTANCE from station (miles)	
SE	CL-7B	2.1	
4. INGESTION a. Milk	Samples from milking animals in 3 locations with 5 km distance having the highest dose potential. If there are none, then, 1 sample from milking animals in each of three areas between 5 to 8 km distant where doses are calculated to be greater than 1 mrem per year.	Semimonthly when animals are on pasture, monthly at other times.	Gamma isotopic and I-131 analysis semimonthly when animals are on pasture; monthly at other times.

Table 5.0-1 (continued)

EXPOSURE PATHWAY and/or SAMPLE TYPE	REQUIRED NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS	REQUIRED SAMPLING AND COLLECTION FREQUENCY	REQUIRED TYPES AND FREQUENCY OF ANALYSIS
No milking animals within 8 km of the site were identified in the land use survey.			
	1 sample from milking animals at a control location, 15-30 km distant and in the least prevalent wind direction.		
SECTOR	CODE	DISTANCE from station (miles)	
WSW (control)	CL-116		14
b. Fish and invertebrates	1 sample of each commercially and recreationally important species in vicinity of plant discharge.	Sample in season or semiannually if they are not seasonal.	Gamma isotopic analysis on edible portions.
SECTOR	CODE	DISTANCE from station (miles)	
E	CL-19		3.1
c. Food Products	1 sample of each principal class of food products from any area that is irrigated by water in which liquid plant wastes have been discharged*.	At time of harvest	Gamma isotopic analysis on edible portions.

*No known usage of Salt Creek water for irrigation in DeWitt, Logan, Menard, or Cass Counties.

Table 5.0-1 (continued)

EXPOSURE PATHWAY and/or SAMPLE TYPE	REQUIRED NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS	REQUIRED SAMPLING AND COLLECTION FREQUENCY	REQUIRED TYPES AND FREQUENCY OF ANALYSIS
c. Food Products (Cont.)	Samples of 3 different kinds of broad leaf vegetation grown nearest each of two different offsite locations of highest predicted annual average ground-level D/Q if milk sampling is not performed.	Monthly when available	Gamma isotopic and I-131 analysis.

SECTOR	CODE	DISTANCE from station (miles)
NE	CL-115	0.9
E	CL-18	2.5

1 sample of each of the similar broad leaf vegetation grown 15-30 km distant in the least prevalent wind direction if milk sampling is not performed.

SECTOR	CODE	DISTANCE from station (miles)
SSE (Control)	CL-114	12.5

Table 5.0-1 (continued)

EXPOSURE PATHWAY and/or SAMPLE TYPE	REQUIRED SAMPLING AND COLLECTION FREQUENCY	REQUIRED TYPES AND FREQUENCY OF ANALYSIS
ENVIRONMENTAL REPORT (OPERATING LICENSE STAGE) TABLE 6.1-8 REQUIREMENTS		
1. Direct Radiation	Quarterly	Gamma dose, quarterly
SECTOR	CODE	DISTANCE from station (miles)
NNE	CL-2	0.7
NE	CL-3	0.6
WSW	CL-4	0.8
SW	CL-6	0.7
SE	CL-7A	2.3
E	CL-8	2.2
2. Airborne	Continuous sampler operation with sample collection weekly, composite quarterly.	Radioiodine Cannister: I-131 analysis weekly. Particulate Sampler: Gross beta radioactivity analysis following filter changes. Gamma isotopic analysis of composite (by location, quarterly).
SECTOR	CODE	DISTANCE from station (miles)
W	CL-1	1.8
WSW	CL-4	0.8
SW	CL-6	0.7
SE	CL-7A	2.3

Table 5.0-1 (continued)

EXPOSURE PATHWAY and/or SAMPLE TYPE	REQUIRED SAMPLING AND COLLECTION FREQUENCY	REQUIRED TYPES AND FREQUENCY OF ANALYSIS
3. Surface Drinking Water	Composite sample over 2-week period when I-131 analysis is performed monthly composite otherwise.	I-131 analysis on each composite for the dose calculated for the consumption of the water if greater than 1 mrem per year. Composite for gross beta and gamma isotpic analysis monthly. Composite for tritium analysis quarterly.
SECTOR	CODE	DISTANCE from station (miles)
WNW	CL-14	within service building
4. Surface Water	Monthly grab sample composited quarterly by location.	Gamma isotopic analysis. Tritium analysis on quarterly composite.
SECTOR	CODE	DISTANCE from station (miles)
ESE	CL-9	2.7
ENE	CL-10	5.0
SW	CL-13	3.6
5. Bottom Sediment	Semiannual grab sample.	Gamma isotpic analysis.
SECTOR	CODE	DISTANCE from station (miles)
SE	CL-7C	1.3
SW	CL-10	5.0

Table 5.0-1 (continued)

EXPOSURE PATHWAY and/or SAMPLE TYPE	REQUIRED SAMPLING AND COLLECTION FREQUENCY	REQUIRED TYPES AND FREQUENCY OF ANALYSIS
6. Shoreline Sediment	Semiannual grab sample.	Gamma isotopic analysis.
SECTOR	CODE	DISTANCE from station (miles)
SW	CL-10	5.0
7. Slime or aquatic vegetation (periphyton)	Semiannual grab sample.	Gamma isotopic analysis.
SECTOR	CODE	DISTANCE from station (miles)
SE	CL-7C	1.3
ENE	CL-10	5.0
8. Soil	Every three years grab sample.	Gamma isotopic analysis.
SECTOR	CODE	DISTANCE from station (miles)
W	CL-1	1.8
NNE	CL-2	0.7
NE	CL-3	0.6
WSW	CL-4	0.8
SW	CL-6	0.7
SE	CL-7A	2.3
E	CL-8	2.2
S	CL-11	16
E	CL-94	0.5
9. Ground Water	Biweekly Grab	I-131 - biweekly Gamma isotope analysis and Gross beta analysis - monthly. Tritium analysis - quarterly composite of monthly.
SECTOR	CODE	DISTANCE from station (miles)
E	CL-12	1.6*
ESE	CL-7E	2.3

* Sample location is in pump station distant from well. Well located 1.0 mile S of plant on edge of lake.

FIGURE 5.0-1

REMP LOCATIONS WITHIN 1.5 MILES OF CPS

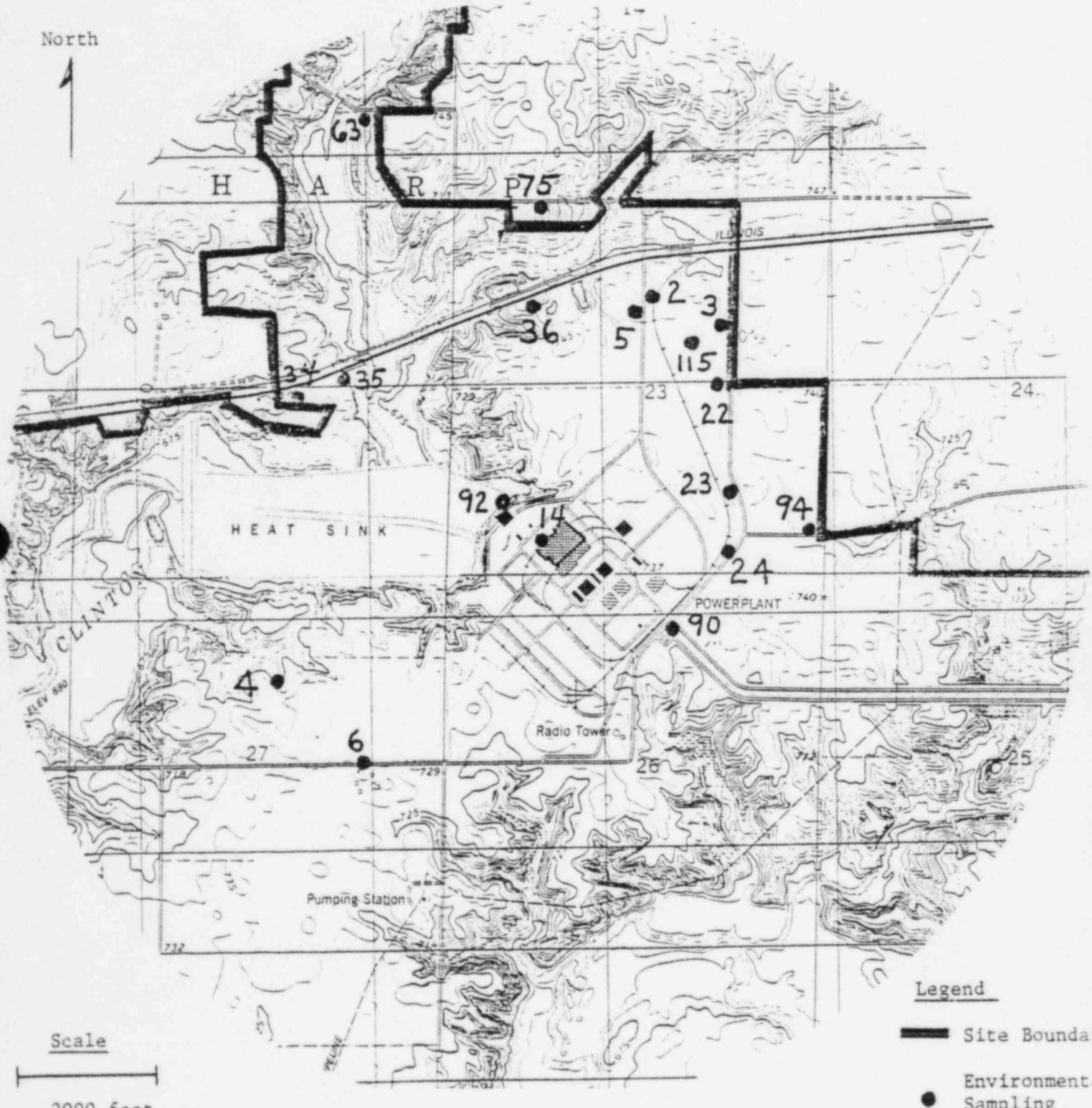


FIGURE 5.0-2

REMP LOCATIONS WITHIN 6 MILES OF CPS

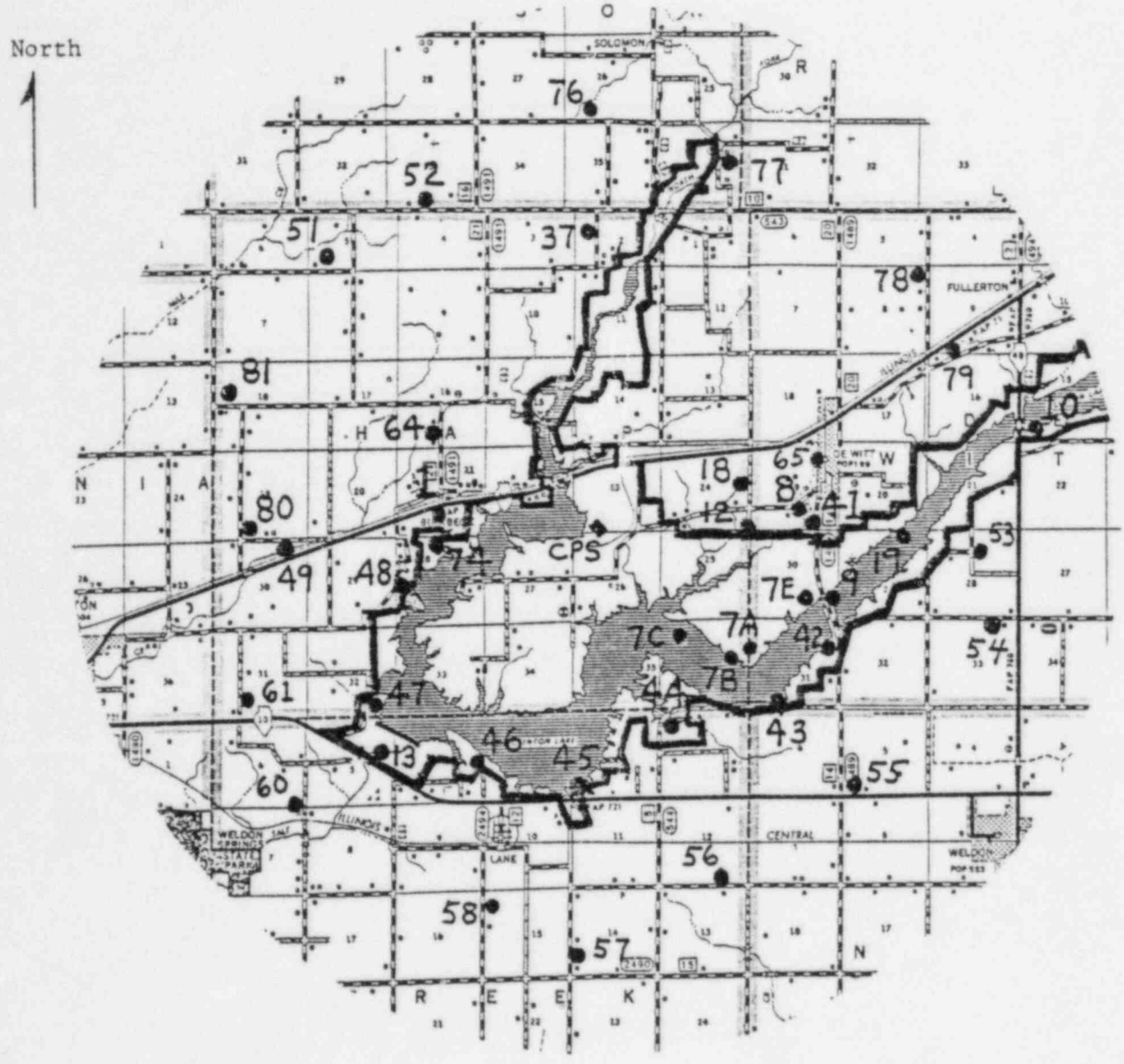
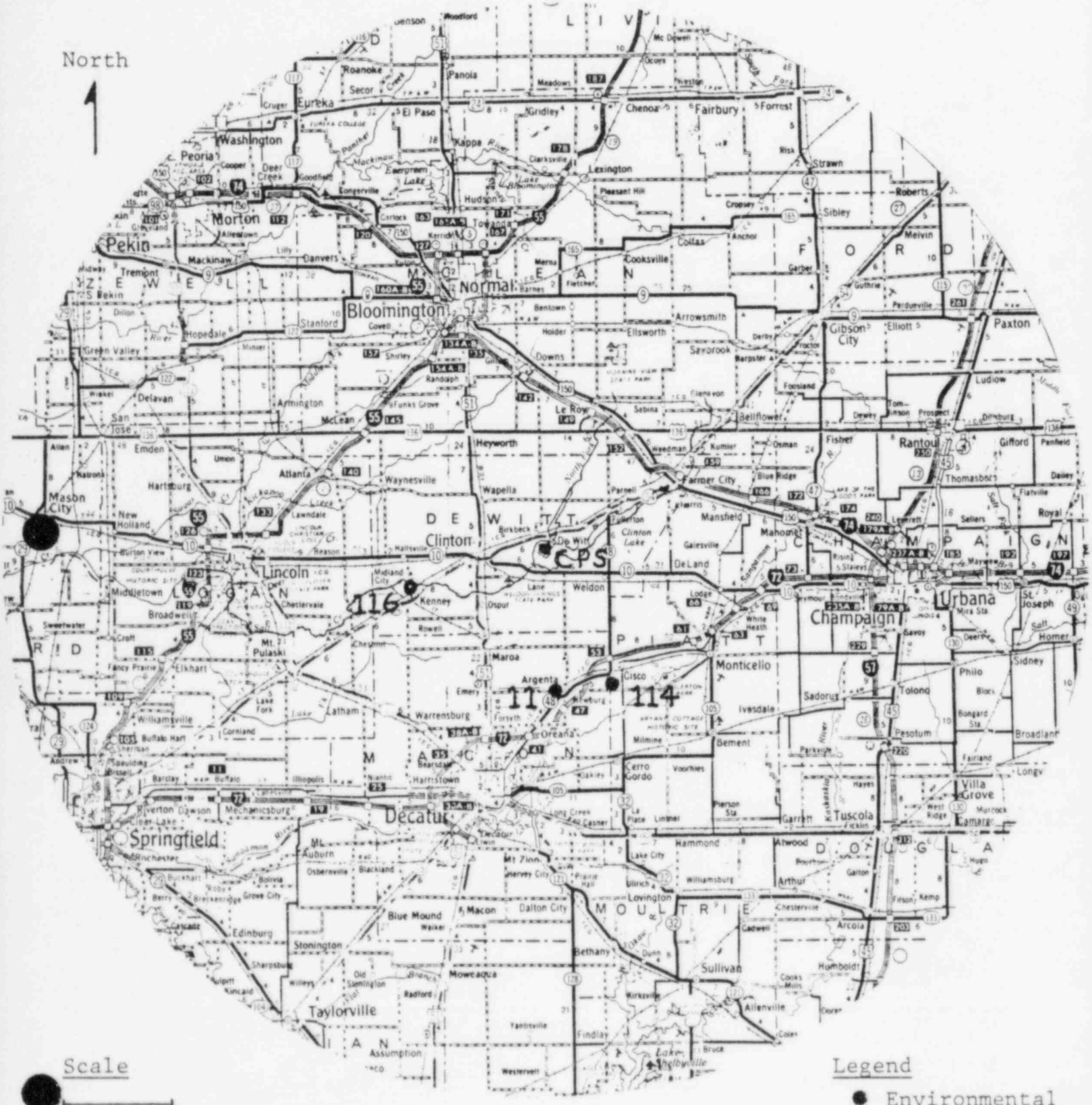


FIGURE 5.0-3

REMP LOCATIONS WITHIN 50 MILES OF CPS



6.0 ADJUSTMENT OF CPS RETS

Consistent with the NRC Commissioners' opinion on 10CFR50 Appendix I dated April 30, 1975, CPS will use environs monitoring data to improve dose calculational models and to request CPS RETS changes on the basis of such operating experience data. Such adjustments are recognized as being especially important for the radioiodine-milk pathway where conservative regulatory guide assumptions have been made. By using environs monitoring data, uncertainties associated with plume behavior, radioiodine chemical form, deposition and retention on forages, and milk consumption patterns may be circumvented or reduced.

7.0 ATMOSPHERIC TRANSPORT AND DISPERSION MODEL

7.1 Introduction

The atmospheric transport and dispersion model used by Illinois Power Company is a straight-line, sector-averaged Gaussian model designed to estimate average relative concentrations at various receptor points. The model was developed in accordance with routine release analysis procedures specified by Regulatory Guide 1.111 (Revision 1 July 1977), Section C.1.c "Constant Mean Wind Direction Models".

All meteorological and dose calculations prescribed in this manual for long-term releases are based on meteorological data acquired onsite for the period April 1975 through March 1976. This period of record was selected from five years of data (April 1972 through March 1977) and represents conservative dispersion conditions and highest data recovery. Acquired meteorological data will be reviewed and X/Q values updated, if necessary, in the SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT.

Even though the CPS RETS utilize historical annual average dispersion conditions in determining the Limiting Condition for Operation (LCO) for radioactive materials in gaseous effluents, near-real time (hourly) meteorological data will be summarized and coupled with corresponding releases. This summary will be included in the SEMIANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT.

The methodology utilized in calculating the undecayed, undepleted dispersion (Table 7.2-1) and deposition (Table 7.2-2) values is described in section 7.2. Near-real time meteorological data processing is described in section 7.3. Site boundary dispersion parameters are listed in Table 7.2-5.

7.2 Historical Meteorological Data Processing

The data presented in Tables 7.2-1 and 7.2-2 are based upon data acquired by a single onsite meteorological tower instrumented at the 10 and 60 meter heights with temperature, wind speed and wind direction sensors. Discharge point characteristics (refer to Table 7.2-4) permit use of the mixed-mode dispersion model for all calculations. Therefore, two stability wind roses, elevated and ground, were developed jointly by considering the wind data hour by hour. When the exit velocity to wind speed ratio indicates the release should be considered as elevated, the upper level data is used; as ground, lower level data.

Reported wind speeds which are less than the anemometer's threshold are assigned a value equal to one-half of threshold speed. For reported wind speeds which are less than the direction vane's threshold, a direction is assigned in proportion to the observed wind direction distribution of the lowest noncalm speed class. Refer to Table 7.2-3 for the wind direction and windspeed classification criteria.

7.2.1 Numerical Model

The constant mean wind direction model assumes that the effluent is uniformally distributed within each downwind sector and that the release rate is constant during the time period considered by the model. The concentration to source term ratio (X/Q) at any downwind location is calculated by equation (1):

$$\frac{X(R,\theta)}{Q} = \frac{2.032}{R} \sum_{u} \sum_{s} f(u,\theta,s)\ (uS_z)^{-1} \exp\left[-0.5\left(\frac{h_e}{S_z}\right)^2\right] \quad (1)$$

where

$X/Q\ (R,\theta)$ = Relative effluent radionuclide plume concentration at distance R and direction θ, sec/m^3

2.032 = The constant $(2/\pi)^{\frac{1}{2}}$ divided by the width, in radians, of a 22.5° sector ($\pi/8$), dimensionless

R = Distance downwind to receptor point (R,θ), meter

θ = Downwind direction to receptor point (R,θ), degreee or sector

u = Wind speed, m/sec

s = Pasquill atmospheric stability class, A through G

f = Observed joint frequency in which the wind blows with speed u in downwind direction and atmospheric stability class s, dimensionless

S_z = Vertical dispersion coefficient corrected for building wake effects, meter

h_e = Effective effluent release height, meter

Atmospheric stability is classified as follows:

Pasquill Stability	Temperature Lapse Rate (°C/100m)
A (Extremely Unstable)	< -1.9
B	-1.9 to -1.7
C	-1.7 to -1.5
D (Neutral)	-1.5 to -0.5
E	-0.5 to 1.5
F	1.5 to 4.0
G (Extremely Stable)	> 4.0

7.2.2 Source Configuration Considerations

In the mixed-mode model, the height of the release is proportioned between elevated (discharge point height plus momentum plume rise) and ground (discharge point height equal to zero) levels. Separate wind and stability data are used for each release height and corresponding X/Q ratios calculated. The fraction of the time the plume is considered ground level, G_t, is determined from the ratio of the discharge point vertical exit velocity to the wind speed, W_o/u, and by the following relationships:

$$G_t = \begin{cases} 1.00 & ; W_o/u \leq 1.0 \\ 2.58-1.58(W_o/u) & ; 1.0 < W_o/u \leq 1.5 \\ 0.3-0.06(W_o/u) & ; 1.5 < W_o/u < 5.0 \\ 0.00 & ; W_o/u \geq 5.0 \end{cases}$$

It follows that the release can be considered as ground level $100G_t$ percent of the time and elevated $100(1-G_t)$ percent of the time.

To calculate ground level X/Q, equation (1) is used with the effective effluent release height set to zero ($h_e = 0$). The correction factor applied to the vertical dispersion coefficient, S_z, to account for increased plume mixing within the building wake is determined by equation (2):

$$S_z = [\sigma_z^2 + D_z^2/2\pi]^{\frac{1}{2}} \qquad (2)$$

with the restriction that $S_z \leq (3)^{\frac{1}{2}} \sigma_z$

where

D_z = Maximum height of neighboring structure causing wake effects, meter

σ_z = Vertical dispersion coefficient, meters

$= aR^b + C$ (below)

≤ 1000

STABILITY	100< R< 1000			R >1000		
CLASS	a	b	c	a	b	c
A	0.00066	1.941	9.27	0.00024	2.094	-9.6
B	0.0382	1.149	3.3	0.055	1.098	2.0
C	0.113	0.911	0.0	0.113	0.911	0.0
D	0.222	0.725	-1.7	1.26	0.516	-13.0
E	0.211	0.678	-1.3	6.73	0.305	-34.0
F	0.086	0.74	-0.35	18.05	0.18	-48.6
G	0.052	0.74	-0.21	10.83	0.18	-29.2

The expression for σ_z simulates Regulatory Guide 1.111, Figure 1.

7.2.3 Relative Deposition Factor (D/Q)

Using stability wind rose meteorological data, relative deposition is calculated using equation (3):

$$D/Q = \frac{16}{2\pi R} \sum_s f(\theta, s)\, D_r(S, R, h_s) \quad , m^{-2} \qquad (3)$$

where

D_r = Relative deposition rate, m^{-1}

= Deposition rate per unit downwind distance (μCi/sec-m) divided by the source term (μCi/sec)

For mixed-mode releases, the relative deposition rate is calculated using the following equation:

$$(D_r)_m = G_t\ (D_r)_g + (1-G_t)\ (D_r)_e \quad , m^{-1} \qquad (4)$$

where

$(D_r)_m$ = Relative deposition rate of mixed-mode releases, m^{-1}

$(D_r)_g$ = Relative deposition rate of ground-level releases, m^{-1} (Regulatory Guide 1.111, Figure 6)

$(D_r)_e$ = Relative deposition rate of elevated releases, m^{-1} (Regulatory Guide 1.111, Figure 8)

Table 7.2-1

ANNUAL AVERAGE MIXED-MODE X/Q
April 1975 - April 1976

Distance (meter)	Sector							
	N	NNE	NE	ENE	E	ESE	SE	SSE
1.00+002	8.092-005*	6.751-005	5.207-005	3.177-005	3.737-005	3.269-005	2.398-005	2.030-005
1.10+002	6.764-005	5.645-005	4.356-005	2.657-005	3.124-005	2.732-005	2.005-005	1.699-005
1.20+002	5.749-005	4.799-005	3.705-005	2.260-005	2.655-005	2.321-005	1.704-005	1.446-005
1.30+002	4.954-005	4.137-005	3.195-005	1.948-005	2.289-005	2.000-005	1.469-005	1.247-005
1.40+002	4.320-005	3.608-005	2.787-005	1.699-005	1.995-005	1.743-005	1.281-005	1.088-005
1.50+002	3.805-005	3.178-005	2.457-005	1.497-005	1.758-005	1.536-005	1.128-005	9.594-006
1.60+002	3.382-005	2.824-005	2.184-005	1.331-005	1.562-005	1.366-005	1.003-005	8.534-006
1.70+002	3.028-005	2.529-005	1.957-005	1.191-005	1.399-005	1.223-005	8.981-006	7.647-006
1.80+002	2.729-005	2.279-005	1.765-005	1.074-005	1.261-005	1.103-005	8.096-006	6.897-006
1.90+002	2.474-005	2.066-005	1.601-005	9.737-006	1.143-005	1.001-005	7.340-006	6.256-006
2.00+002	2.255-005	1.883-005	1.459-005	8.875-006	1.042-005	9.122-006	6.690-006	5.705-006
2.10+002	2.065-005	1.724-005	1.337-005	8.127-006	9.537-006	8.355-006	6.126-006	5.226-006
2.20+002	1.899-005	1.585-005	1.230-005	7.474-006	8.769-006	7.685-006	5.634-006	4.808-006
2.30+002	1.753-005	1.463-005	1.135-005	6.900-006	8.095-006	7.096-006	5.202-006	4.440-006
2.40+002	1.624-005	1.355-005	1.052-005	6.393-006	7.498-006	6.575-006	4.820-006	4.115-006
2.50+002	1.510-005	1.260-005	9.784-006	5.944-006	6.971-006	6.114-006	4.482-006	3.827-006
2.60+002	1.412-005	1.178-005	9.150-006	5.558-006	6.523-006	5.727-006	4.197-006	3.584-006
2.70+002	1.324-005	1.104-005	8.578-006	5.210-006	6.119-006	5.378-006	3.940-006	3.364-006
2.80+002	1.244-005	1.037-005	8.062-006	4.896-006	5.754-006	5.061-006	3.707-006	3.165-006
2.90+002	1.171-005	9.762-006	7.594-006	4.611-006	5.423-006	4.774-006	3.496-006	2.985-006
3.00+002	1.106-005	9.211-006	7.168-006	4.352-006	5.121-006	4.511-006	3.304-006	2.820-006
3.20+002	9.904-006	8.246-006	6.422-006	3.898-006	4.593-006	4.051-006	2.966-006	2.532-006
3.40+002	8.932-006	7.434-006	5.794-006	3.516-006	4.146-006	3.662-006	2.681-006	2.288-006
3.60+002	8.103-006	6.741-006	5.258-006	3.190-006	3.765-006	3.329-006	2.437-006	2.080-006
3.80+002	7.402-006	6.154-006	4.804-006	2.913-006	3.440-006	3.045-006	2.230-006	1.902-006
4.00+002	6.819-006	5.664-006	4.424-006	2.681-006	3.166-006	2.805-006	2.054-006	1.750-006
4.20+002	6.307-006	5.233-006	4.090-006	2.478-006	2.925-006	2.594-006	1.899-006	1.616-006
4.40+002	5.853-006	4.852-006	3.794-006	2.298-006	2.712-006	2.407-006	1.763-006	1.499-006
4.60+002	5.449-006	4.513-006	3.532-006	2.138-006	2.522-006	2.241-006	1.641-006	1.394-006
4.80+002	5.089-006	4.211-006	3.297-006	1.995-006	2.353-006	2.093-006	1.532-006	1.300-006
5.00+002	4.764-006	3.940-006	3.087-006	1.866-006	2.202-006	1.960-006	1.435-006	1.216-006
5.20+002	4.472-006	3.696-006	2.897-006	1.751-006	2.065-006	1.840-006	1.346-006	1.140-006
5.40+002	4.207-006	3.475-006	2.725-006	1.646-006	1.941-006	1.731-006	1.267-006	1.072-006
5.60+002	3.966-006	3.274-006	2.569-006	1.551-006	1.829-006	1.632-006	1.194-006	1.010-006
5.80+002	3.747-006	3.091-006	2.427-006	1.464-006	1.727-006	1.542-006	1.128-006	9.530-007
6.00+002	3.546-006	2.924-006	2.297-006	1.385-006	1.633-006	1.460-006	1.068-006	9.013-007
6.50+002	3.112-006	2.563-006	2.016-006	1.215-006	1.432-006	1.282-006	9.378-007	7.899-007
7.00+002	2.762-006	2.273-006	1.790-006	1.078-006	1.268-006	1.138-006	8.329-007	7.002-007
7.50+002	2.480-006	2.038-006	1.609-006	9.683-007	1.134-006	1.020-006	7.485-007	6.278-007
8.05+002	2.220-006	1.822-006	1.443-006	8.679-007	1.012-006	9.128-007	6.712-007	5.618-007
8.50+002	2.037-006	1.671-006	1.325-006	7.970-007	9.259-007	8.370-007	6.167-007	5.154-007
9.00+002	1.861-006	1.526-006	1.212-006	7.291-007	8.439-007	7.645-007	5.647-007	4.712-007
9.50+002	1.709-006	1.400-006	1.115-006	6.702-007	7.732-007	7.018-007	5.196-007	4.330-007
1.00+003	1.582-006	1.296-006	1.032-006	6.209-007	7.146-007	6.488-007	4.821-007	4.010-007
1.10+003	1.358-006	1.112-006	8.885-007	5.345-007	6.118-007	5.576-007	4.165-007	3.458-007
1.20+003	1.183-006	9.689-007	7.763-007	4.671-007	5.322-007	4.864-007	3.653-007	3.029-007
1.30+003	1.044-006	8.551-007	6.866-007	4.133-007	4.691-007	4.297-007	3.246-007	2.688-007
1.40+003	9.360-007	7.684-007	6.171-007	3.719-007	4.213-007	3.859-007	2.931-007	2.426-007
1.50+003	8.509-007	7.005-007	5.621-007	3.391-007	3.842-007	3.513-007	2.683-007	2.221-007
1.61+003	7.725-007	6.379-007	5.114-007	3.089-007	3.500-007	3.195-007	2.453-007	2.033-007

*8.092×10^{-5} sec/m^3

Table 7.2-1 (Continued)

ANNUAL AVERAGE MIXED-MODE X/Q
April 1975 - April 1976

Distance (meter)	Sector							
	N	NNE	NE	ENE	E	ESE	SE	SSE
1.80+003	6.626-007	5.499-007	4.406-007	2.667-007	3.020-007	2.748-007	2.132-007	1.768-007
2.00+003	5.740-007	4.787-007	3.834-007	2.325-007	2.631-007	2.387-007	1.870-007	1.552-007
2.20+003	5.043-007	4.225-007	3.385-007	2.056-007	2.324-007	2.103-007	1.664-007	1.381-007
2.41+003	4.447-007	3.743-007	3.000-007	1.825-007	2.061-007	1.860-007	1.485-007	1.234-007
2.60+003	4.024-007	3.398-007	2.726-007	1.660-007	1.873-007	1.686-007	1.357-007	1.127-007
2.80+003	3.642-007	3.087-007	2.477-007	1.510-007	1.703-007	1.530-007	1.240-007	1.030-007
3.00+003	3.320-007	2.823-007	2.267-007	1.384-007	1.559-007	1.397-007	1.140-007	9.476-008
3.22+003	3.021-007	2.577-007	2.071-007	1.266-007	1.424-007	1.274-007	1.047-007	8.699-008
3.60+003	2.601-007	2.230-007	1.795-007	1.098-007	1.235-007	1.100-007	9.134-008	7.591-008
4.02+003	2.243-007	1.932-007	1.558-007	9.545-008	1.072-007	9.518-008	7.977-008	6.630-008
4.40+003	1.991-007	1.721-007	1.390-007	8.526-008	9.564-008	8.469-008	7.149-008	5.941-008
4.83+003	1.760-007	1.527-007	1.235-007	7.582-008	8.498-008	7.501-008	6.377-008	5.299-008
5.00+003	1.680-007	1.460-007	1.181-007	7.254-008	8.128-008	7.165-008	6.107-008	5.074-008
5.20+003	1.595-007	1.388-007	1.122-007	6.903-008	7.732-008	6.806-008	5.817-008	4.834-008
5.63+003	1.435-007	1.252-007	1.014-007	6.239-008	6.984-008	6.130-008	5.267-008	4.376-008
6.00+003	1.320-007	1.154-007	9.349-008	5.760-008	6.444-008	5.643-008	4.868-008	4.044-008
6.44+003	1.202-007	1.054-007	8.543-008	5.269-008	5.892-008	5.145-008	4.458-008	3.702-008
7.24+003	1.029-007	9.057-008	7.345-008	4.539-008	5.072-008	4.409-008	3.844-008	3.193-008
7.50+003	9.827-008	8.657-008	7.022-008	4.342-008	4.851-008	4.211-008	3.678-008	3.055-008
8.05+003	8.957-008	7.908-008	6.416-008	3.972-008	4.436-008	3.839-008	3.365-008	2.795-008
8.50+003	8.334-008	7.370-008	5.980-008	3.706-008	4.137-008	3.573-008	3.140-008	2.608-008
9.00+003	7.730-008	6.848-008	5.557-008	3.447-008	3.848-008	3.315-008	2.920-008	2.425-008
9.50+003	7.200-008	6.388-008	5.185-008	3.219-008	3.592-008	3.088-008	2.726-008	2.265-008
1.00+004	6.732-008	5.981-008	4.855-008	3.017-008	3.366-008	2.888-008	2.554-008	2.122-008
1.21+004	5.263-008	4.700-008	3.816-008	2.379-008	2.652-008	2.258-008	2.010-008	1.671-008
1.40+004	4.339-008	3.889-008	3.157-008	1.973-008	2.199-008	1.861-008	1.664-008	1.384-008
1.61+004	3.622-008	3.257-008	2.644-008	1.656-008	1.845-008	1.553-008	1.393-008	1.160-008
1.80+004	3.134-008	2.826-008	2.293-008	1.439-008	1.603-008	1.343-008	1.208-008	1.006-008
2.00+004	2.736-008	2.472-008	2.007-008	1.261-008	1.405-008	1.172-008	1.056-008	8.807-009
2.20+004	2.421-008	2.192-008	1.779-008	1.119-008	1.247-008	1.037-008	9.354-009	7.808-009
2.41+004	2.150-008	1.950-008	1.582-008	9.967-009	1.111-008	9.201-009	8.314-009	6.945-009
2.60+004	1.955-008	1.776-008	1.441-008	9.086-009	1.012-008	8.365-009	7.567-009	6.326-009
2.80+004	1.779-008	1.618-008	1.313-008	8.286-009	9.233-009	7.608-009	6.888-009	5.763-009
3.22+004	1.490-008	1.358-008	1.103-008	6.968-009	7.765-009	6.368-009	5.775-009	4.838-009
3.40+004	1.390-008	1.268-008	1.029-008	6.510-009	7.254-009	5.939-009	5.389-009	4.516-009
4.02+004	1.124-008	1.027-008	8.345-009	5.285-009	5.890-009	4.796-009	4.358-009	3.659-009
4.20+004	1.065-008	9.735-009	7.912-009	5.012-009	5.586-009	4.543-009	4.130-009	3.469-009
4.83+004	8.942-009	8.184-009	6.657-009	4.221-009	4.704-009	3.813-009	3.468-009	2.918-009
5.00+004	8.559-009	7.835-009	6.375-009	4.042-009	4.506-009	3.649-009	3.320-009	2.794-009
5.63+004	7.374-009	6.756-009	5.503-009	3.491-009	3.892-009	3.142-009	2.860-009	2.410-009
5.80+004	7.110-009	6.515-009	5.307-009	3.367-009	3.754-009	3.029-009	2.758-009	2.325-009
6.00+004	6.815-009	6.246-009	5.090-009	3.230-009	3.601-009	2.903-009	2.644-009	2.229-009
6.44+004	6.243-009	5.724-009	4.667-009	2.962-009	3.303-009	2.658-009	2.421-009	2.043-009
7.24+004	5.392-009	4.946-009	4.037-009	2.563-009	2.858-009	2.294-009	2.091-009	1.766-009
7.50+004	5.162-009	4.736-009	3.866-009	2.455-009	2.738-009	2.196-009	2.002-009	1.692-009
8.05+004	4.730-009	4.341-009	3.546-009	2.252-009	2.511-009	2.012-009	1.834-009	1.551-009
8.50+004	4.419-009	4.056-009	3.315-009	2.105-009	2.348-009	1.879-009	1.713-009	1.450-009
9.00+004	4.117-009	3.779-009	3.090-009	1.963-009	2.189-009	1.750-009	1.595-009	1.351-009
9.50+004	3.850-009	3.534-009	2.891-009	1.837-009	2.049-009	1.636-009	1.492-009	1.264-009
1.00+005	3.613-009	3.317-009	2.715-009	1.725-009	1.924-009	1.535-009	1.400-009	1.186-009

Table 7.2-1 (Continued)

ANNUAL AVERAGE MIXED-MODE X/Q
April 1975 - April 1976

Distance (meter)	Sector							
	S	SSW	SW	WSW	W	WNW	NW	NNW
1.00+002	2.139-005	2.027-005	3.558-005	3.483-005	3.307-005	2.584-005	3.791-005	4.966-005
1.10+002	1.791-005	1.697-005	2.978-005	2.916-005	2.767-005	2.162-005	3.173-005	4.153-005
1.20+002	1.525-005	1.444-005	2.534-005	2.481-005	2.354-005	1.839-005	2.700-005	3.531-005
1.30+002	1.315-005	1.246-005	2.186-005	2.140-005	2.030-005	1.586-005	2.329-005	3.044-005
1.40+002	1.148-005	1.087-005	1.907-005	1.868-005	1.770-005	1.383-005	2.032-005	2.655-005
1.50+002	1.012-005	9.582-006	1.681-005	1.646-005	1.560-005	1.220-005	1.791-005	2.339-005
1.60+002	9.000-006	8.519-006	1.495-005	1.463-005	1.387-005	1.085-005	1.592-005	2.079-005
1.70+002	8.064-006	7.631-006	1.339-005	1.311-005	1.242-005	9.717-006	1.426-005	1.862-005
1.80+002	7.272-006	6.880-006	1.208-005	1.182-005	1.120-005	8.763-006	1.286-005	1.679-005
1.90+002	6.596-006	6.239-006	1.095-005	1.071-005	1.016-005	7.948-006	1.166-005	1.522-005
2.00+002	6.014-006	5.687-006	9.986-006	9.766-006	9.258-006	7.247-006	1.063-005	1.388-005
2.10+002	5.509-006	5.208-006	9.146-006	8.944-006	8.478-006	6.639-006	9.730-006	1.271-005
2.20+002	5.068-006	4.790-006	8.413-006	8.227-006	7.798-006	6.108-006	8.948-006	1.169-005
2.30+002	4.680-006	4.423-006	7.768-006	7.596-006	7.200-006	5.641-006	8.260-006	1.079-005
2.40+002	4.338-006	4.098-006	7.197-006	7.038-006	6.671-006	5.228-006	7.652-006	9.997-006
2.50+002	4.034-006	3.811-006	6.692-006	6.543-006	6.203-006	4.862-006	7.113-006	9.294-006
2.60+002	3.770-006	3.563-006	6.254-006	6.110-006	5.795-006	4.542-006	6.641-006	8.685-006
2.70+002	3.533-006	3.339-006	5.861-006	5.721-006	5.429-006	4.255-006	6.217-006	8.136-006
2.80+002	3.319-006	3.138-006	5.505-006	5.370-006	5.099-006	3.995-006	5.834-006	7.641-006
2.90+002	3.125-006	2.955-006	5.183-006	5.052-006	4.800-006	3.760-006	5.488-006	7.193-006
3.00+002	2.949-006	2.789-006	4.889-006	4.763-006	4.528-006	3.547-006	5.172-006	6.784-006
3.20+002	2.640-006	2.499-006	4.376-006	4.258-006	4.052-006	3.174-006	4.622-006	6.071-006
3.40+002	2.380-006	2.255-006	3.943-006	3.833-006	3.652-006	2.859-006	4.159-006	5.470-006
3.60+002	2.158-006	2.047-006	3.574-006	3.472-006	3.311-006	2.592-006	3.766-006	4.959-006
3.80+002	1.969-006	1.870-006	3.259-006	3.164-006	3.022-006	2.365-006	3.432-006	4.526-006
4.00+002	1.810-006	1.720-006	2.992-006	2.903-006	2.778-006	2.176-006	3.150-006	4.167-006
4.20+002	1.670-006	1.589-006	2.758-006	2.675-006	2.564-006	2.009-006	2.904-006	3.852-006
4.40+002	1.546-006	1.473-006	2.552-006	2.474-006	2.375-006	1.863-006	2.687-006	3.573-006
4.60+002	1.436-006	1.370-006	2.369-006	2.296-006	2.208-006	1.732-006	2.495-006	3.325-006
4.80+002	1.339-006	1.279-006	2.207-006	2.137-006	2.059-006	1.616-006	2.324-006	3.104-006
5.00+002	1.251-006	1.197-006	2.061-006	1.995-006	1.925-006	1.512-006	2.171-006	2.905-006
5.20+002	1.172-006	1.123-006	1.930-006	1.868-006	1.805-006	1.418-006	2.034-006	2.726-006
5.40+002	1.101-006	1.056-006	1.811-006	1.752-006	1.696-006	1.333-006	1.909-006	2.564-006
5.60+002	1.036-006	9.950-007	1.704-006	1.648-006	1.597-006	1.256-006	1.797-006	2.416-006
5.80+002	9.775-007	9.396-007	1.606-006	1.553-006	1.508-006	1.185-006	1.695-006	2.282-006
6.00+002	9.239-007	8.890-007	1.518-006	1.467-006	1.425-006	1.121-006	1.602-006	2.159-006
6.50+002	8.086-007	7.800-007	1.326-006	1.281-006	1.249-006	9.831-007	1.401-006	1.895-006
7.00+002	7.160-007	6.917-007	1.173-006	1.134-006	1.106-006	8.721-007	1.240-006	1.681-006
7.50+002	6.414-007	6.200-007	1.050-006	1.017-006	9.922-007	7.832-007	1.111-006	1.510-006
8.05+002	5.733-007	5.544-007	9.375-007	9.095-007	8.876-007	7.017-007	9.936-007	1.353-006
8.50+002	5.255-007	5.081-007	8.585-007	8.341-007	8.138-007	6.442-007	9.106-007	1.241-006
9.00+002	4.799-007	4.640-007	7.832-007	7.621-007	7.433-007	5.891-007	8.313-007	1.135-006
9.50+002	4.405-007	4.258-007	7.181-007	6.997-007	6.821-007	5.414-007	7.626-007	1.043-006
1.00+003	4.081-007	3.943-007	6.642-007	6.482-007	6.313-007	5.019-007	7.058-007	9.655-007
1.10+003	3.507-007	3.387-007	5.695-007	5.569-007	5.417-007	4.317-007	6.050-007	8.296-007
1.20+003	3.063-007	2.955-007	4.963-007	4.861-007	4.721-007	3.771-007	5.268-007	7.238-007
1.30+003	2.711-007	2.612-007	4.383-007	4.299-007	4.167-007	3.336-007	4.648-007	6.394-007
1.40+003	2.445-007	2.353-007	3.945-007	3.875-007	3.747-007	3.003-007	4.180-007	5.745-007
1.50+003	2.239-007	2.153-007	3.607-007	3.546-007	3.419-007	2.742-007	3.818-007	5.232-007
1.61+003	2.049-007	1.969-007	3.294-007	3.241-007	3.116-007	2.502-007	3.482-007	4.760-007

Table 7.2-1 (Continued)

ANNUAL AVERAGE MIXED-MODE X/Q
April 1975 - April 1976

Distance (meter)	Sector							
	S	SSW	SW	WSW	W	WNW	NW	NNW
1.80+003	1.781-007	1.710-007	2.854-007	2.811-007	2.691-007	2.163-007	3.010-007	4.098-007
2.00+003	1.563-007	1.500-007	2.496-007	2.460-007	2.347-007	1.889-007	2.627-007	3.563-007
2.20+003	1.390-007	1.334-007	2.212-007	2.182-007	2.075-007	1.672-007	2.325-007	3.142-007
2.41+003	1.241-007	1.192-007	1.968-007	1.942-007	1.842-007	1.486-007	2.065-007	2.782-007
2.60+003	1.133-007	1.089-007	1.793-007	1.770-007	1.676-007	1.353-007	1.879-007	2.525-007
2.80+003	1.035-007	9.962-008	1.634-007	1.613-007	1.525-007	1.232-007	1.711-007	2.293-007
3.00+003	9.511-008	9.168-008	1.498-007	1.479-007	1.397-007	1.130-007	1.568-007	2.096-007
3.22+003	8.725-008	8.423-008	1.372-007	1.355-007	1.277-007	1.034-007	1.434-007	1.913-007
3.60+003	7.606-008	7.362-008	1.192-007	1.177-007	1.108-007	8.983-008	1.245-007	1.655-007
4.02+003	6.635-008	6.445-008	1.036-007	1.024-007	9.632-008	7.816-008	1.083-007	1.433-007
4.40+003	5.942-008	5.786-008	9.260-008	9.146-008	8.602-008	6.987-008	9.672-008	1.277-007
4.83+003	5.296-008	5.170-008	8.236-008	8.134-008	7.648-008	6.219-008	8.604-008	1.133-007
5.00+003	5.070-008	4.954-008	7.879-008	7.782-008	7.317-008	5.952-008	8.232-008	1.083-007
5.20+003	4.829-008	4.723-008	7.497-008	7.405-008	6.962-008	5.666-008	7.835-008	1.029-007
5.63+003	4.370-008	4.282-008	6.774-008	6.692-008	6.291-008	5.125-008	7.083-008	9.281-008
6.00+003	4.037-008	3.962-008	6.252-008	6.176-008	5.806-008	4.734-008	6.540-008	8.554-008
6.44+003	3.696-008	3.632-008	5.716-008	5.648-008	5.310-008	4.333-008	5.984-008	7.811-008
7.24+003	3.186-008	3.139-008	4.919-008	4.862-008	4.571-008	3.737-008	5.157-008	6.709-008
7.50+003	3.049-008	3.005-008	4.704-008	4.650-008	4.372-008	3.576-008	4.934-008	6.412-008
8.05+003	2.789-008	2.752-008	4.299-008	4.251-008	3.997-008	3.273-008	4.514-008	5.856-008
8.50+003	2.602-008	2.570-008	4.008-008	3.964-008	3.728-008	3.055-008	4.212-008	5.456-008
9.00+003	2.421-008	2.393-008	3.725-008	3.685-008	3.466-008	2.844-008	3.919-008	5.069-008
9.50+003	2.260-008	2.236-008	3.476-008	3.439-008	3.236-008	2.657-008	3.661-008	4.728-008
1.00+004	2.118-008	2.096-008	3.254-008	3.221-008	3.031-008	2.491-008	3.432-008	4.426-008
1.21+004	1.669-008	1.655-008	2.557-008	2.534-008	2.386-008	1.968-008	2.708-008	3.475-008
1.40+004	1.383-008	1.373-008	2.113-008	2.098-008	1.976-008	1.635-008	2.249-008	2.874-008
1.61+004	1.160-008	1.152-008	1.768-008	1.758-008	1.656-008	1.374-008	1.889-008	2.406-008
1.80+004	1.007-008	1.001-008	1.531-008	1.525-008	1.437-008	1.196-008	1.643-008	2.087-008
2.00+004	8.816-009	8.765-009	1.338-008	1.335-008	1.258-008	1.050-008	1.441-008	1.826-008
2.20+004	7.820-009	7.777-009	1.185-008	1.184-008	1.116-008	9.329-009	1.280-008	1.618-008
2.41+004	6.960-009	6.923-009	1.052-008	1.053-008	9.925-009	8.320-009	1.141-008	1.440-008
2.60+004	6.342-009	6.309-009	9.570-009	9.594-009	9.040-009	7.593-009	1.041-008	1.311-008
2.80+004	5.780-009	5.751-009	8.708-009	8.742-009	8.236-009	6.932-009	9.502-009	1.195-008
3.22+004	4.856-009	4.833-009	7.292-009	7.343-009	6.915-009	5.843-009	8.002-009	1.003-008
3.40+004	4.536-009	4.514-009	6.802-009	6.857-009	6.456-009	5.464-009	7.481-009	9.367-009
4.02+004	3.679-009	3.662-009	5.494-009	5.560-009	5.230-009	4.448-009	6.084-009	7.593-009
4.20+004	3.488-009	3.472-009	5.204-009	5.272-009	4.958-009	4.222-009	5.772-009	7.198-009
4.83+004	2.936-009	2.923-009	4.365-009	4.436-009	4.168-009	3.565-009	4.868-009	6.056-009
5.00+004	2.812-009	2.799-009	4.177-009	4.248-009	3.991-009	3.417-009	4.664-009	5.800-009
5.63+004	2.428-009	2.417-009	3.595-009	3.667-009	3.441-009	2.958-009	4.033-009	5.005-009
5.80+004	2.342-009	2.331-009	3.465-009	3.537-009	3.318-009	2.855-009	3.891-009	4.828-009
6.00+004	2.246-009	2.236-009	3.321-009	3.392-009	3.182-009	2.740-009	3.733-009	4.630-009
6.44+004	2.060-009	2.050-009	3.040-009	3.110-009	2.916-009	2.516-009	3.426-009	4.245-009
7.24+004	1.782-009	1.774-009	2.622-009	2.691-009	2.520-009	2.182-009	2.968-009	3.671-009
7.50+004	1.707-009	1.699-009	2.510-009	2.577-009	2.413-009	2.092-009	2.844-009	3.517-009
8.05+004	1.566-009	1.558-009	2.298-009	2.364-009	2.211-009	1.921-009	2.611-009	3.225-009
8.50+004	1.464-009	1.457-009	2.145-009	2.210-009	2.066-009	1.798-009	2.442-009	3.015-009
9.00+004	1.365-009	1.358-009	1.997-009	2.060-009	1.925-009	1.678-009	2.278-009	2.810-009
9.50+004	1.277-009	1.271-009	1.867-009	1.928-009	1.801-009	1.572-009	2.133-009	2.630-009
1.00+005	1.199-009	1.194-009	1.751-009	1.811-009	1.690-009	1.478-009	2.004-009	2.469-009

Table 7.2-2

ANNUAL AVERAGE MIXED MODE D/Q
April 1975 - April 1976

Distance (meter)	Sector							
	N	NNE	NE	ENE	E	ESE	SE	SSE
1.00+002	2.843-007*	2.467-007	1.936-007	1.150-007	1.484-007	1.507-007	9.963-008	7.608-008
1.10+002	2.505-007	2.174-007	1.706-007	1.014-007	1.308-007	1.328-007	8.782-008	6.706-008
1.20+002	2.232-007	1.937-007	1.521-007	9.034-008	1.165-007	1.183-007	7.828-008	5.978-008
1.30+002	2.007-007	1.742-007	1.368-007	8.128-008	1.048-007	1.064-007	7.044-008	5.379-008
1.40+002	1.819-007	1.579-007	1.241-007	7.372-008	9.499-008	9.649-008	6.389-008	4.880-008
1.50+002	1.661-007	1.441-007	1.133-007	6.732-008	8.670-008	8.808-008	5.836-008	4.458-008
1.60+002	1.525-007	1.323-007	1.041-007	6.186-008	7.962-008	8.089-008	5.363-008	4.097-008
1.70+002	1.408-007	1.222-007	9.621-008	5.714-008	7.350-008	7.469-008	4.954-008	3.786-008
1.80+002	1.306-007	1.133-007	8.931-008	5.303-008	6.817-008	6.928-008	4.599-008	3.515-008
1.90+002	1.216-007	1.055-007	8.326-008	4.944-008	6.350-008	6.454-008	4.288-008	3.278-008
2.00+002	1.137-007	9.868-008	7.794-008	4.627-008	5.938-008	6.037-008	4.015-008	3.071-008
2.10+002	1.061-007	9.210-008	7.281-008	4.322-008	5.542-008	5.635-008	3.752-008	2.870-008
2.20+002	9.938-008	8.624-008	6.825-008	4.051-008	5.190-008	5.278-008	3.518-008	2.692-008
2.30+002	9.334-008	8.101-008	6.418-008	3.809-008	4.875-008	4.959-008	3.308-008	2.533-008
2.40+002	8.792-008	7.630-008	6.052-008	3.591-008	4.592-008	4.672-008	3.120-008	2.390-008
2.50+002	8.302-008	7.206-008	5.722-008	3.395-008	4.337-008	4.413-008	2.951-008	2.261-008
2.60+002	7.859-008	6.821-008	5.423-008	3.218-008	4.105-008	4.179-008	2.798-008	2.144-008
2.70+002	7.456-008	6.471-008	5.152-008	3.056-008	3.895-008	3.966-008	2.659-008	2.039-008
2.80+002	7.087-008	6.152-008	4.905-008	2.909-008	3.703-008	3.771-008	2.532-008	1.943-008
2.90+002	6.751-008	5.859-008	4.679-008	2.775-008	3.527-008	3.593-008	2.416-008	1.855-008
3.00+002	6.441-008	5.591-008	4.471-008	2.651-008	3.366-008	3.430-008	2.310-008	1.775-008
3.20+002	5.856-008	5.083-008	4.074-008	2.415-008	3.060-008	3.120-008	2.106-008	1.619-008
3.40+002	5.356-008	4.650-008	3.735-008	2.214-008	2.800-008	2.855-008	1.932-008	1.487-008
3.60+002	4.925-008	4.276-008	3.442-008	2.040-008	2.575-008	2.627-008	1.782-008	1.373-008
3.80+002	4.550-008	3.951-008	3.188-008	1.889-008	2.379-008	2.429-008	1.652-008	1.274-008
4.00+002	4.223-008	3.667-008	2.967-008	1.757-008	2.209-008	2.256-008	1.538-008	1.188-008
4.20+002	3.934-008	3.417-008	2.771-008	1.641-008	2.058-008	2.103-008	1.438-008	1.112-008
4.40+002	3.678-008	3.195-008	2.598-008	1.538-008	1.925-008	1.968-008	1.350-008	1.045-008
4.60+002	3.450-008	2.998-008	2.444-008	1.447-008	1.806-008	1.847-008	1.271-008	9.857-009
4.80+002	3.246-008	2.821-008	2.307-008	1.365-008	1.700-008	1.740-008	1.201-008	9.326-009
5.00+002	3.063-008	2.662-008	2.183-008	1.291-008	1.604-008	1.643-008	1.138-008	8.851-009
5.20+002	2.883-008	2.506-008	2.058-008	1.217-008	1.511-008	1.548-008	1.074-008	8.360-009
5.40+002	2.720-008	2.365-008	1.945-008	1.150-008	1.426-008	1.461-008	1.016-008	7.915-009
5.60+002	2.572-008	2.237-008	1.842-008	1.090-008	1.349-008	1.383-008	9.638-009	7.512-009
5.80+002	2.437-008	2.120-008	1.749-008	1.034-008	1.279-008	1.311-008	9.158-009	7.143-009
6.00+002	2.314-008	2.013-008	1.663-008	9.832-009	1.214-008	1.246-008	8.720-009	6.807-009
6.50+002	2.048-008	1.783-008	1.478-008	8.735-009	1.076-008	1.105-008	7.774-009	6.081-009
7.00+002	1.830-008	1.594-008	1.326-008	7.835-009	9.621-009	9.892-009	7.001-009	5.487-009
7.50+002	1.645-008	1.434-008	1.195-008	7.062-009	8.658-009	8.909-009	6.331-009	4.969-009
8.05+002	1.476-008	1.287-008	1.076-008	6.356-009	7.779-009	8.011-009	5.720-009	4.497-009
8.50+002	1.357-008	1.184-008	9.919-009	5.858-009	7.160-009	7.379-009	5.290-009	4.165-009
9.00+002	1.244-008	1.086-008	9.116-009	5.383-009	6.570-009	6.777-009	4.880-009	3.849-009
9.50+002	1.145-008	1.001-008	8.421-009	4.972-009	6.059-009	6.255-009	4.526-009	3.575-009
1.00+003	1.060-008	9.269-009	7.814-009	4.613-009	5.613-009	5.801-009	4.218-009	3.338-009
1.10+003	9.043-009	7.918-009	6.690-009	3.950-009	4.800-009	4.965-009	3.630-009	2.877-009
1.20+003	7.828-009	6.862-009	5.810-009	3.430-009	4.163-009	4.312-009	3.170-009	2.516-009
1.30+003	6.858-009	6.019-009	5.106-009	3.015-009	3.654-009	3.789-009	2.801-009	2.228-009
1.40+003	6.070-009	5.333-009	4.534-009	2.677-009	3.241-009	3.365-009	2.502-009	1.993-009
1.50+003	5.420-009	4.768-009	4.062-009	2.399-009	2.900-009	3.015-009	2.255-009	1.800-009
1.61+003	4.831-009	4.256-009	3.635-009	2.146-009	2.592-009	2.698-009	2.031-009	1.624-009

*2.843×10^{-7} m^{-2}

Table 7.2-2 (Continued)

ANNUAL AVERAGE MIXED-MODE D/Q
April 1975 - April 1976

Distance (meter)	Sector							
	N	NNE	NE	ENE	E	ESE	SE	SSE
1.80+003	4.027-009	3.557-009	3.051-009	1.802-009	2.171-009	2.265-009	1.725-009	1.385-009
2.00+003	3.398-009	3.010-009	2.594-009	1.532-009	1.841-009	1.927-009	1.486-009	1.198-009
2.20+003	2.888-009	2.563-009	2.212-009	1.307-009	1.569-009	1.645-009	1.276-009	1.030-009
2.41+003	2.466-009	2.192-009	1.896-009	1.121-009	1.344-009	1.411-009	1.102-009	8.910-010
2.60+003	2.174-009	1.935-009	1.677-009	9.915-010	1.188-009	1.248-009	9.803-010	7.940-010
2.80+003	1.917-009	1.709-009	1.484-009	8.777-010	1.050-009	1.106-009	8.732-010	7.084-010
3.00+003	1.706-009	1.523-009	1.325-009	7.839-010	9.371-010	9.878-010	7.845-010	6.376-010
3.22+003	1.515-009	1.353-009	1.179-009	6.974-010	8.330-010	8.786-010	7.000-010	5.695-010
3.60+003	1.253-009	1.121-009	9.786-010	5.792-010	6.907-010	7.295-010	5.841-010	4.761-010
4.02+003	1.039-009	9.302-010	8.138-010	4.818-010	5.737-010	6.068-010	4.883-010	3.987-010
4.40+003	8.930-010	8.008-010	7.018-010	4.156-010	4.943-010	5.234-010	4.229-010	3.459-010
4.83+003	7.637-010	6.856-010	6.020-010	3.566-010	4.236-010	4.491-010	3.645-010	2.987-010
5.00+003	7.200-010	6.467-010	5.683-010	3.367-010	3.997-010	4.239-010	3.447-010	2.826-010
5.20+003	6.719-010	6.037-010	5.309-010	3.145-010	3.732-010	3.959-010	3.224-010	2.644-010
5.63+003	5.836-010	5.246-010	4.621-010	2.738-010	3.245-010	3.445-010	2.813-010	2.309-010
6.00+003	5.221-010	4.696-010	4.141-010	2.453-010	2.906-010	3.086-010	2.526-010	2.075-010
6.44+003	4.612-010	4.151-010	3.665-010	2.172-010	2.569-010	2.731-010	2.240-010	1.842-010
7.24+003	3.757-010	3.383-010	2.993-010	1.774-010	2.095-010	2.229-010	1.834-010	1.510-010
7.50+003	3.541-010	3.189-010	2.822-010	1.672-010	1.975-010	2.101-010	1.729-010	1.423-010
8.05+003	3.143-010	2.830-010	2.506-010	1.485-010	1.753-010	1.865-010	1.535-010	1.265-010
8.50+003	2.864-010	2.580-010	2.285-010	1.354-010	1.597-010	1.700-010	1.400-010	1.153-010
9.00+003	2.600-010	2.342-010	2.075-010	1.230-010	1.450-010	1.543-010	1.271-010	1.048-010
9.50+003	2.372-010	2.137-010	1.894-010	1.123-010	1.323-010	1.408-010	1.160-010	9.569-011
1.00+004	2.175-010	1.959-010	1.738-010	1.030-010	1.213-010	1.291-010	1.064-010	8.779-011
1.21+004	1.592-010	1.433-010	1.274-010	7.547-011	8.874-011	9.446-011	7.792-011	6.435-011
1.40+004	1.245-010	1.121-010	9.971-011	5.909-011	6.936-011	7.386-011	6.096-011	5.038-011
1.61+004	9.878-011	8.893-011	7.924-011	4.696-011	5.504-011	5.861-011	4.841-011	4.004-011
1.80+004	8.204-011	7.386-011	6.588-011	3.904-011	4.570-011	4.868-011	4.022-011	3.329-011
2.00+004	6.890-011	6.202-011	5.538-011	3.282-011	3.837-011	4.088-011	3.379-011	2.799-011
2.20+004	5.851-011	5.266-011	4.713-011	2.792-011	3.258-011	3.472-011	2.873-011	2.382-011
2.41+004	4.990-011	4.490-011	4.028-011	2.386-011	2.778-011	2.961-011	2.454-011	2.036-011
2.60+004	4.394-011	3.954-011	3.554-011	2.105-011	2.446-011	2.608-011	2.163-011	1.796-011
2.80+004	3.871-011	3.483-011	3.136-011	1.857-011	2.154-011	2.297-011	1.907-011	1.585-011
3.22+004	3.045-011	2.740-011	2.478-011	1.467-011	1.694-011	1.808-011	1.506-011	1.254-011
3.40+004	2.768-011	2.492-011	2.258-011	1.337-011	1.541-011	1.645-011	1.372-011	1.143-011
4.02+004	2.069-011	1.864-011	1.700-011	1.006-011	1.152-011	1.231-011	1.032-011	8.625-012
4.20+004	1.921-011	1.732-011	1.582-011	9.364-012	1.070-011	1.143-011	9.604-012	8.031-012
4.83+004	1.515-011	1.368-011	1.257-011	7.437-012	8.444-012	9.020-012	7.613-012	6.384-012
5.00+004	1.428-011	1.291-011	1.188-011	7.026-012	7.962-012	8.504-012	7.186-012	6.031-012
5.63+004	1.157-011	1.048-011	9.700-012	5.738-012	6.459-012	6.897-012	5.862-012	4.935-012
5.80+004	1.099-011	9.965-012	9.235-012	5.463-012	6.138-012	6.553-012	5.578-012	4.700-012
6.00+004	1.036-011	9.403-012	8.728-012	5.163-012	5.789-012	6.179-012	5.268-012	4.443-012
6.44+004	9.173-012	8.346-012	7.773-012	4.599-012	5.131-012	5.473-012	4.683-012	3.958-012
7.24+004	7.470-012	6.831-012	6.386-012	3.779-012	4.188-012	4.457-012	3.832-012	3.252-012
7.50+004	7.003-012	6.414-012	5.995-012	3.549-012	3.930-012	4.179-012	3.595-012	3.055-012
8.05+004	6.158-012	5.658-012	5.287-012	3.131-012	3.460-012	3.674-012	3.165-012	2.696-012
8.50+004	5.576-012	5.137-012	4.800-012	2.844-012	3.137-012	3.326-012	2.869-012	2.449-012
9.00+004	5.033-012	4.651-012	4.345-012	2.576-012	2.835-012	3.001-012	2.591-012	2.217-012
9.50+004	4.572-012	4.239-012	3.960-012	2.349-012	2.580-012	2.725-012	2.356-012	2.020-012
1.00+005	4.178-012	3.888-012	3.631-012	2.155-012	2.361-012	2.488-012	2.154-012	1.851-012

Table 7.2-2 (Continued)

ANNUAL AVERAGE MIXED-MODE D/Q
April 1975 - April 1976

Distance (meter)	Sector							
	S	SSW	SW	WSW	W	WNW	NW	NNW
1.00+002	6.335-008	6.617-008	1.006-007	6.238-008	6.380-008	6.154-008	7.734-008	1.363-007
1.10+002	5.584-008	5.834-008	8.863-008	5.499-008	5.625-008	5.426-008	6.815-008	1.201-007
1.20+002	4.978-008	5.201-008	7.899-008	4.903-008	5.014-008	4.837-008	6.072-008	1.070-007
1.30+002	4.479-008	4.681-008	7.106-008	4.412-008	4.513-008	4.353-008	5.461-008	9.623-008
1.40+002	4.063-008	4.247-008	6.443-008	4.003-008	4.094-008	3.950-008	4.951-008	8.724-008
1.50+002	3.712-008	3.881-008	5.883-008	3.657-008	3.740-008	3.608-008	4.520-008	7.964-008
1.60+002	3.411-008	3.567-008	5.405-008	3.361-008	3.437-008	3.317-008	4.151-008	7.313-008
1.70+002	3.152-008	3.297-008	4.992-008	3.106-008	3.177-008	3.066-008	3.832-008	6.752-008
1.80+002	2.926-008	3.063-008	4.632-008	2.884-008	2.950-008	2.848-008	3.555-008	6.263-008
1.90+002	2.729-008	2.857-008	4.317-008	2.690-008	2.751-008	2.656-008	3.312-008	5.834-008
2.00+002	2.555-008	2.677-008	4.039-008	2.520-008	2.577-008	2.489-008	3.097-008	5.457-008
2.10+002	2.398-008	2.502-008	3.772-008	2.355-008	2.409-008	2.326-008	2.891-008	5.094-008
2.20+002	2.239-008	2.347-008	3.535-008	2.209-008	2.259-008	2.182-008	2.708-008	4.771-008
2.30+002	2.106-008	2.209-008	3.322-008	2.078-008	2.126-008	2.054-008	2.544-008	4.482-008
2.40+002	1.987-008	2.085-008	3.132-008	1.961-008	2.006-008	1.938-008	2.397-008	4.223-008
2.50+002	1.879-008	1.973-008	2.960-008	1.855-008	1.897-008	1.834-008	2.264-008	3.989-008
2.60+002	1.782-008	1.872-008	2.804-008	1.759-008	1.800-008	1.740-008	2.144-008	3.776-008
2.70+002	1.694-008	1.780-008	2.662-008	1.672-008	1.711-008	1.655-008	2.034-008	3.584-008
2.80+002	1.613-008	1.697-008	2.533-008	1.593-008	1.630-008	1.577-008	1.935-008	3.408-008
2.90+002	1.539-008	1.621-008	2.415-008	1.521-008	1.556-008	1.506-008	1.843-008	3.247-008
3.00+002	1.472-008	1.551-008	2.307-008	1.455-008	1.489-008	1.441-008	1.759-008	3.099-008
3.20+002	1.342-008	1.416-008	2.100-008	1.327-008	1.358-008	1.315-008	1.600-008	2.819-008
3.40+002	1.232-008	1.300-008	1.924-008	1.218-008	1.247-008	1.208-008	1.465-008	2.580-008
3.60+002	1.136-008	1.201-008	1.772-008	1.124-008	1.151-008	1.116-008	1.348-008	2.374-008
3.80+002	1.053-008	1.115-008	1.640-008	1.043-008	1.068-008	1.036-008	1.246-008	2.195-008
4.00+002	9.811-009	1.039-008	1.524-008	9.713-009	9.951-009	9.656-009	1.157-008	2.039-008
4.20+002	9.175-009	9.732-009	1.422-008	9.086-009	9.311-009	9.040-009	1.079-008	1.901-008
4.40+002	8.612-009	9.146-009	1.332-008	8.532-009	8.746-009	8.496-009	1.009-008	1.779-008
4.60+002	8.111-009	8.625-009	1.252-008	8.039-009	8.243-009	8.012-009	9.475-009	1.670-008
4.80+002	7.664-009	8.160-009	1.181-008	7.599-009	7.793-009	7.580-009	8.923-009	1.573-008
5.00+002	7.262-009	7.743-009	1.116-008	7.204-009	7.390-009	7.192-009	8.426-009	1.486-008
5.20+002	6.853-009	7.311-009	1.052-008	6.800-009	6.975-009	6.790-009	7.937-009	1.399-008
5.40+002	6.482-009	6.919-009	9.938-009	6.433-009	6.600-009	6.426-009	7.493-009	1.321-008
5.60+002	6.145-009	6.563-009	9.409-009	6.101-009	6.258-009	6.095-009	7.090-009	1.250-008
5.80+002	5.838-009	6.238-009	8.927-009	5.797-009	5.947-009	5.793-009	6.723-009	1.185-008
6.00+002	5.556-009	5.940-009	8.486-009	5.519-009	5.661-009	5.517-009	6.387-009	1.126-008
6.50+002	4.949-009	5.297-009	7.534-009	4.920-009	5.045-009	4.920-009	5.662-009	9.980-009
7.00+002	4.452-009	4.770-009	6.755-009	4.430-009	4.541-009	4.430-009	5.069-009	8.932-009
7.50+002	4.022-009	4.311-009	6.087-009	4.003-009	4.102-009	4.004-009	4.564-009	8.042-009
8.05+002	3.629-009	3.891-009	5.478-009	3.614-009	3.701-009	3.614-009	4.103-009	7.229-009
8.50+002	3.353-009	3.595-009	5.049-009	3.341-009	3.419-009	3.339-009	3.779-009	6.656-009
9.00+002	3.089-009	3.313-009	4.640-009	3.080-009	3.150-009	3.077-009	3.470-009	6.109-009
9.50+002	2.861-009	3.068-009	4.286-009	2.854-009	2.917-009	2.851-009	3.202-009	5.636-009
1.00+003	2.662-009	2.855-009	3.978-009	2.658-009	2.714-009	2.653-009	2.969-009	5.224-009
1.10+003	2.287-009	2.451-009	3.407-009	2.285-009	2.329-009	2.278-009	2.541-009	4.468-009
1.20+003	1.994-009	2.134-009	2.961-009	1.994-009	2.028-009	1.984-009	2.206-009	3.877-009
1.30+003	1.760-009	1.881-009	2.604-009	1.760-009	1.788-009	1.749-009	1.939-009	3.404-009
1.40+003	1.569-009	1.676-009	2.315-009	1.571-009	1.592-009	1.558-009	1.722-009	3.021-009
1.50+003	1.412-009	1.506-009	2.076-009	1.415-009	1.431-009	1.401-009	1.543-009	2.705-009
1.61+003	1.270-009	1.352-009	1.860-009	1.273-009	1.284-009	1.258-009	1.380-009	2.418-009

Table 7.2-2 (Continued)

ANNUAL AVERAGE MIXED-MODE D/Q
April 1975 - April 1976

Distance (meter)	Sector							
	S	SSW	SW	WSW	W	WNW	NW	NNW
1.80+003	1.076-009	1.142-009	1.565-009	1.080-009	1.085-009	1.063-009	1.159-009	2.028-009
2.00+003	9.246-010	9.779-010	1.335-009	9.299-010	9.285-010	9.109-010	9.868-010	1.723-009
2.20+003	7.931-010	8.368-010	1.140-009	7.983-010	7.945-010	7.797-010	8.425-010	1.469-009
2.41+003	6.837-010	7.197-010	9.794-010	6.888-010	6.833-010	6.708-010	7.228-010	1.259-009
2.60+003	6.078-010	6.384-010	8.677-010	6.127-010	6.061-010	5.953-010	6.398-010	1.113-009
2.80+003	5.408-010	5.668-010	7.693-010	5.456-010	5.381-010	5.287-010	5.668-010	9.854-010
3.00+003	4.855-010	5.077-010	6.883-010	4.901-010	4.820-010	4.737-010	5.066-010	8.799-010
3.22+003	4.332-010	4.525-010	6.128-010	4.374-010	4.295-010	4.223-010	4.508-010	7.827-010
3.60+003	3.615-010	3.770-010	5.096-010	3.651-010	3.577-010	3.519-010	3.746-010	6.499-010
4.02+003	3.022-010	3.146-010	4.245-010	3.054-010	2.984-010	2.938-010	3.118-010	5.406-010
4.40+003	2.618-010	2.721-010	3.667-010	2.646-010	2.580-010	2.542-010	2.691-010	4.663-010
4.83+003	2.257-010	2.342-010	3.151-010	2.282-010	2.220-010	2.188-010	2.310-010	4.001-010
5.00+003	2.134-010	2.213-010	2.976-010	2.158-010	2.098-010	2.068-010	2.182-010	3.777-010
5.20+003	1.996-010	2.069-010	2.781-010	2.019-010	1.961-010	1.934-010	2.038-010	3.527-010
5.63+003	1.741-010	1.805-010	2.421-010	1.761-010	1.710-010	1.687-010	1.773-010	3.069-010
6.00+003	1.563-010	1.620-010	2.171-010	1.582-010	1.534-010	1.514-010	1.589-010	2.749-010
6.44+003	1.386-010	1.436-010	1.922-010	1.403-010	1.360-010	1.342-010	1.406-010	2.432-010
7.24+003	1.135-010	1.175-010	1.570-010	1.149-010	1.113-010	1.099-010	1.148-010	1.985-010
7.50+003	1.070-010	1.108-010	1.480-010	1.083-010	1.049-010	1.036-010	1.082-010	1.871-010
8.05+003	9.509-011	9.850-011	1.315-010	9.624-011	9.323-011	9.209-011	9.608-011	1.662-010
8.50+003	8.674-011	8.986-011	1.199-010	8.778-011	8.503-011	8.401-011	8.759-011	1.515-010
9.00+003	7.880-011	8.166-011	1.089-010	7.974-011	7.726-011	7.635-011	7.953-011	1.376-010
9.50+003	7.197-011	7.459-011	9.937-011	7.281-011	7.055-011	6.974-011	7.259-011	1.256-010
1.00+004	6.603-011	6.845-011	9.115-011	6.680-011	6.474-011	6.400-011	6.657-011	1.152-010
1.21+004	4.844-011	5.026-011	6.678-011	4.899-011	4.750-011	4.699-011	4.874-011	8.443-011
1.40+004	3.794-011	3.940-011	5.226-011	3.837-011	3.722-011	3.684-011	3.813-011	6.607-011
1.61+004	3.017-011	3.135-011	4.152-011	3.050-011	2.960-011	2.932-011	3.027-011	5.248-011
1.80+004	2.509-011	2.610-011	3.451-011	2.536-011	2.462-011	2.440-011	2.515-011	4.362-011
2.00+004	2.110-011	2.196-011	2.900-011	2.133-011	2.071-011	2.053-011	2.113-011	3.665-011
2.20+004	1.797-011	1.872-011	2.466-011	1.815-011	1.764-011	1.750-011	1.795-011	3.115-011
2.41+004	1.536-011	1.603-011	2.106-011	1.552-011	1.510-011	1.498-011	1.531-011	2.659-011
2.60+004	1.356-011	1.416-011	1.856-011	1.370-011	1.333-011	1.323-011	1.349-011	2.343-011
2.80+004	1.197-011	1.251-011	1.637-011	1.209-011	1.177-011	1.169-011	1.189-011	2.066-011
3.22+004	9.465-012	9.918-012	1.291-011	9.565-012	9.326-012	9.276-012	9.372-012	1.629-011
3.40+004	8.629-012	9.051-012	1.175-011	8.722-012	8.508-012	8.467-012	8.529-012	1.482-011
4.02+004	6.505-012	6.845-012	8.819-012	6.580-012	6.431-012	6.411-012	6.402-012	1.112-011
4.20+004	6.056-012	6.377-012	8.198-012	6.128-012	5.992-012	5.977-012	5.955-012	1.034-011
4.83+004	4.814-012	5.082-012	6.483-012	4.878-012	4.782-012	4.779-012	4.731-012	8.187-012
5.00+004	4.548-012	4.804-012	6.115-012	4.611-012	4.523-012	4.523-012	4.473-012	7.729-012
5.63+004	3.719-012	3.937-012	4.970-012	3.779-012	3.714-012	3.721-012	3.658-012	6.295-012
5.80+004	3.542-012	3.751-012	4.726-012	3.601-012	3.541-012	3.550-012	3.485-012	5.989-012
6.00+004	3.348-012	3.548-012	4.458-012	3.406-012	3.352-012	3.363-012	3.297-012	5.656-012
6.44+004	2.983-012	3.164-012	3.953-012	3.040-012	2.997-012	3.011-012	2.945-012	5.030-012
7.24+004	2.451-012	2.603-012	3.223-012	2.507-012	2.478-012	2.498-012	2.439-012	4.130-012
7.50+004	2.301-012	2.444-012	3.021-012	2.356-012	2.331-012	2.351-012	2.298-012	3.881-012
8.05+004	2.030-012	2.155-012	2.655-012	2.082-012	2.063-012	2.084-012	2.040-012	3.430-012
8.50+004	1.844-012	1.957-012	2.403-012	1.893-012	1.878-012	1.900-012	1.864-012	3.119-012
9.00+004	1.669-012	1.771-012	2.167-012	1.717-012	1.706-012	1.729-012	1.699-012	2.829-012
9.50+004	1.521-012	1.613-012	1.967-012	1.567-012	1.560-012	1.583-012	1.559-012	2.582-012
1.00+005	1.394-012	1.478-012	1.796-012	1.440-012	1.436-012	1.459-012	1.440-012	2.372-012

Table 7.2-3

WIND SPEED AND WIND DIRECTION CLASSIFICATION

Wind Speed (u)

Class	Wind Speed (mph)	Class	Wind Speed (mph)
1	$0.0 \geq u <$ Threshold	6	$18.5 > u \leq 24.5$
2	Threshold $\geq u \leq 3.5$	7	$24.5 > u \leq 31.5$
3	$3.5 > u \leq 7.5$	8	$31.5 > u \leq 38.5$
4	$7.5 > u \leq 12.5$	9	$38.5 > u \leq 46.5$
5	$12.5 > u \leq 18.5$	10	$46.5 > u \leq 99.8$

Wind Direction (θ)

Sector	Wind Direction (degrees)
N	$348.75 > \theta \leq 11.25$
NNE	$11.25 > \theta \leq 33.75$
NE	$33.75 > \theta \leq 56.25$
ENE	$56.25 > \theta \leq 78.75$
E	$78.75 > \theta \leq 101.25$
ESE	$101.25 > \theta \leq 123.75$
SE	$123.75 > \theta \leq 146.25$
SSE	$146.25 > \theta \leq 168.75$
S	$168.75 > \theta \leq 191.25$
SSW	$191.25 > \theta \leq 213.75$
SW	$213.75 > \theta \leq 236.25$
WSW	$236.25 > \theta \leq 258.75$
W	$258.75 > \theta \leq 281.25$
WNW	$281.25 > \theta \leq 303.75$
NW	$303.75 > \theta \leq 326.25$
NNW	$326.25 > \theta \leq 348.75$

Table 7.2-4

GASEOUS EFFLUENT RELEASE POINT CHARACTERISTICS

	HVAC Exhaust Stack	SGTS Exhaust Stack
Release Point Height (m)	61	61
Building Height (m)	58	58
Release Point Geometry	Duct	Pipe
Release Point Area (m^2)	11.15	0.16
Release Point Diameter (m)	3.77*	0.46
Annual Average Flow Rate (m^3/sec)	111.71	1.89
Vertical Exit Velocity (m/sec)	10.02	11.80

*Effective $\sqrt{2(A/\pi)}$ diameter

TABLE 7.2-5

SITE BOUNDARY DISPERSION AND DEPOSITION PARAMETERS

Sector	Distance (mile/meter)	Release Point $\overline{X/Q}$ (sec/m³)		Release Point $\overline{D/Q}$ (m^{-2})	
		HVAC Stack	SGTS Stack	HVAC Stack	SGTS Stack
N	0.9/1402	9.360E-7	9.360E-7	6.070E-9	6.070E-9
NNE	0.8/1341	8.551E-7	8.551E-7	6.019E-9	6.019E-9
NE	0.7/1097	8.885E-7	8.885E-7	6.690E-9	6.690E-9
ENE	0.8/1219	4.671E-7	4.671E-7	3.430E-9	3.430E-9
E	0.8/1219	5.322E-7	5.322E-7	4.163E-9	4.163E-9
ESE	3.0/4816	7.501E-8	7.501E-8	4.491E-10	4.491E-10
SE	2.4/3841	7.977E-8	7.977E-8	4.883E-10	4.883E-10
SSE	2.1/3353	8.699E-8	8.699E-8	5.695E-10	5.695E-10
S	2.1/3353	8.725E-8	8.725E-8	4.332E-10	4.332E-10
SSW	2.9/4633	5.170E-8	5.170E-8	2.342E-10	2.342E-10
SW	3.2/5121	7.497E-8	7.497E-8	2.781E-10	2.781E-10
WSW	2.1/3414	1.355E-7	1.355E-7	4.374E-10	4.374E-10
W	1.4/2256	2.075E-7	2.075E-7	7.945E-10	7.945E-10
WNW	0.7/1097	4.317E-7	4.317E-7	2.278E-9	2.278E-9
NW	0.9/1463	3.818E-7	3.818E-7	1.543E-9	1.543E-9
NNW	1.0/1585	4.760E-7	4.760E-7	2.418E-9	2.418E-9

CPS RETS	Pathway	Controlling Sector	Comments
3.11.2.1	Immersion	N	Considers occupancy factors for other sectors
3.11.2.1	Inhalation	N	Considers occupancy factors for other sectors
3.11.2.2	Air Dose	N	Considers occupancy factors for other sectors
3.11.2.3	Inhalation	N	Considers occupancy factors for other sectors
3.11.2.3	Ground Plane	N	Considers occupancy factors for other sectors
3.11.2.3	Cow Milk	N	No milking cows within 5 mile radius of CPS*
3.11.2.3	Goat Milk	N	No milking goats within 5 mile radius of CPS*
3.11.2.3	Cow Meat	N	No meat animals identified in annual census**
3.11.2.3	Vegetation	N	

NOTES

*Assumes a milking animal resides at a distance of 4.5 miles from CPS in the worst case sector as stated on page 30 of NUREG-0133.

** Assumes cow meat animal located 4.5 miles from CPS in the worst case sector.

7.3 Concurrent Meteorological Data Processing

Meteorological data is acquired and processed through a model which utilizes bi-level hourly meteorological tower data or single level joint frequency data to perform the required analysis. Three distinct release modes are treated: elevated, ground and mixed. A set of five output arrays are generated for each dose receptor location as follows:

- Relative undecayed, undepleted plume concentration (X/Q)
- Relative decayed and depleted radioiodine and particulate concentration (D2DPXQ)
- Relative decayed noble gas concentration (D1XQ)
- Relative particulate and radioiodine deposition (D/Q)
- Standard deviations of the undecayed, undepleted plume concentrations

Since the Regulatory Guide 1.111 depletion and deposition curves are defined only within the range encompassing 100 to 200,000 meters, analysis results are not considered valid outside this range. The following sections describe the calculations performed by the transport and dispersion model for a one hour time interval.

7.3.1 Determination of Pasquill Stability Class

The Pasquill Stability Class is determined by categorizing the temperature gradient, T, into one of several ranges between -0.900 and 0.900 °C/meter according to the following equation:

$$T = \frac{T_U - T_L}{H_U - H_L} \text{ , °C/meter} \qquad (5)$$

where

T_U = Meteorological (met) tower upper level temperature, °C

T_L = Meteorological tower lower level temperature, °C

H_U = Meteorological tower upper level instrumentation height
= 60 meters

H_L = Meteorological tower lower level instrumentation height
= 10 meters

ΔT is then classified according to the following scheme:

Pasquill Stability	Defining Condition
A (Extremely Unstable)	$-0.900 < \Delta T \leq -0.019$
B	$-0.019 < \Delta T \leq -0.017$
C	$-0.017 < \Delta T \leq -0.015$
D (Neutral)	$-0.015 < \Delta T \leq -0.005$
E	$-0.005 < \Delta T \leq 0.015$
F	$0.015 < \Delta T \leq 0.040$
G (Extremely Stable)	$0.040 < \Delta T \leq 0.900$
Invalid	$\Delta T \leq -0.900$ or $\Delta T > 0.900$

7.3.2 Calculation of Stack Height Wind Speed

The wind speed at the release point (HVAC Exhaust Stack or Standby Gas Treatment System Exhaust Stack) height, STACWS, is calculated using the expressions:

$$STACWS = WSP_U \, (STACKH/H_U)^P, \text{ meter/sec} \quad (6)$$

$$P = \frac{\log(WSP_L/WSP_U)}{\log(H_L/H_U)}, \text{ dimensionless} \quad (7)$$

where

WSP_U = Upper met tower level wind speed, meter/sec

WSP_L = Lower met tower level wind speed, meter/sec

STACKH = Physical release point stack height

P = Wind power law exponent, dimensionless

All other parameters are as defined for equation (5).

7.3.3 Determination of Release Mode and the Entrainment Coefficient

The mode of release can be elevated, ground or mixed; the latter being a combination of the first two. The mode of release, as well as an entrainment coefficient, TCORR, are determined from the stack height, STACH, building height, BLDGHT, stack exit velocity, EXITV, and the wind speed at the stack height, STACWS.

For effluents exhausted from release points that are higher than twice the height of adjacent solid structures,

STACKH > 2(BLDGHT) , TCORR = 0.0 (8)

the release is considered completely elevated and the entrainment coefficient is zero. For effluents released from points less than the height of adjacent solid structures, a ground-level release is assumed

STACKH < BLDGHT , TCORR = 1.0 (9)

and the entrainment coefficient is unity. For effluents released from points or vents at the level of, or above, adjacent solid structures, but lower than elevated release points.

2(BLDGHT) > STACKH > BLDGHT (10)

the release is treated as elevated, ground or mixed according to the following relationships:

ELEVATED: TCORR = 0.0 if EXITV >5(STACWS) (11)

GROUND: TCORR = 1.0 if EXITV <STACWS (12)

MIXED: TCORR = 0.30-0.06(EXITV/STACWS) if (13)
5(STACWS)$\geq$EXITV > 1.5 (STACWS)

TCORR = 2.58-1.58(EXITV/STACWS) if (14)
1.5(STACWS) $\geq$EXITV$\geq$(STACWS)

In the mixed mode, the release is considered to occur as an elevated release 100(1-TCORR) percent of the time and as a ground release 100(TCORR) percent of the time. Each of these cases are then evaluated separately and the concentration X/Q calculated according to the fraction of the time each release occurs.

7.3.4 Calculation of Vertical Standard Deviation

The vertical plume spread (vertical standard deviation), σ_z, is a function of the distance from the release point to the reception point for a given Pasquill stability class. The numerical value of σ_z is obtained by a polynomial fitting equation which simulates Figure 1 of Regulatory Guide 1.111:

$$\sigma_z = 10^{[A + B \log (X) + C (\log (X))^2]}, \text{ meter} \quad (15)$$

where

X = Distance to a specific receptor, meter

A,B,C = Empirical factors which vary by stability class, determined by fitting polynomial equations to the Regulatory Guide 1.111 Figure 1 curves, dimensionless

Empirical Factors Used in Equation (15)

Pasquill Class	A	B	C
A	2.79166	2.69043	1.07483
B	2.11394	1.47930	0.40676
C	1.81954	0.88317	-0.06101
D	1.51851	0.74130	-0.08699
E	1.36173	0.68570	-0.11956
F	1.14613	0.6[illegible]066	-0.13263
G	1.14613	0.6[illegible]66	-0.12363

Additionally, an optional value called the "mixing height lid" may be specified which limits the value of σ_z to be no greater than this value.

7.3.5 Calculation of the Building Wake Correction

For ground-based and mixed-mode releases, an adjustment is made in the calculation of X/Q that takes into consideration initial mixing of the effluent plume within the building wake. This adjustment is an additional factor added in quadrature to the vertical plume spread equation (15):

$$\Sigma_z = [\sigma_z^2 + 0.5(\text{BLDGHT})^2/\pi]^{\frac{1}{2}} \quad (16)$$

with the requirement that Σ_z is restricted to values $\Sigma_z \leq (3)^{\frac{1}{2}} (\sigma_z)$.

7.3.6 Calculation of Momentum Plume Rise

For elevated or mixed-mode releases only, the amount of plume rise due to the initial vertical momentum of the exhausted effluent, ΔH, is calculated. For Pasquill stability classes A,B,C and D, ΔH is calculated per section 7.3.6.1; for classes E,F and G, section 7.3.6.2 is used.

7.3.6.1 ΔH For Pasquill Class A,B,C and D

H is calculated using both equations (17) and (18) and the minimum value is selected for use. In addition, when the vertical exit velocity, EXITV, is less than 1.5 times the horizontal windspeed, STACWS, a downwash correction is subtracted from equation (17) per equation (19).

$$\Delta H_1 = 1.44(STACD)(EXITV/STACWS)^{2/3} \quad (17)$$
$$(X/STACD)^{1/3} - DOWNWASH, \text{ meter}$$

$$\Delta H_2 = 3.0\ (STACD)(EXITV/STACWS), \text{ meter} \quad (18)$$

$$DOWNWASH = 3.0(STACD)(1.5-EXITV/STACWS), \text{ meter} \quad (19)$$

where

STACD = Internal release point stack diameter
= 3.77 meters (HVAC Exhaust Stack)
= 0.46 meters (SGTS Exhaust Stack)

EXITV = Stack exit velocity, meter/second

All other parameters are as defined previously.

7.3.6.2 ΔH For Pasquill Class E,F and G

ΔH is determined by selecting the minimum value calculated by equations (17) and (18) above and equations (20) and (21) below:

$$\Delta H_3 = 4.0\ [(0.5(EXITV)(STACD))^2/S]^{\frac{1}{4}}, \text{meter} \quad (20)$$

$$\Delta H_4 = 1.5\ [(0.5(EXITV)(STACD))^2/STACWS]^{1/3}(S)^{-1/6}, \quad (21)$$
meter

where

S = Restoring acceleration per unit vertical displacement for adiabatic motion, sec^{-2}
  = 8.70E-04 (E stability)
  = 1.75E-03 (F stability)
  = 2.45E-03 (G stability)

All other parameters are as defined in section 7.3.6.1

7.3.7 Calculation of the Effective Plume Height

The effective plume height, H, is determined using section 7.3.6 results for the momentum plume rise, ΔH, and the terrain height, TERAIN:

$$H = STACKH + \Delta H - TERAIN \quad , \text{meter} \qquad (22)$$

where

TERAIN = Difference between the plant base height above mean sea level (MSL) and the receptor point height above MSL, meter
  ≥ 0.0

7.3.8 Determination of Affected Sectors

The wind direction for the hour determines which sector will be affected. Sectors are 22.5° arcs and are classified according to the following scheme:

Sector Number	Compass Direction	Wind Direction (WD)
1	N	$0.0° < WD < 11.25°$ or $348.75° \leq WD < 360.00°$
2	NNE	$11.25° \leq WD < 33.75°$
3	NE	$33.75° \leq WD < 56.25°$
4	ENE	$56.25° \leq WD < 78.25°$
5	E	$78.75° \leq WD < 101.25°$
6	ESE	$101.25° \leq WD < 123.75°$
7	SE	$123.75° \leq WD < 146.25°$
8	SSE	$146.25° \leq WD < 168.75°$
9	S	$168.75° \leq WD < 191.25°$
10	SSW	$191.25° \leq WD < 213.75$
11	SW	$213.75° \leq WD < 236.25°$
12	WSW	$236.25° \leq WD < 258.75$
13	W	$258.75° \leq WD < 281.25°$
14	WNW	$281.25° \leq WD < 303.75°$
15	NW	$303.75° \leq WD < 326.25°$
16	NNW	$326.25° \leq WD < 348.75°$

For elevated releases, the wind direction at the upper met tower level is used; ground releases follow the direction of the wind at the lower met tower level. For mixed-mode releases, two X/Q calculations are performed: one for each of the two met tower levels. If the wind direction is the same at both levels, the resulting X/Q will be summed into the same sector; otherwise, the X/Q will be summed into the appropriate sectors. During periods of calm wind, the wind speed is set at one-half the anemometer threshold value and assigned the direction of the previous hour.

7.3.9 Calculation of Depletion and Deposition Factors

The depletion, DPF, and deposition, DPSF, factors are calculated using the curves provided by Regulatory Guide 1.111. Actual values are calculated using polynomial equations developed to simulate the Regulatory Guide curves. Both the DPF and DPSF calculations depend on the effective plume height, H, the stability class, S, and the distance, X, to the receptor.

The Regulatory Guide 1.111 curves represent plumes that are 100, 60, 30, and 0 (ground-level) meters above the ground. For plumes between 0 and 15 meters above the ground, the model uses the ground-level release graphs; for those between 15 and 45 meters, it uses the 30 meter curves; between 45 and 80 meters above the ground, it uses the 60 meter curves; and for those greater than 80 meters above the ground, it uses the 100 meter curves. The model assumes that, after full plume rise is achieved, the plume cannot get higher from the ground. The derivation of these curves assumed no change in terrain height with downwind distance. Since topography does change with distance, and likewise the vertical distance between the plume centerline and the ground, it is necessary to read from more than one depletion or deposition curve of Regulatory Guide 1.111 as the plume travels with distance.

7.3.9.1 DPF Calculation

The effective plume height, H, is categorized into one of four J-ranges according to the following scheme:

Plume Height (meters)	J Value
$0 \leq H \leq 15$	5
$15 < H \leq 45$	6
$45 < H \leq 80$	7
$H > 80$	8

Similarly, the stability class is categorized into one of three S-ranges as follows:

Stability Class	S Value
A, B, C	1
D	2
E, F, G	3

The (SJ) product is then calculated and an (A) value determined at the receptor location X according to the following scheme (where no A value is given, DPF=1.0):

S*J Value	X	A	DPF
5	$X < 100$		1.0
	$X \geq 100$	A = 1	calculated
6	$X < 200$		1.0
	$X \geq 200$	A = 5	calculated
7	$X < 300$		1.0
	$X \geq 300$	A = 17	calculated
8	$X < 600$		1.0
	$X \geq 600$	A = 29	calculated
10	all X		1.0
12	$X < 400$		1.0
	$X \geq 400$	A = 9	calculated
14	$X < 1000$		1.0
	$X \geq 1000$	A = 21	calculated
15	all X		1.0
16	$X < 1700$		1.0
	$X \geq 1700$	A = 33	calculated
18	$X < 6000$		1.0
	$X \geq 6000$	A = 13	calculated
21	$X < 60,000$		1.0
	$X \geq 60,000$	A = 25	calculated
24	all X		1.0

DPF is calculated using the value for A and equations (23) and (24):

$$DPF = B(A) + B(A + 1)d + B(A + 2)d^2 + B(A + 3)d^3 \quad (23)$$

$$d = \log (X) \quad (24)$$

The corresponding values for the B(A), B(A + 1), B(A + 2) and B(A + 3) terms are as follows:

B(1) =	.788234	B(19) =	.426473
B(2) =	.207198	B(20) =	-.0471767
B(3) =	-.0563034	B(21) =	.615442
B(4) =	.0	B(22) =	.317258
B(5) =	2.59508	B(23) =	-.0631839
B(6) =	-1.43610	B(24) =	.0
B(7) =	.433300	B(25) =	-6.89581
B(8) =	-.0466221	B(26) =	3.37961
B(9) =	1.507264	B(27) =	-.361582
B(10) =	-.2745668	B(28) =	.0
B(11) =	.0556577	B(29) =	3.58532
B(12) =	-.007670194	B(30) =	-2.21101
B(13) =	-18.01858857	B(31) =	.642613
B(14) =	12.755137	B(32) =	-.0651465
B(15) =	-2.7658938	B(33) =	.234274
B(16) =	.19103896	B(34) =	.512656
B(17) =	2.47756	B(35) =	-.0857995
B(18) =	1.36010	B(36) =	.0

7.3.9.2 DPSF Calculations

Using the same (SJ) and X values determined in section 7.3.9.1, corresponding C value is defined according to the following scheme (where no C value is given, DPSF = 0):

S*J Value	X	C	DPSF
5	X< 100		0
	X≥ 100	C = 1	calculated
6	X< 100		0
	X≥ 100	C = 8	calculated
7	X< 100		0
	X≥ 100	C = 29	calculated
8	X< 100		0
	X> 100	C = 50	calculated
10	all X		0
12	X< 100		0
	X≥ 100	C = 15	calculated
14	X< 120		0
	X≥ 120	C = 36	calculated
15	all X		0
16	X< 210		0
	X≥ 210	C = 57	calculated
18	X< 2900		0
	X≥ 2900	C = 22	calculated
21	X< 26,000		0
	X≥ 26,000	C = 43	calculated
24	all X		0

DPSF is calculated using the value for C and equations (24), (25), and (26):

$$DPSF = 10^{Y}/(0.392699X) \quad (25)$$

$$Y = A(C) + A(C+1)d + A(C+2)d^2 + A(C+3)^3 + A(C+4)d^4 + A(C+5)d^5 + A(C+6)d^6 \quad (26)$$

The corresponding values for the A(C), A(C+1), A(C+2), A(C+3), A(C+4), A(C+5) and A(C+6) terms are as follows:

A(1)	= -3.17821	A(33)	= 7.552876
A(2)	= -.153463	A(34)	= -.82569984
A(3)	= -.0759066	A(35)	= .036134823
A(4)	= 0.	A(36)	= -53.7335
A(5)	= 0.	A(37)	= 45.3671
A(6)	= 0.	A(38)	= -15.3282
A(7)	= 0.	A(39)	= 2.24735
A(8)	= -25.7331	A(40)	= -.122674
A(9)	= 26.2738	A(41)	= 0.
A(10)	= -11.3014	A(42)	= 0.
A(11)	= 2.04278	A(43)	=-674.351
A(12)	= -.134412	A(44)	= 384.531
A(13)	= 0.	A(45)	= -73.7766
A(14)	= 0.	A(46)	= 4.72041
A(15)	= -47.5827	A(47)	= 0.
A(16)	= 43.8050	A(48)	= 0.
A(17)	= -16.0781	A(49)	= 0.
A(18)	= 2.53726	A(50)	= -55.5622
A(19)	= -.148044	A(51)	= 53.6534
A(20)	= 0.	A(52)	= -20.6300
A(21)	= 0.	A(53)	= 3.44177
A(22)	=-128.5278	A(54)	= -.212314
A(23)	= 77.28943	A(55)	= 0.
A(24)	= -15.90284	A(56)	= 0.
A(25)	= 1.071885	A(57)	= 436.987302
A(26)	= 0.	A(58)	=-755.860224
A(27)	= 0.	A(59)	= 515.64145
A(28)	= 0.	A(60)	=-181.713295
A(29)	= 41.824767	A(61)	= 35.153579
A(30)	=-103.969677	A(62)	= -3.558356
A(31)	= 86.215344	A(63)	= .14774
A(32)	= -35.1021096		

7.3.10 Ground Level X/Q, D2DPXQ, D1XQ, D/Q Analysis

7.3.10.1 Undecayed, Undepleted Plume Relative Concentration, X/Q

The atmospheric concentration of effluent at ground level, normalized by the source term Q, is given by the following equation:

$$X/Q = \frac{2.032(TCORR)}{WSP_L(X)A_{min}}, \text{ sec/m}^3 \qquad (27)$$

where

A_{min} = The lesser of the two values obtained by equations (28) and (29), meter

$$A_1 = (\sigma_z^2 + \Sigma_z)^{\frac{1}{2}}, \text{ meter} \qquad (28)$$

$$A_2 = (3)^{\frac{1}{2}} \sigma_z \text{ , meter} \quad (29)$$

2.032 = The constant $(2/\pi)^{\frac{1}{2}}$ divided by the width in radians of a 22.5° sector (i.e., $\pi/8$), dimensionless

X = Distance between release point to receptor, meter

7.3.10.2 Decayed, Depleted Radioiodine and Particulate Relative Concentration, D2DPXQ

The decayed, depleted radioiodine concentration, D2DPXQ, is calculated in accordance with the following equation:

$$D2DPXQ = DPF\ (DC2)\ X/Q \text{ , sec/m}^3 \quad (30)$$

where

DPF = The depletion factor calculated per section 7.3.9, dimensionless

DC2 = The radioiodine decay factor, dimensionless

$= \exp\ [-0.693(X)/t_{\frac{1}{2}}\ (WSP_L)]$

$= \exp\ [-0.693(X)/(8\ day)(24\ hr/day)(3600\ sec/hr)(WSP_L)]$

$= \exp\ [-1.00E\text{-}06\ (X/WSP_L)]$

7.3.10.3 Decayed Noble Gas Plume Relative Concentration, D1XQ

The decayed noble gas plume relative concentration, D1XQ, is calculated in accordance with the following equation:

$$D1XQ = DC1\ (X/Q) \quad , \quad sec/m^3 \qquad (31)$$

where

DC1 = The noble gas decay factor, dimensionless

$$= \exp\ [-0.693(X)/t_{\frac{1}{2}}(WSP_L)]$$

$$= \exp\ [-0.693(X)/(2.26\ day)(24\ hr/day)(3600\ sec/hr)(WSP_L)]$$

$$= \exp\ [-3.55E\text{-}06\ (X/WSP_L)]$$

7.3.10.4 Radioiodine and Particulate Relative Deposition, D/Q

The relative deposition for radioiodines and particulates, D/Q, is calculated in accordance with the following equation:

$$D/Q = \frac{DPSF(DC2)(TCORR), \quad m^{-2}}{(2\ \pi/16)\ X} \qquad (32)$$

where

DPSF = The deposition factor, calculated per section 7.3.9, m^{-1}

7.3.11 Elevated X/Q, D2DPXQ, D1XQ, D/Q Analysis

7.3.11.1 Undecayed, Undepleted Plume Relative Concentration, X/Q

The atmospheric concentration of effluent at ground level, normalized by the source term Q, is given by the following equation:

$$X/Q = \frac{2.032(1\text{-TCORR})\exp[-0.5(H/\sigma_z)^2]}{\text{STACWS}\ (X)\ \sigma_z}, \text{ sec/m}^3 \quad (33)$$

where all parameters are as previously defined.

7.3.11.2 Decayed, Depleted Radioiodine and Particulate Relative Concentration, D2DPXQ

The calculation of D2DPXQ for elevated releases follows section 7.3.10.2 methodology with the exception that the WSP_L value used in the calculation of DC2 in equation (30) is replaced by the STACWS value and the equation (33) X/Q is used.

7.3.11.3 Decayed Noble Gas Plume Relative Concentration, D1XQ

The calculation of D1XQ for elevated releases follows section 7.3.10.3 methodology by substituting the equation (33) X/Q value into equation (31) and STACWS for WSP_L in the calculation of DC1.

7.3.11.4 Radioiodine and Particulate Relative Deposition, D/Q

The calculation of D/Q for elevated releases follows section 7.3.10.4 methodology by substituting (1-TCORR) for the TCORR term in equation (32) and STACWS for WSP_L in the calculation of DC2.

7.3.12 Short Term Dispersion Calculations

Airborne releases are classified as short term in NUREG-0133 if they occur at a frequency less than 500 hours during a calendar year not to exceed 150 hours in any quarter. NUREG-0324 entitled XOQDOQ, PROGRAM FOR THE METEOROLOGICAL EVALUATION OF ROUTINE EFFLUENT RELEASES AT NUCLEAR POWER STATIONS, presents a method for obtaining dispersion parameter values for short term releases. The method involves calculating a short term correction factor, F, which relates the short term dispersion value to the annual average dispersion value. This same correction factor is then applied to all the dispersion and deposition values (D1XQ, D2DPXQ, DOQ) to obtain the corresponding short term values.

7.3.12.1 Standard Deviation of X/Q

The standard deviation of X/Q, divided by X/Q, for each receptor location is calculated by equation (34):

$$\frac{\sigma}{X/Q} = (n/n-1)^{\frac{1}{2}} \quad \frac{[n \sum_n (X/Q)^2 - (\sum_n X/Q)^2]^{\frac{1}{2}}}{\sum_n X/Q} \qquad (34)$$

where

n = Number of hours of valid data

$\sum_n$ = Summation over all the X/Q values obtained by equation (27) at a receptor location for the specified time period.

The value calculated by equation (34) is used to specify an exponent, S, used to calculate the short term correction factor.

7.3.12.2 Short Term Correction Factor Calculation

The short term correction factor is calculated by equation (35):

$$F = (T_s/T_a)^S \qquad (35)$$

where T_s = Total number of hours of the short term release.

T_a = Total number of hours in the analyzed period.

S = Correction factor exponent calculated by equation (36).

$$S = \frac{\log [X/Q \; / \; (X/Q + \sigma)]}{\log T_a} = \frac{-\log (1+\sigma \; / X/Q)}{\log T_a} \qquad (36)$$