Wayne H. Jens
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October 11, 1984
EF2-71988

Director of Nuclear Reactor Regulation
Attention: Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Youngblood:

Reference: (1) Fermi 2
NRC Docket No. 50-341
(2) Detroit Edison letter to NRC, "Revised Offsite Dose Calculation Manual", EF2-69216, dated July 25, 1984

Subject: Revised Offsite Dose Calculation Manual

A revised Offsite Dose Calculation Manual (ODCM) is provided as the attachment to this letter. The revisions reflected in the attachment and delineated below, are a result of NRC comments on the previous revision (Reference 2). These comments were provided in a September 25, 1984 telephone conversation between C. Nichols, T. Mo, and E. Branagan of NRC and W. V. Lipton and O. K. Earle of Detroit Edison. The NRC comments and their resolution are provided below.

a) Comment: Provide a figure in ODCM which reflects the site boundary for gaseous and liquid effluents.

Resolution: Figure 4.0-1 provides the requested information.

b) Comment: Provide source information for the land use census used.

Resolution: Section 2.2 has been modified to indicate that the initial controlling receptor location is consistent with the 1983 land use census.

c) Comment: Provide a commitment to verify all computer codes used to support dose assessments described in the ODCM.

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Response: Fermi 2 commits to verify the computer codes used to support the dose assessment methods discussed in the ODCM. Such an evaluation, including the development of test data sets to support comparisons with external calculations, has been performed on the software incorporated to support the effluents accountability system.

d) Comment: Confirm that the monitor trip setpoint for the fuel pool ventilation exhaust monitor is more conservative than 10CFR20.

Resolution: Trip setpoints for the fuel pool ventilation exhaust monitors will be adjusted to trip at levels below 10CFR20 limits.

Please direct any questions to Mr. O. K. Earle at 313-586-4211.

Sincerely,

cc: Mr. P. M. Byron*
Mr. M. D. Lynch*
Mr. C. Nichols*
Mr. T. Mo*
USNRC Document Control Desk; Washington, D.C. 20555*

*With Attachment

OFFSITE DOSE CALCULATION MANUAL

for

DETROIT EDISON COMPANY

ENRICO FERMI ATOMIC POWER PLANT - UNIT 2

MAY 1984

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1. J. S. Boegli, R. R. Bellamy, W. L. Britz, and R. L. Waterfield, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", NUREG-0133 (October 1978).

2. Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR 50, Appendix I, U.S. NRC Regulatory Guide 1.109 (March 1976).

3. Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR 50, Appendix I, U.S. NRC Regulatory Guide 1.109, Rev. 1 (October 1977).

4. "Environmental Report, Operating License Stage", Detroit Edison Company, Fermi-2 Plant.

5. "Final Safety Analysis Report", Detroit Edison Company, Fermi-2 Plant.

6. Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors, U.S. NRC Regulatory Guide 1.111 (March 1976).

7. Development of Sector-Specific Recirculation-Stagnation Factor for Meteorological Data Collected at the Enrico Fermi Atomic Power Plant, Unit 2, Project No. 3020, Camp Dresser & McKee Inc. Environmental Sciences Division, September 13, 1978.

8. Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors, U.S. NRC Regulatory Guide 1.111, Rev. 1 (July 1977).

INTRODUCTION

The OFFSITE DOSE CALCULATION manual is a supporting document of the RADIOLOGICAL EFFLUENT TECHNICAL SPECIFICATIONS. As such the ODCM describes the methodology and parameters to be used in the calculation of offsite doses due to radioactive liquid and gaseous effluents and in the calculation of liquid and gaseous effluent monitoring instrumentation alarm/trip setpoints. The ODCM contains a list and graphical description of the specific sample locations for the radiological environmental monitoring program. Schematic configurations of liquid and gaseous radwaste effluent systems releases to unrestricted areas are also included.

The ODCM will be maintained at the plant for use as a reference guide and training document of accepted methodologies and calculations. Changes in the calculational methods or parameters will be incorporated into the ODCM in order to assure that the ODCM represents the present methodology in all applicable areas. Computer software to perform the described calculations will be maintained current with the ODCM.

SECTION 1.

LIQUID EFFLUENTS

The Enrico Fermi Atomic Power Plant, Unit 2, is located on Lake Erie which supplies make-up water to the Circulating Water System and receives decant from the Circulating Water Reservoir. All releases from the Liquid Radwaste System are to the Circulating Water Reservoir decant line. Radionuclide concentrations are determined by analysis of samples removed from hold-up tanks after mixing to allow representativeness according to plant procedures.

1.1 LIQUID EFFLUENT MONITOR SETPOINTS

The calculated liquid monitor setpoint values will be regarded as upper bounds for the actual setpoint adjustments. Setpoint adjustments are not required to be performed if the existing setpoint level corresponds to a lower count rate than the calculated value. The actual monitor setpoint, which corresponds to the calculated concentration plus background for the specific monitor, is determined from calibration data or from operational data associated with liquid sample analysis data. (See Section 1.1.1).

1.1.1 LIQUID RADWASTE EFFLUENT RADIATION LINE MONITOR D11 - N007

The liquid radwaste effluent line monitor provides alarm and automatic termination of release functions prior to exceeding the concentration limits specified in 10CFR 20, Appendix B, Table II, Column 2 at the release point to the unrestricted area. To meet this specification, the alarm/trip setpoints for the liquid effluent monitor and flow measurement devices are set to assure that the following equation is satisfied:

$$\frac{cf}{F + f} \leq C_{MPC}$$

C_{MPC} = the effluent concentration limit (Specification 3.11.1.1) implementing 10CFR 20 for the site, corresponding to the specific mix of radionuclides in the effluent stream being considered for discharge, 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 plus the effluent stream, represents a value which, if exceeded, would result in concentrations exceeding the limits of 10CFR 20 in the unrestricted area.

f = the flow setpoint as determined at the radiation monitor location, in volume per unit time, but in the same units as F, below.

F = the dilution water flow setpoint as determined prior to the release point, in volume per unit time.

At Fermi-2, the Liquid Radwaste System Waste Sample Tanks discharge to the Circulating Water Reservoir Decant Line to Lake Erie. This decant line furnishes the dilution flow (F). The waste effluent flow (f) and the monitor setpoint (c) for the liquid radwaste pathway are determined and set to meet the conditions of the equation for a given effluent concentration, C_{MPC}. The method by which this is accomplished is as follows:

Step 1) The radionuclide concentration for a waste sample tank to be released is obtained from the sum of measured concentrations as determined by the analyses required in STS Table 4.11-1:

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

where

C_g = the concentration, C_g, of each measured gamma emitter observed by gamma-ray spectroscopy of each waste sample.

C_a = the concentration of alpha emitters in liquid waste as measured in the MONTHLY composite sample. (NOTE: Sample is analyzed for gross α).

C_s = the measured concentrations of Sr-89 and Sr-90 in liquid waste as observed in the QUARTERLY composite sample.

C_f = The measured concentrations of Fe-55 in liquid waste as observed in the QUARTERLY composite sample.

C_t = the measured concentration of H-3 in liquid waste as determined from analysis of the MONTHLY composite sample.

The C_g term will be included in the analysis of each batch; terms for alpha, strontiums, iron, and tritium may be included as appropriate.

Step 2) The measured radionuclide concentrations are used to calculate a Dilution Factor, DF, which is the ratio of total dilution flow rate to tank flow rate required to assure that the limiting concentrations of 10CFR 20, Appendix B, Table II, Column 2 are met at the point of discharge.

$$DF = \sum_i \frac{C_i}{MPC_i} \div SF$$

$$= \left[\sum_g \frac{C_g}{MPC_g} + \left(\frac{C_a}{MPC_a} + \frac{C_s}{MPC_s} + \frac{C_f}{MPC_f} + \frac{C_t}{MPC_t} \right) \right] \div SF$$

where

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

MPC_i = MPC_g, MPC_a, MPC_s, MPC_f, and MPC_t are limiting concentrations of the appropriate radionuclide from 10CFR 20, Appendix B, Table II, Column 2. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} µCi/ml total activity.

SF = the safety factor; a conservative factor used to compensate for statistical fluctuations and errors of measurements. (For example, SF = 0.5 corresponds to a 100 percent variation.)

Step 3) The dilution flow rate setpoint for minimum dilution flow rate, F_d, is established at ninety percent of the expected dilution flow rate:

$$F_d = (0.9) \times (\text{Circulating Water Reservoir Decant Line Flow Rate})$$

Step 4) For the case DF < 1, the waste sample tank effluent concentration meets the limits of 10CFR 20 without dilution and effluent discharge flow rate may be assigned any desired value. For DF > 1, the maximum permissible discharge flow rate, f_t, must be calculated:

$$f_t = \frac{F_d + f_p}{DF} \approx \frac{F_d}{DF} \quad \text{for } F_d \gg f_p$$

where:

F_d = Dilution flow rate to be used in effluent monitor setpoint calculations.

F_d = (0.9) x (Circulating Water Reservoir Decant Line Flow Rate)

DF = Dilution Factor from step 2.

f_p = Flow rate of Waste Sample Tank discharge. (This value will have an upper limit of the maximum discharge capacity of the particular waste sample tank pump.)

NOTE: If radioactivity from plant operations accumulates in the Circulating Water Reservoir such that measurable quantities of radionuclides are detected in the Circulating Water Reservoir, calculation of F_d must include a term to account for radioactivity present in the dilution stream prior to the introduction of the waste sample tank effluent:

F_d = (Circulating Water Reservoir Decant Line Flow Rate) x (0.9) x (1 - MPC fraction of Circulating Water Reservoir).

Step 5) The liquid radwaste effluent radiation monitor setpoint may now be determined based on the values of $\sum_i C_i$, f_t and F_d which were specified to provide compliance with the limits of 10CFR 20, Appendix B, Table II, Column 2. The monitor response is primarily to gamma radiation, therefore, the actual setpoint is based on $\sum_g C_g$. The monitor setpoint which corresponds to the particular setpoint concentration, c, is determined based on monitor calibration data or on operational data which correlates monitor response to sample analyses associated with actual effluent releases. (Example of monitor calibration graph is shown in Figure 1.0-1.)

The setpoint concentration, c, is determined as follows:

$$c = A \sum_g C_g \frac{\mu Ci}{ml}$$

where

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

$$= \frac{f_t}{f_{(actual)}}$$ (See Note 2 below)

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

If $A < 1$, No release may be made. Re-evaluate Steps 2, 3, and 4.

NOTE 1: The calculated setpoint concentration, c, establishes the base value for the monitor setpoint. However, in establishing the actual monitor setpoint for a particular monitor, background radiation levels must be considered. Normally, the actual monitor setpoint includes the calculated setpoint value plus background. Background levels must be controlled such that radioactivity levels in the effluent stream being monitored can be accurately assessed at or below the calculated setpoint value.

NOTE 2: If $DF < 1$, $A = (1/DF)$

If calculated setpoint values are near actual concentrations planned for release, it may be impractical to set the monitor alarm based on this value. In this case a new setpoint may be calculated by decreasing the effluent flow, increasing the dilution flow, or by decreasing $\sum_i C_i$ by further processing of the liquid radwaste planned for release, and by following the methodology presented in Steps 2, 3, and 4.

Within the limits of the conditions stated above, the monitor setpoint for the Liquid Radwaste Effluent Radiation Monitor is determined as follows:

Liquid Radwaste Effluent Radiation Monitor D11 - N007

Perform Step 2), solving the equation for DF using the appropriate values in the concentration term from the sample analyses for the Liquid Radwaste Sample Tank batch to be discharged. Then perform Steps 3), 4), and 5) to determine the monitor setpoint.

If no discharge is planned for this pathway, the monitor setpoint should be established as close to background as practical to prevent spurious alarms and yet alarm should an inadvertent release occur.

1.1.2 CIRCULATING WATER RESERVOIR DECANT LINE RADIATION MONITOR D11 - N402

The Circulating Water Reservoir Decant Line is the blowdown line to Lake Erie, and it furnishes dilution for liquid radwaste discharges. The radiation monitor has no control function, but serves as support (backup) for the Liquid Radwaste Effluent Line Monitor.

The radiation monitor setpoint is established as follows:

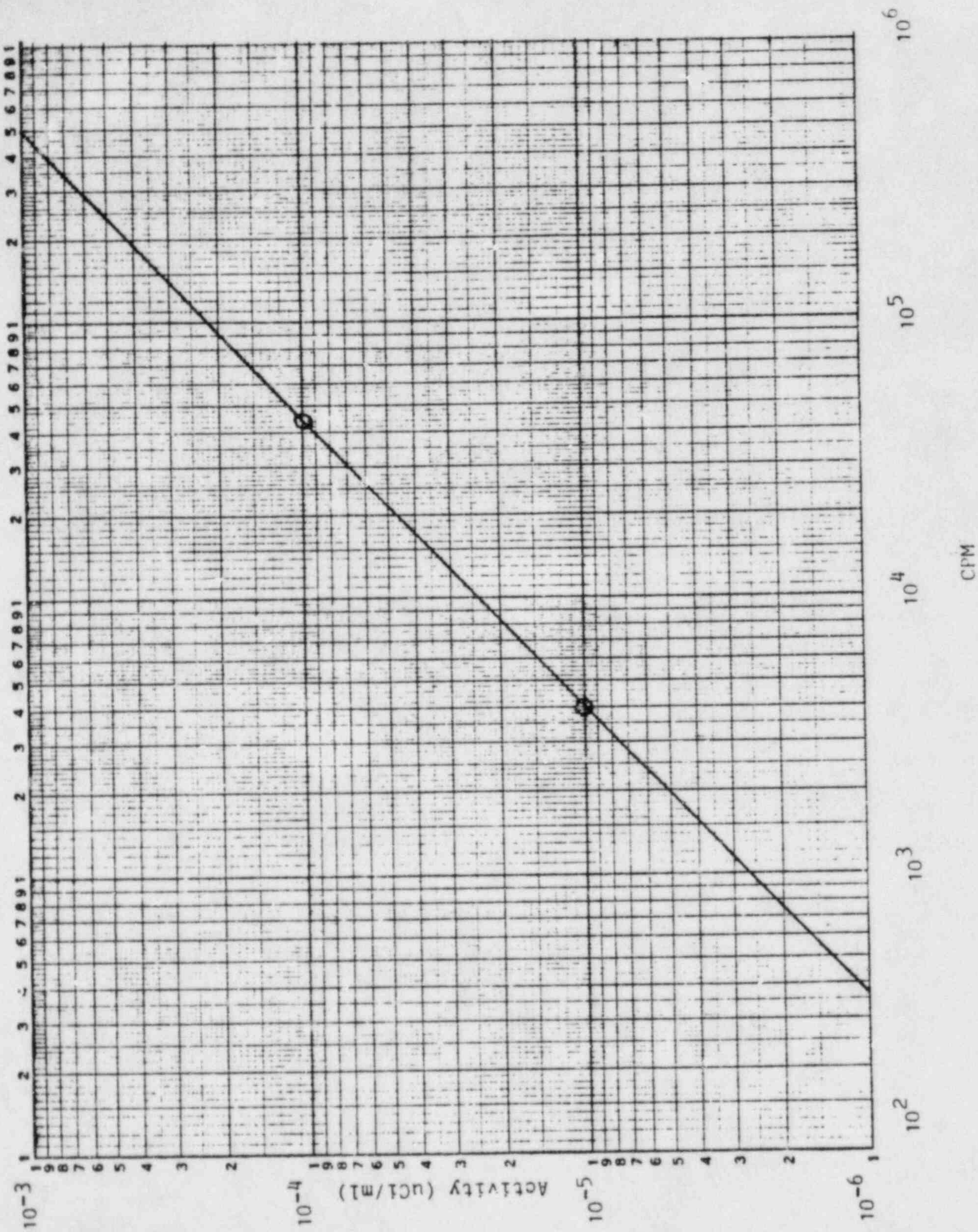
$$c = \left(\sum_{g} C_g \right) \div DF$$

where $\sum_{g} C_g$ and DF have values as determined in Section 1.1.1 Step 1 and Step 2 respectively for the liquid radwaste sample tank planned for release.

(For practicality, for this monitor only, if DF is determined to be < 1, DF may be set equal to 1 for the purpose of calculating the monitor setpoint.)

FIGURE 1.0-1

EXAMPLE CALIBRATION CURVE FOR LIQUID EFFLUENT MONITOR



1.2 DOSE CALCULATION FOR LIQUID EFFLUENTS

For liquid dose calculations consideration is given to the two primary current flow patterns existing in the Lagoona Beach embayment of Lake Erie. The maximum potential individual exposure is expected to exist with the current flow in the northerly direction and only the fish consumption pathway considered in the liquid dose calculations. However, in the case when the current flow is in the southerly direction, the nearby location of the municipal water intake for the city of Monroe makes it desirable to consider the water consumption pathway as well as the fish consumption pathway.

The methodology for both cases is described in the following sections.

1.2.1 DOSE TO CRITICAL RECEPTOR DUE TO FISH CONSUMPTION

The dose contribution to the maximum exposed individual by way of fish consumption from all radionuclides identified in liquid effluents released to unrestricted areas is calculated using the following expression:

$$D_\tau = \sum_i A_{i\tau} \sum_{\ell=1}^{m} \Delta t_\ell \, C_{i\ell} \, e^{-\lambda_i t_c} \, F_\ell$$

where

D_τ = The cumulative dose commitment to the total body or any organ, τ, due to radioactivity in liquid effluents for the total time period $\sum_{\ell=1}^{m} \Delta t_\ell$, in mrem (Reference 1).

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

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

λ_i = The decay constant for radionuclide i. (sec.$^{-1}$)

t_c = The transit time to the location of the individual expected to receive the greatest potential dose due to the liquid pathway (1770m northeast of Fermi-2); 13,000 seconds. (Reference 5 Section 2.4.12).

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

$$F_\ell = \frac{\text{(average undiluted liquid waste flow)}}{\text{(average flow from the discharge structure during periods of radioactive materials release)} \times (Z)}$$

NOTE: The denominator is limited to 1000 cfs or less. (Reference 1, Section 4.3).

where

Z = Applicable dilution factor for the receiving water body at Fermi-2.

Z = 10 (Reference 1, Section 4.3; Reference 5, Chapter 5, Section 5.2.)

$A_{i\tau}$ = The site related fish ingestion dose commitment factor to the total body or any organ τ for each identified principal gamma and beta emitter listed in Table 1.2-3 in mrem/hr per µCi/ml.

$$A_{i\tau} = K_o (U_F BF_i) DF_i$$

where

K_o = Units conversion factor 1.14×10^5

$$10^6 \frac{pCi}{\mu Ci} \times 10^3 \frac{ml}{l} \div 8760 \frac{hr}{yr}$$

U_F = Adult fish consumption (21 kg/yr).

BF_i = Bioaccumulation factor for radionuclide i, in fish, in pCi/kg per pCi/l from Table 1.2-1 (taken from Reference 3, Table A-1).

DF_i = Dose conversion factor for radionuclide i, for adults in preselected organ, τ, in mrem/pCi, from Table 1.2-2 (taken from Reference 3, Table E-11).

If radioactivity in the Circulating Water Reservoir Decant Line becomes > LLD, prior to the junction with the Liquid Radwaste Effluent Line, that concentration must be included in the dose determination. For this part of the dose calculation, $F_\ell = 1$ and Δt = the entire time period for which the dose is being calculated.

1.2.2 DOSE DUE TO FISH AND DRINKING WATER CONSUMPTION

The dose contribution to an exposed individual by way of fish and drinking water consumption from all radionuclides identified in liquid effluents released to unrestricted areas is calculated using the following expression:

$$D_\tau = \left[\sum_i A_{i\tau} \sum_{\ell=1}^{m} \Delta t_\ell C_{i\ell}\, e^{-\lambda_i t_f} F_\ell\right] + \left[\sum_i A'_{i\tau} \sum_{\ell=1}^{m} \Delta t_\ell C_{i\ell}\, e^{-\lambda_i t_d} F_\ell\right]$$

where

D_τ = The cumulative dose commitment to the total body or any organ, τ, due to radioactivity in liquid effluents for the total time period $\sum_{\ell=1}^{m} \Delta t_\ell$, in mrem (Reference 1).

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

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

λ_i = The decay constant for radionuclide i. (sec.$^{-1}$)

t_f = The transit time to the location 1530m south of Fermi 2; 11,000 seconds. (Reference 5, Section 2.4.12)

t_d = The transit time to the city of Monroe water intake; 23,000 seconds. (Reference 5, Section 2.4.12)

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

$$F_\ell = \frac{\text{(average undiluted liquid waste flow)}}{\text{(average flow from the discharge structure during periods of radioactive materials release)} \times (Z)}$$

NOTE: The denominator is limited to 1000 cfs or less. (Reference 1, Section 4.3).

where

Z = Applicable dilution factor for the receiving water body at Fermi 2.

= 10 (Reference 1, Section 4.3; Reference 5, Chapter 5 Section 5.2.)

$A'_{i\tau}$ = The site related drinking water ingestion dose commitment factor to the total body or any organ τ for each identified principal gamma and beta emitter listed in Table 1.2-4 in mrem/hr per µCi/ml.

$$A'_{i\tau} = K_o \left(\frac{U_w}{D_w}\right) DF_i$$

where

K_o = Units conversion factor 1.14×10^5

$$10^6 \frac{pCi}{\mu Ci} \times 10^3 \frac{ml}{l} \div 8760 \frac{hr}{yr}$$

U_w = Adult water consumption (730 liters/year).

D_w = Dilution factor from the near field within one-quarter mile of the release point to the potable water intake for adult water consumption for Fermi 2 Plant, D_w = 7.7 (Reference 5, Chapter 5, Section 5.3)

DF_i = Dose conversion factor for nuclide i, for adults in preselected organ, τ, in mrem/pCi, from Table 1.2-2 (taken from Reference 3, Table E-11).

$A_{i\tau}$ = See Section 1.2.1

If radioactivity in the Circulating Water Reservoir Decant Line becomes > LLD, prior to the junction with the Liquid Radwaste Effluent Line, that concentration must be included in the dose determination. For this part of the dose calculation, F_ℓ = 1/Z, and Δt = the entire time period for which the dose is being calculated.

TABLE 1.2-1
BIOACCUMULATION FACTORS
(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
AG	2.3E 00
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

*Values in Table 1.2-1 are taken from Reference 3, Table A-1.

TABLE 1.2-2

Page 1 of 2

ADULT INGESTION DOSE FACTORS*

(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-06	NO DATA	2.29E-07	NO DATA	NO DATA	NO DATA	2.70E-05
SR 92	2.15E-06	NO DATA	9.30E-08	NO DATA	NO DATA	NO DATA	4.26E-05
Y 90	9.62E-09	NO DATA	2.58E-10	NO DATA	NO DATA	NO DATA	1.02E-04
Y 91M	9.09E-11	NO DATA	3.52E-12	NO DATA	NO DATA	NO DATA	2.67E-10
Y 91	1.41E-07	NO DATA	3.77E-09	NO DATA	NO DATA	NO DATA	7.76E-05
Y 92	8.45E-10	NO DATA	2.[illegible]7E-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

*Values in Table 1.2-2 are taken from Reference 3, Table E-11.

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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	2.69E-06	9.71E-07	3.59E-07	8.06E-07	1.09E-05	NO DATA	1.07E-05
TE127M	6.77E-06	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-06	1.82E-06	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-06	7.53E-07	3.63E-04	4.31E-06	NO DATA	2.22E-06
I 134	1.06E-07	2.88E-07	1.03E-07	4.99E-06	4.58E-07	NO DATA	2.51E-10
I 135	4.43E-07	1.16E-06	4.29E-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	2.84E-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	1.51E-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

*Values in Table 1.2-2 are taken from Reference 3, Table E-11.

TABLE 1.2-3

SITE RELATED INGESTION DOSE COMMITMENT FACTOR, $A_{i\tau}$ (FISH CONSUMPTION)

(mrem/hr per µCi/ml)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01
C-14	3.13E+04	6.26E+03	6.26E+03	6.26E+03	6.26E+03	6.26E+03	6.26E+03
Na-24	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02	4.07E+02
P-32	4.62E+07	2.87E+06	1.79E+06	0.00E+00	0.00E+00	0.00E+00	5.19E+06
Cr-51	0.00E+00	0.00E+00	1.27E+00	7.61E-01	2.81E-01	1.69E+00	3.20E+02
Mn-54	0.00E+00	4.38E+03	8.35E+02	0.00E+00	1.30E+03	0.00E+00	1.34E+04
Mn-56	0.00E+00	1.10E+02	1.95E+01	0.00E+00	1.40E+02	0.00E+00	3.51E+03
Fe-55	6.58E+02	4.55E+02	1.06E+02	0.00E+00	0.00E+00	2.54E+02	2.61E+02
Fe-59	1.04E+03	2.44E+03	9.36E+02	0.00E+00	0.00E+00	6.82E+02	8.14E+03
Co-58	0.00E+00	8.92E+01	2.00E+02	0.00E+00	0.00E+00	0.00E+00	1.81E+03
Co-60	0.00E+00	2.56E+02	5.65E+02	0.00E+00	0.00E+00	0.00E+00	4.81E+03
Ni-63	3.11E+04	2.16E+03	1.04E+03	0.00E+00	0.00E+00	0.00E+00	4.50E+02
Ni-65	1.26E+02	1.64E+01	7.49E+00	0.00E+00	0.00E+00	0.00E+00	4.17E+02
Cu-64	0.00E+00	9.97E+00	4.68E+00	0.00E+00	2.51E+01	0.00E+00	8.50E+02
Zn-65	2.32E+04	7.37E+04	3.33E+04	0.00E+00	4.93E+04	0.00E+00	4.64E+04
Zn-69	4.93E+01	9.43E+01	6.56E+00	0.00E+00	6.13E+01	0.00E+00	1.42E+01
Br-83	0.00E+00	0.00E+00	4.04E+01	0.00E+00	0.00E+00	0.00E+00	5.82E+01
Br-84	0.00E+00	0.00E+00	5.24E+01	0.00E+00	0.00E+00	0.00E+00	4.11E-04
Br-85	0.00E+00	0.00E+00	2.15E+00	0.00E+00	0.00E+00	0.00E+00	1.01E-15
Rb-86	0.00E+00	1.01E+05	4.71E+04	0.00E+00	0.00E+00	0.00E+00	1.99E+04
Rb-88	0.00E+00	2.90E+02	1.54E+02	0.00E+00	0.00E+00	0.00E+00	4.00E-09
Rb-89	0.00E+00	1.92E+02	1.35E+02	0.00E+00	0.00E+00	0.00E+00	1.12E-11
Sr-89	2.21E+04	0.00E+00	6.35E+02	0.00E+00	0.00E+00	0.00E+00	3.55E+03
Sr-90	5.44E+05	0.00E+00	1.34E+05	0.00E+00	0.00E+00	0.00E+00	1.57E+04
Sr-91	4.07E+02	0.00E+00	1.64E+01	0.00E+00	0.00E+00	0.00E+00	1.94E+03
Sr-92	1.54E+02	0.00E+00	6.68E+00	0.00E+00	0.00E+00	0.00E+00	3.06E+03
Y-90	5.76E-01	0.00E+00	1.54E-02	0.00E+00	0.00E+00	0.00E+00	6.10E+03
Y-91m	5.44E-03	0.00E+00	2.11E-04	0.00E+00	0.00E+00	0.00E+00	1.60E-02
Y-91	8.44E+00	0.00E+00	2.26E-01	0.00E+00	0.00E+00	0.00E+00	4.64E+03
Y-92	5.06E-02	0.00E+00	1.48E-03	0.00E+00	0.00E+00	0.00E+00	8.86E+02
Y-93	1.60E-01	0.00E+00	4.43E-03	0.00E+00	0.00E+00	0.00E+00	5.09E+03
Zr-95	2.40E-01	7.70E-02	5.21E-02	0.00E+00	1.21E-01	0.00E+00	2.44E+02
Zr-97	1.33E-02	2.68E-03	1.22E-03	0.00E+00	4.04E-03	0.00E+00	8.30E+02
Nb-95	4.47E+02	2.48E+02	1.34E+02	0.00E+00	2.46E+02	0.00E+00	1.51E+06
Mo-99	0.00E+00	1.03E+02	1.96E+01	0.00E+00	2.34E+02	0.00E+00	2.39E+02
Tc-99m	8.87E-03	2.51E-02	3.19E-01	0.00E+00	3.81E-01	1.23E-02	1.48E+0[illegible]
Tc-101	9.12E-03	1.31E-02	1.29E-01	0.00E+00	2.37E-01	6.72E-03	3.95E-14
Ru-103	4.43E+00	0.00E+00	1.91E+00	0.00E+00	1.69E+01	0.00E+00	5.17E+02
Ru-105	3.69E-01	0.00E+00	1.46E-01	0.00E+00	4.76E+00	0.00E+00	2.26E+02

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Ru-106	6.58E+01	0.00E+00	8.33E+00	0.00E+00	1.27E+02	0.00E+00	4.26E+03
Ag-110m	8.81E-01	8.15E-01	4.84E-01	0.00E+00	1.60E+00	0.00E+00	3.33E+02
Te-125m	2.57E+03	9.30E+02	3.44E+02	7.72E+02	1.04E+04	0.00E+00	1.02E+04
Te-127m	6.48E+03	2.32E+03	7.90E+02	1.66E+03	2.63E+04	0.00E+00	2.17E+04
Te-127	1.05E+02	3.78E+01	2.28E+01	7.80E+01	4.29E+02	0.00E+00	8.31E+03
Te-129m	1.10E+04	4.11E+03	1.74E+03	3.78E+03	4.60E+04	0.00E+00	5.54E+04
Te-129	3.01E+01	1.13E+01	7.33E+00	2.31E+01	1.26E+02	0.00E+00	2.27E+01
Te-131m	1.66E+03	8.10E+02	6.75E+02	1.28E+03	8.21E+03	0.00E+00	8.04E+04
Te-131	1.89E+01	7.88E+00	5.96E+00	1.55E+01	8.26E+01	0.00E+00	2.67E+00
Te-132	2.41E+03	1.56E+03	1.47E+03	1.72E+03	1.50E+04	0.00E+00	7.38E+04
I-130	2.71E+01	8.01E+01	3.16E+01	6.79E+03	1.25E+02	0.00E+00	6.89E+01
I-131	1.49E+02	2.14E+02	1.22E+02	7.00E+04	3.66E+02	0.00E+00	5.64E+01
I-132	7.29E+00	1.95E+01	6.82E+00	6.82E+02	3.11E+01	0.00E+00	3.66E+00
I-133	5.10E+01	8.87E+01	2.70E+01	1.30E+04	1.55E+02	0.00E+00	7.97E+01
I-134	3.81E+00	1.03E+01	3.70E+00	1.79E+02	1.64E+01	0.00E+00	9.01E-03
I-135	1.59E+01	4.17E+01	1.54E+01	2.75E+03	6.68E+01	0.00E+00	4.70E+01
Cs-134	2.98E+05	7.09E+05	5.79E+05	0.00E+00	2.29E+05	7.61E+04	1.24E+04
Cs-136	3.12E+04	1.23E+05	8.86E+04	0.00E+00	6.85E+04	9.38E+03	1.40E+04
Cs-137	3.82E+05	5.22E+05	3.42E+05	0.00E+00	1.77E+05	5.89E+04	1.01E+04
Cs-138	2.64E+02	5.22E+02	2.59E+02	0.00E+00	3.84E+02	3.79E+01	2.23E-03
Ba-139	9.29E-01	6.62E-04	2.72E-02	0.00E+00	6.19E-04	3.75E-04	1.65E+00
Ba-140	1.94E+02	2.44E-01	1.27E+01	0.00E+00	8.30E-02	1.40E-01	4.00E+02
Ba-141	4.51E-01	3.41E-04	1.52E-02	0.00E+00	3.17E-04	1.93E-04	2.13E-10
Ba-142	2.04E-01	2.10E-04	1.28E-02	0.00E+00	1.77E-04	1.19E-04	2.87E-19
La-140	1.50E-01	7.54E-02	1.99E-02	0.00E+00	0.00E+00	0.00E+00	5.54E+03
La-142	7.66E-03	3.48E-03	8.68E-04	0.00E+00	0.00E+00	0.00E+00	2.54E+01
Ce-141	2.24E-02	1.52E-02	1.72E-03	0.00E+00	7.04E-03	0.00E+00	5.79E+01
Ce-143	3.95E-03	2.92E+00	3.23E-04	0.00E+00	1.29E-03	0.00E+00	1.09E+02
Ce-144	1.17E+00	4.88E-01	6.27E-02	0.00E+00	2.90E-01	0.00E+00	3.95E+02
Pr-143	5.51E-01	2.21E-01	2.73E-02	0.00E+00	1.27E-01	0.00E+00	2.41E+03
Pr-144	1.80E-03	7.48E-04	9.16E-05	0.00E+00	4.22E-04	0.00E+00	2.59E-10
Nd-147	3.76E-01	4.35E-01	2.60E-02	0.00E+00	2.54E-01	0.00E+00	2.09E+03
W-187	2.96E+02	2.47E+02	8.65E+01	0.00E+00	0.00E+00	0.00E+00	8.10E+04
Np-239	2.85E-02	2.80E-03	1.54E-03	0.00E+00	8.74E-03	0.00E+00	5.75E+02

SITE RELATED INGESTION DOSE COMMITMENT FACTOR, $A'_{i\tau}$

(WATER CONSUMPTION)

(mrem/hr per µCi/ml)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	1.14E+00	1.14E+00	1.14E+00	1.14E+00	1.14E+00	1.14E+00
C-14	3.06E+01	6.14E+00	6.14E+00	6.14E+00	6.14E+00	6.14E+00	6.14E+00
Na-24	1.83E+01	1.83E+01	1.83E+01	1.83E+01	1.83E+01	1.83E+01	1.83E+01
P-32	2.09E+03	1.30E+02	8.06E+01	0.00E+00	0.00E+00	0.00E+00	2.35E+02
Cr-51	0.00E+00	0.00E+00	2.87E-02	1.71E-02	6.34E-03	3.82E-02	7.23E+00
Mn-54	0.00E+00	4.94E+01	9.43E+00	0.00E+00	1.47E+01	0.00E+00	1.52E+02
Mn-56	0.00E+00	1.24E+00	2.21E-01	0.00E+00	1.58E+00	0.00E+00	3.96E+01
Fe-55	2.97E+01	2.05E+01	4.79E+00	0.00E+00	0.00E+00	1.15E+01	1.18E+01
Fe-59	4.69E+01	1.10E+02	4.22E+01	0.00E+00	0.00E+00	3.08E+01	3.68E+02
Co-58	0.00E+00	8.05E+00	1.81E+01	0.00E+00	0.00E+00	0.00E+00	1.64E+02
Co-60	0.00E+00	2.31E+01	5.10E+01	0.00E+00	0.00E+00	0.00E+00	4.35E+02
Ni-63	1.40E+03	9.74E+01	4.71E+01	0.00E+00	0.00E+00	0.00E+00	2.03E+01
Ni-65	5.70E+00	7.42E-01	3.38E-01	0.00E+00	0.00E+00	0.00E+00	1.88E+01
Cu-64	0.00E+00	9.00E-01	4.22E-01	0.00E+00	2.27E+00	0.00E+00	7.68E+01
Zn-65	5.23E+01	1.66E+02	7.52E+01	0.00E+00	1.11E+02	0.00E+00	1.05E+02
Zn-69	1.11E-01	2.13E-01	1.48E-02	0.00E+00	1.39E-01	0.00E+00	3.19E-02
Br-83	0.00E+00	0.00E+00	4.35E-01	0.00E+00	0.00E+00	0.00E+00	6.26E-01
Br-84	0.00E+00	0.00E+00	5.64E-01	0.00E+00	0.00E 00	0.00E+00	4.42E-06
Br-85	0.00E+00	0.00E+00	2.31E-02	0.00E+00	0.00E+00	0.00E+00	1.08E-17
Rb-86	0.00E+00	2.29E+02	1.06E+02	0.00E+00	0.00E+00	0.00E+00	4.49E+01
Rb-88	0.00E+00	6.53E-01	3.47E-01	0.00E+00	0.00E+00	0.00E+00	9.04E-12
Rb-89	0.00E+00	4.34E-01	3.05E-01	0.00E+00	0.00E+00	0.00E+00	2.52E-14
Sr-89	3.32E+03	0.00E+00	9.56E+01	0.00E+00	0.00E+00	0.00E+00	5.34E+02
Sr-90	8.19E+04	0.00E+00	2.01E+04	0.00E+00	0.00E+00	0.00E+00	2.36E+03
Sr-91	6.13E+01	0.00E+00	2.48E+00	0.00E+00	0.00E+00	0.00E+00	2.92E+02
Sr-92	2.32E+03	0.00E+00	1.01E+00	0.00E+00	0.00E+00	0.00E+00	4.61E+02
Y-90	1.04E-01	0.00E+00	2.79E-03	0.00E+00	0.00E+00	0.00E+00	1.10E+03
Y-91m	9.82E-04	0.00E+00	3.81E-05	0.00E+00	0.00E+00	0.00E+00	2.88E-03
Y-91	1.52E+00	0.00E+00	4.08E-02	0.00E+00	0.00E+00	0.00E+00	8.39E+02
Y-92	9.13E-03	0.00E+00	2.68E-04	0.00E+00	0.00E+00	0.00E+00	1.60E+02
Y-93	2.90E-02	0.00E+00	8.00E-04	0.00E+00	0.00E+00	0.00E+00	9.18E+02
Zr-95	3.29E-01	1.05E-01	7.13E-02	0.00E+00	1.65E-01	0.00E+00	3.34E+02
Zr-97	1.82E-02	3.66E-03	1.68E-03	0.00E+00	5.53E-03	0.00E+00	1.14E+03
Nb-95	6.73E-02	3.74E-02	2.01E-02	0.00E+00	3.70E-02	0.00E+00	2.27E+02
Mo-99	0.00E+00	4.66E+01	8.86E+00	0.00E+00	1.05E+02	0.00E+00	1.08E+02
Tc-99	2.68E-03	7.55E-03	9.61E-02	0.00E+00	1.15E-01	3.70E-03	4.47E+00
Tc-101	2.74E-03	3.96E-03	3.88E-02	0.00E+00	7.12E-02	2.03E-03	1.19E-14

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
Ru-103	2.00E+00	0.00E+00	8.61E-01	0.00E+00	7.64E+00	0.00E+00	2.34E+02
Ru-105	1.66E-01	0.00E+00	6.57E-02	0.00E+00	2.16E+00	0.00E+00	1.02E+02
Ru-106	2.97E+01	0.00E+00	3.77E+00	0.00E+00	5.74E+01	0.00E+00	1.92E+03
Ag-110m	1.73E+00	1.60E+00	9.51E-01	0.00E+00	3.14E+00	0.00E+00	6.53E+02
Te-125m	2.90E+00	1.05E+01	3.88E+00	8.71E+00	1.18E+02	0.00E+00	1.16E+02
Te-127m	7.31E+01	2.61E+01	8.92E+00	1.87E+01	2.97E+02	0.00E+00	2.45E+02
Te-127	1.19E+00	4.27E-01	2.57E-01	8.81E-01	4.84E+00	0.00E+00	9.38E+01
Te-129m	1.24E+02	4.64E+01	1.96E+01	4.27E+01	5.18E+02	0.00E+00	6.26E+02
Te-129	3.39E-01	1.28E-01	8.27E-02	2.61E-01	1.43E+00	0.00E+00	2.56E-01
Te-131m	1.87E+01	9.14E+00	7.62E+00	1.45E+01	9.26E+01	0.00E+00	9.08E+02
Te-131	2.13E-01	8.90E-02	6.73E-01	1.75E-01	9.32E-01	0.00E+00	3.01E-02
Te-132	2.73E+01	1.77E+01	1.65E+01	1.95E+01	1.70E+02	0.00E+00	8.34E+02
I-130	8.17E+00	2.42E+01	9.51E+00	2.04E+03	3.77E+01	0.00E+00	2.08E+01
I-131	4.49E+01	6.43E+01	3.69E+01	2.10E+04	1.10E+02	0.00E+00	1.70E+01
I-132	2.19E+00	5.87E+00	2.05E+00	2.05E+02	9.35E+00	0.00E+00	1.10E+00
I-133	1.53E+01	2.68E+01	8.14E+00	3.92E+03	4.66E+01	0.00E+00	2.40E+01
I-134	1.15E+00	3.12E+00	1.11E+00	5.39E+01	4.95E+00	0.00E+00	2.71E-03
I-135	4.79E+00	1.25E+01	4.62E+00	8.27E+02	2.01E+01	0.00E+00	1.42E+01
Cs-134	6.73E+02	1.60E+03	1.31E+03	0.00E+00	5.18E+02	1.71E+02	2.81E+01
Cs-136	7.04E+01	2.70E+02	2.00E+02	0.00E+00	1.55E+02	2.12E+01	3.16E+01
Cs-137	8.61E+02	1.18E+03	7.71E+02	0.00E+00	4.00E+02	1.32E+02	2.29E+01
Cs-138	5.96E-01	1.18E+00	5.83E-01	0.00E+00	8.66E-01	8.55E-02	5.03E-06
Ba-139	1.05E+00	7.47E-04	3.06E-02	0.00E+00	6.99E-04	4.23E-04	1.86E+00
Ba-140	2.19E+02	2.75E-01	1.44E+01	0.00E+00	9.38E-02	1.58E-01	4.52E+02
Ba-141	5.09E-01	3.84E-04	1.71E-02	0.00E+00	3.57E-04	2.18E-04	2.40E-10
Ba-142	2.30E-01	2.36E-04	1.45E-02	0.00E+00	2.00E-04	1.34E-04	3.25E-19
La-140	2.70E-02	1.36E-02	3.60E-03	0.00E+00	0.00E+00	0.00E+00	1.00E+03
La-142	1.39E-03	6.29E-04	1.57E-04	0.00E+00	0.00E+00	0.00E+00	4.60E+00
Ce-141	1.01E-01	6.84E-02	7.77E-03	0.00E+00	3.18E-02	0.00E+00	2.61E+02
Ce-143	1.78E-02	1.32E+01	1.45E-03	0.00E+00	5.81E-03	0.00E+00	4.92E+02
Ce-144	5.27E+00	2.21E+00	2.83E-01	0.00E+00	1.31E+00	0.00E+00	1.78E+03
Pr-143	9.95E+02	3.99E-02	4.92E-03	0.00E+00	2.30E-02	0.00E+00	4.35E+02
Pr-144	3.25E-04	1.35E-04	1.65E-05	0.00E+00	7.62E-05	0.00E+00	4.68E-11
Nd-147	6.79E-02	7.86E-02	4.70E-03	0.00E+00	4.60E-02	0.00E+00	3.77E+02
W-187	1.11E+00	9.31E-01	3.25E-01	0.00E+00	0.00E+00	0.00E+00	3.05E+02
Np-239	1.29E-02	1.26E-03	6.97E-04	0.00E+00	3.95E-03	0.00E+00	2.60E+02

1.2.3 METHODOLOGY FOR INDIVIDUAL LIQUID DOSE PROJECTIONS
(To Determine Necessity of Operating Liquid Radwaste Treatment System)

The NRC requires that dose projections be performed to indicate whether cumulative doses over a thirty-one (31) day period are likely to exceed 25% of the annual design objective dose limit adjusted to a thirty-one (31) day period. The 25% actuation levels of 0.06 mrem total body dose and 0.2 mrem organ dose were selected by NRC based on their cost-benefit analysis for operation of radwaste systems. When the thirty-one (31) day projected dose exceeds 0.06 mrem to the total body or 0.2 mrem to any organ, operation of appropriate portions of the radwaste systems would be required.

When the percent of the quarterly limits exceed 4% for the total body or any organ (i.e. the cumulative total body dose exceeds 0.06 mrem and the cumulative organ dose exceeds 0.2 mrem) determine the thirty-one (31) day dose projection as follows:

$$D_{tb(prj)} = \left[\frac{D_{tb(accumulated)}}{X}\right] \times [31]$$

$$D_{o(prj)} = \left[\frac{D_{o(accumulated)}}{X}\right] \times [31]$$

where

$D_{tb(accumulated)}$ = the cumulative total body dose for the elapsed portion of the current quarter plus the release under consideration for the particular reactor unit.

$D_{o(accumulated)}$ = the cumulative organ doses for the elapsed portion of the current quarter plus the release under consideration for the particular reactor unit.

X = the number of days into the current quarter to the nearest whole day.

If activities planned during the remainder of the 31-day period are expected to contribute a significant dose and the determination can be reasonably made, this contribution should be included in the equations:

$$D_{tb(prj)} = \left[\frac{D_{tb(accumulated)}}{X}\right] \times [31] + D_{anticipated}$$

$$D_{o(prj)} = \left[\frac{D_{o(accumulated)}}{X}\right] \times [31] + D_{anticipated}$$

where

$D_{anticipated}$ = the anticipated total body or organ dose resulting from anticipated operational occurrences which may occur in addition to routine releases over the thirty-one (31) day period.

If $D_{tb(prj)} > 0.06$ mrem or if $D_{o(prj)} > 0.2$ mrem,

the appropriate portions of the Liquid Radwaste Treatment System must be used to process liquid waste prior to release.

1.3 DEFINITIONS OF LIQUID EFFLUENT TERMS

Term		Definition	Section of Initial Use
A	=	adjustment factor applied to facilitate setting actual monitor setpoints.	1.1.1
$A_{i\tau}$	=	the site related ingestion dose commitment factor due to fish consumption to the total body or any organ τ for each identified principal gamma and beta emitter listed in Table 1.2-3 in mrem-ml per hr-μCi.	1.2
$A'_{i\tau}$	=	the site related ingestion dose commitment factor due to water consumption to the total body or any organ τ for each identified principal gamma and beta emitter listed in Table 1.2-4 in mrem/hr per μCi/ml.	1.2.2
BF_i	=	Bioaccumulation Factor for nuclide i, in fish, pCi/Kg per pCi/l, from Table 1.2-1.	1.2.1
C_{MPC}	=	the effluent concentration limit (Specification 3.11.1.1) implementing 10CFR 20 for the site, in μCi/ml.	1.1.1
C_a	=	the effluent concentration of alpha emitting nuclides observed by gross alpha analysis of the MONTHLY composite sample.	1.1.1
C_f	=	The concentration of Fe-55 in liquid wastes as observed in the QUARTERLY composite sample.	1.1.1
C_g	=	the effluent concentration of a gamma emitting nuclide, g, observed by gamma-ray spectroscopy of the waste sample.	1.1.1
C_i	=	the concentration of nuclide i as determined by the analysis of the waste sample.	1.1.1

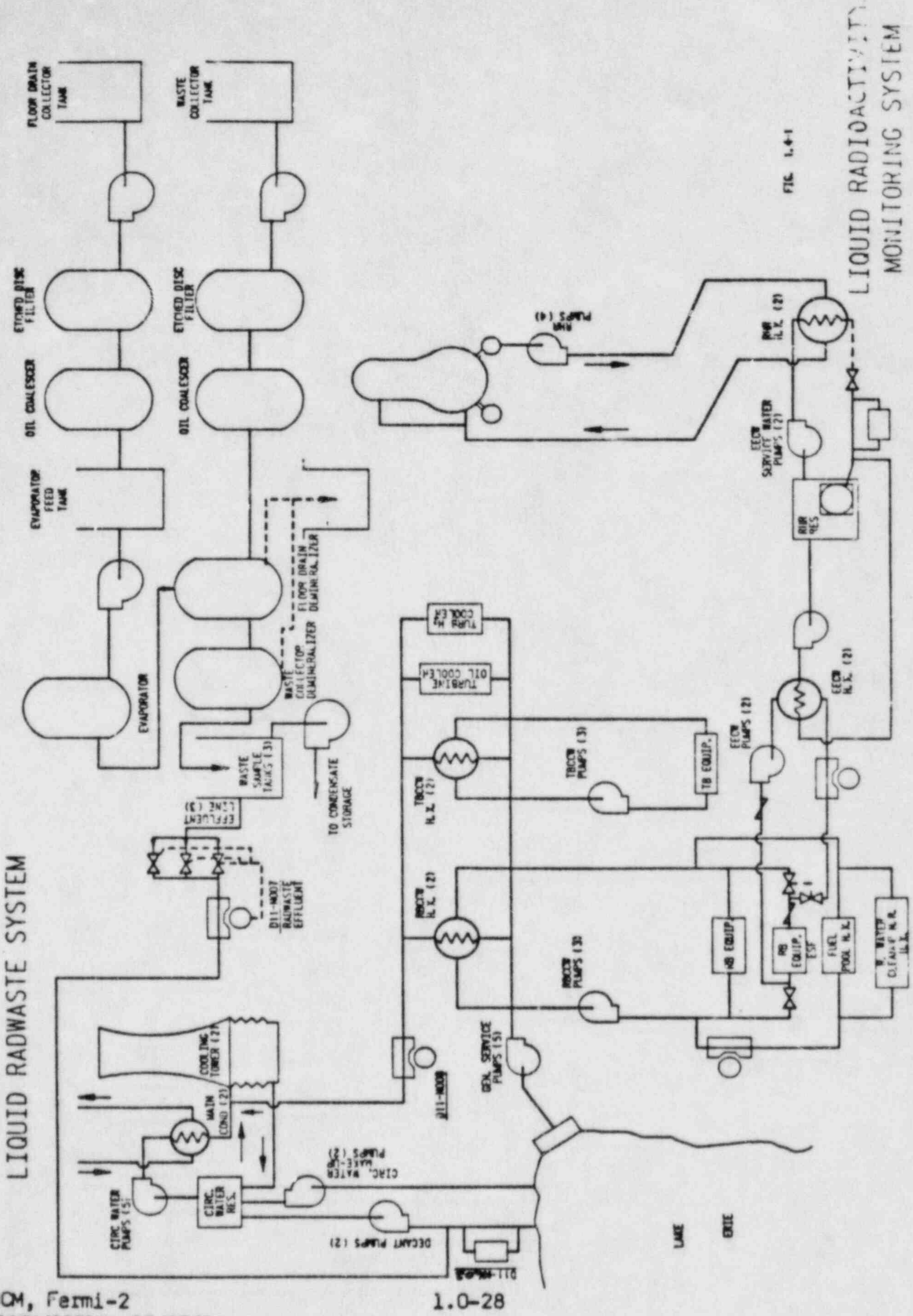
Term	Definition	Section of Initial Use
$C_{i\ell}$	= the average concentration of radionuclide, i, in undiluted liquid effluent during time period Δt_{ℓ} from any liquid release, in μCi/ml.	1.2.1
C_s	= the concentration of Sr-89 or Sr-90 in liquid wastes as determined by analysis of the QUARTERLY composite sample.	1.1.1
C_t	= the measured concentration of H-3 in liquid waste as determined by analysis of the MONTHLY composite.	1.1.1
c	= the setpoint of the radioactivity monitor measuring the radioactivity concentration in the effluent line prior to dilution and subsequent release.	1.1.1
DF_i	= a dose conversion factor for nuclide, i, for adults in preselected organ, τ, in mrem/pCi found in Table 1.2-2.	1.2.1
D_τ	= the cumulative dose commitment to the total body or any organ, τ, from the liquid effluents for the total time period.	1.2.1
DF	= the dilution factor, which is the ratio of the total dilution flow rate to the effluent stream flow rate(s) required to assure that the limiting concentration of 10CFR, Part 20, Appendix B, Table II, Column 2 are met at the point of discharge.	1.1.1
F	= the dilution water flow monitor setpoint as determined prior to the release point, in volume per unit time. (General expression for equation on page 1.0-1.)	1.1.1
F_d	= the flow rate of the dilution stream used for setpoint calculations during the time of release, which is (0.9) x actual dilution flow.	1.1.1

Term	Definition	Section of Initial Use
f_p	= effluent flow rate	1.1.1
f	= the flow setpoint as determined for the radiation monitor location. (General expression.)	1.1.1
f_t	= maximum permissible effluent flow rate	1.1.1
F_ℓ	= the near field average dilution factor for $C_{i\ell}$ during any liquid effluent release.	1.2.1
K_o	= 1.14×10^5, units conversion factor.	1.2.1
MPC_i	= MPC_g, MPC_a, MPC_s, MPC_f, and MPC_t = the limiting concentrations of the appropriate gamma emitting radionuclides, alpha emitting radionuclides, strontium, iron and tritium, respectively, from 10CFR, Part 20, Appendix B, Table II, Column 2.	1.1.1
SF	= the safety factor, a conservative factor used to compensate for statistical fluctuations and errors of measurements.	1.1.1
t_d	= the transit time to the city of Monroe water intake; 23,000 seconds. (Reference 5 Section 2.4.12)	1.2.2

Term	Definition	Section of Initial Use
t_c	= The transit time to the location of the individual expected to receive the greatest potential dose due to the liquid pathway; 13,000 seconds. (Reference 5 Section 2.4.12)	1.2.1
t_f	= The transit time to the location 1530m south of Fermi 2; 11,000 seconds. (Reference 5, Section 2.4.12)	
Δt	= duration of release under consideration.	1.2.1
m	= number of liquid releases.	1.2.1
U_F	= 21 kg/yr, fish consumption (adult).	1.2.1
U_W	= adult water consumption, 730 l/year.	1.2.2
Z	= Applicable dilution factor for the receiving water body at Fermi 2; 10.	1.2.1
λ_i	= The decay constant for radionuclide i. (sec^{-1})	1.2.1

1.4 LIQUID RADIOACTIVITY MONITORING SYSTEM

FIGURE 1.4-1 is a schematic of the Liquid Radioactivity Monitoring System showing the release points to the unrestricted area.


LIQUID RADWASTE SYSTEM
LIQUID RADIOACTIVITY MONITORING SYSTEM
FIG. 1.4-1
FLOOR DRAIN COLLECTOR TANK
WASTE COLLECTOR TANK
ETCHED DISC FILTER
OIL COALESCER
EVAPORATOR FEED TANK
EVAPORATOR
WASTE COLLECTOR DEMINERALIZER
FLOOR DRAIN DEMINERALIZER
WASTE SAMPLE TANKS (3)
TO CONDENSATE STORAGE
EFFLUENT LINE (3)
D11-N007 RADWASTE EFFLUENT
COOLING TOWER (2)
MAIN COND (2)
CIRC. WATER PUMPS (5)
CIRC. WATER RES.
DECANT PUMPS (2)
GEN. SERVICE PUMPS (5)
TURBINE OIL COOLER
TURB H2 COOLER
TBCCW H.X. (2)
TBCCW PUMPS (3)
TB EQUIP.
RBCCW H.X. (2)
RBCCW PUMPS (3)
RB EQUIP.
FUEL POOL H.X.
EECW PUMPS (2)
EECW H.X. (2)
RHR RES
EECW SERVICE WATER PUMPS (2)
RHR H.X. (2)
RHR PUMPS (4)
LAKE ERIE

SECTION 2.
GASEOUS EFFLUENTS

2.1 GASEOUS EFFLUENT MONITOR SETPOINTS

The gaseous monitor setpoint values determined in the following sections will be regarded as upper bounds for the actual setpoint adjustments. That is, setpoint adjustments are not required to be performed if the existing setpoint level corresponds to a lower count rate than the calculated value. Setpoints may be established at values lower than the calculated values if desired.

If no release is planned for a particular pathway, the monitor setpoint should be established as close to background as practical to prevent spurious alarms yet alarm should an inadvertent release occur.

If a calculated setpoint is less than the monitor reading associated with the particular release pathway, no release may be made under current conditions. Under such circumstances, the number of simultaneous release pathways may be reduced or contributing source terms may be reduced and the setpoint recalculated.

2.1.1 REACTOR BUILDING EXHAUST PLENUM, STANDBY GAS TREATMENT SYSTEM, RADWASTE BUILDING VENTILATION, SERVICE BUILDING VENTILATION, TURBINE BUILDING VENTILATION, AND ONSITE STORAGE BUILDING VENTIALATION EXHAUST RADIATION MONITORS

Monitors: D 11 - N407; D 11 - N406A and B; D 11 - N403;
D 11 - N405; D 11 - N404; and D11-N508

For the purpose of implementation of Technical Specification 3.3.7.12, the alarm setpoint level for these noble gas monitors will be calculated as follows:

C_S = monitor reading of the noble gas monitor at the alarm setpoint concentration.

$$C_S = \text{the lesser of} \begin{cases} (B \times SF) \times R_t \times D_{TB} \\ \text{or} \\ (B \times SF) \times R_s \times D_{ss} \end{cases}$$

SF = safety factor; a conservative factor applied to each noble gas monitor to compensate for statistical fluctuations and errors of measurement. (For example, SF = 0.5 corresponds to a 100 percent variation.)

B = an administrative allocation factor applied to apportion the release setpoints among all gaseous release discharge pathways to assure that release limits will not be exceeded by simultaneous releases.

Allocation factors may be assigned any desired value as long as the total of all allocation factors for all simultaneous release pathways does not exceed 1. (For ease of implementation, B may be set equal to 1/n, where n is the number of simultaneous final gaseous release points.)

D_{TB} = Dose rate limit to the total body of an individual which is 500 mrem/year.

R_t = monitor reading per mrem/yr to the total body

$$R_t = C \div \overline{X/Q} \sum_i (K_i\ Q_i)$$

C = monitor reading of a noble gas monitor corresponding to the grab sample radionuclide concentrations taken in accordance with RETS Table 4.11.2.1.2-1. For batch releases the sample must be taken prior to release; for continuous releases the sample is taken during the release. The monitor response corresponding to the measured concentration is determined from the monitor calibration curve for the particular monitor.

$\overline{X/Q}$ = the highest annual average relative concentration at the site boundary. (If desired, the annual average relative concentration at the site boundary for the particular release point may be used.)

= 4.186×10^{-6} sec/m^3 in the NW sector.

K_i = total body dose factor due to gamma emissions from radionuclide i (mrem/yr per $\mu Ci/m^3$) from Table 2.1-1.

Q_i = rate of relea· . noble gas radionuclide i (μCi/sec) from the release pathway under consideration: the product of X_{iv} and F_v, where X_{iv} is the concentration of radionuclide i for the particular release volume and F_v is the release flowrate. (X_{iv} in μCi/cc and F_v in cc/sec.)

NOTE

For all radiation monitor setpoint determinations assume a fixed flow rate which corresponds to the maximum flow rate for a particular release pathway. The applicable flow rate values for use in determining radiation monitor setpoints are found in Table 2.1-2.

D_{ss} = Dose rate limit to the skin of the body of an individual in an unrestricted area which is 3000 mrem/year.

R_s = monitor reading per mrem/yr to the skin

$$R_s = C \div \overline{X/Q} \sum_i \left[(L_i + 1.1\, M_i)\, Q_i \right]$$

L_i = skin dose factor due to beta emissions from radionuclide i (mrem/yr per $\mu Ci/m^3$) from Table 2.1-1.

1.1 = mrem skin dose per mrad air dose

M_i = air dose factor due to gamma emissions from radionuclide i (mrad/yr per $\mu Ci/m^3$) from Table 2.1-1.

2.1.2 CONTAINMENT DRYWELL PURGE

The containment Drywell Purge is a batch-type release which discharges to either the Reactor Building Exhaust Plenum or the Standby Gas Treatment System in accordance with Technical Specification 3.11.2.8. If, based on sample analysis results, a decision is made to route the discharge through the Standby Gas Treatment System, the treated effluent will be monitored by the Standby Gas Treatment System Monitor.

However, if a decision is made to route the discharge through the Reactor Building Exhaust Plenum, the setpoint for the Reactor Building Exhaust Plenum effluent monitor must be redetermined to account for the source term associated with the drywell purge. This is accomplished by following the methodology of Section 2.1.1, with the following exception:

Q_i must be replaced with a new source term, Q_{CR};

where $Q_{CR} = Q_i + q_i$

and where

q_i = the drywell purge source term, which is the radionuclide concentration multiplied by the planned drywell purge release rate.

TABLE 2.1-1

DOSE FACTORS FOR EXPOSURE TO A SEMI-INFINITE CLOUD OF NOBLE GASES*

Nuclide	γ-Body*** (K)	β-Skin***(L)	γ-Air**(M)	β-Air**(N)
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

*Values taken from Reference 3, Table B-1

** $\frac{\text{mrad-m}^3}{\mu\text{Ci-yr}}$

*** $\frac{\text{mrem-m}^3}{\mu\text{Ci-yr}}$

**** $1.17E+03 = 1.17 \times 10^3$

TABLE 2.1-2

GASEOUS RELEASE PATHWAY FLOW RATES

Release Pathway	Flow Rate (cc/sec)*
1. Reactor Building Exhaust Plenum (D11-N407)	5.1E+7
2. Standby Gas Treatment System (D11-N406A and B)	1.9E+6
3. Radwaste Building Ventilation (D11-N403)	1.4E+7
4. Service Building Ventilation (D11-N405)	1.5E+7
5. Turbine Building Ventilation (D11-N404)	1.8E+8
6. Onsite Storage Building Ventilation (D11-N508)	2.5E+6

* Reference 5

2.2 GASEOUS EFFLUENT DOSE RATE AND DOSE CALCULATIONS

Initial controlling receptor selection is consistent with the 1983 land use census.

2.2.1 UNRESTRICTED AREA BOUNDARY DOSE RATES

2.2.1.a Dose Rates Due To Noble Gases

For the purpose of implementation of STS 3.11.2.1.a, the dose rate at the unrestricted area boundary due to noble gases shall be calculated as follows:

D_t = total body dose rate at time of release (mrem/year)

$$= \overline{X/Q} \sum_i (K_i Q_i)$$

D_s = skin dose rate at time of release (mrem/yr)

$$= \overline{X/Q} \sum_i (L_i + 1.1 M_i) Q_i$$

(NOTE: terms defined previously in Section 2.1.1)

In the event of simultaneous releases, dose rates shall be summed to assure that dose rate limits are not exceeded.

2.2.1.b Dose Rates Due to Radioiodines, Tritium, and Particulates

Organ dose rates due to radioiodines, tritium, and all radioactive materials in particulate form with half-lives greater than eight days, will be calculated for the purpose of implementation of Technical Specification 3.11.2.1.b as follows:

D_o = organ dose rate at time of release (mrem/yr)

$$= \overline{X/Q} \sum_i (P_{io} Q_i')$$

where

$\overline{X/Q}$ = the highest annual average relative concentration in any sector at the site boundary. (The highest annual average or the annual average determined for the particular release point may be used.)

= 4.186×10^{-6} sec/m^3 in the NW sector (highest annual average)

P_{io} = organ dose parameter for organ o and radionuclide i, (mrem/yr per $\mu Ci/m^3$) for inhalation determined as follows:

$$P_{io} = K\ (BR)\ DF_{io}$$

and where

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

BR = breathing rate for child age group
= 3700 m^3/year (Table 2.2-10) (from Reference 3)

DF_{io} = inhalation pathway dose factor for child age group for organ o and radionuclide i (Table 2.2-2) (from Reference 3)

Q_i' = release rate of non-noble gas radionuclide i (required by Technical Specification 3.11.2.1.b)(μCi/sec) for the type of release under consideration.

NOTE: In order to assure that potential dose rates (pre-release) to an organ due to radioiodine, tritium and particulates in simultaneous gaseous releases from the site do not exceed 1500 mrem/year as specified in Technical Specification 3.11.2.1(b), potential organ dose rate D_o must be limited as follows:

$$D_o + (B \times SF) \leq 1500 \text{ mrem/year}$$

where B and SF are assigned the same values as were used in Section 2.1 for the release source pathway under consideration. To further ensure that dose rate limits were not exceeded, (post-release) dose rates from simultaneous releases shall be summed.

2.2.2 UNRESTRICTED AREA AIR DOSE AND DOSE TO INDIVIDUAL

2.2.2.a Air Dose in Unrestricted Area

For the purpose of implementation of Technical Specifications 3.11.2.2 and 3.11.2.4, the air dose in unrestricted areas shall be determined as follows:

D_γ = air dose due to gamma emissions from noble gas radionuclide i (mrad)

$$= 3.17 \times 10^{-8} \sum_i \left[M_i \; (\overline{X/Q}) \; \tilde{Q}_i \right]$$

where

3.17×10^{-8} = the fraction of one year per one second

$\tilde{Q}_i$ = cumulative release of noble gas radionuclide i over the period of interest (μCi) for the type of release under consideration.

M_i = defined in Section 2.1.1

$\overline{X/Q}$ = 4.186×10^{-6} sec/m^3 in the NW sector (This is the highest annual average; the annual average for the particular release point may be used if desired).

D_β = air dose due to beta emissions from noble gas radionuclide i (mrad).

$$= 3.17 \times 10^{-8} \sum_i \left[N_i \; (\overline{X/Q}) \; \tilde{Q}_i \right]$$

N_i = air dose factor due to beta emissions from noble gas radionuclide i (mrad/yr per μCi/m^3 from Table 2.1-1).

2.2.2.b Dose To An Individual In Unrestricted Area

Dose to an individual from radioiodines, tritium, and radioactive materials in particulate form will be calculated for the purpose of implementation of Technical Specifications 3.11.2.3 and 3.11.2.4 as follows:

D_j = dose to an organ of an individual from radioiodines, tritium, and radionuclides in particulate form (mrem).

$$= 3.17 \times 10^{-8} \sum_p \left[W_p' \sum_i \left(R_{aipj} \tilde{Q}_i' \right) \right]$$

where

3.17×10^{-8} = fraction of one year per one second.

W_p' = pathway-dependent relative dispersion for unrestricted areas at the controlling sector.

W_p' =

$\overline{X/Q}'$ = annual average relative dispersion parameter for location of controlling critical receptor.

$\overline{X/Q}'$ applies to inhalation and all tritium pathways only. (For all tritium pathways, the $\tilde{Q}_i'$ source term is limited to tritium.)

= 2.686×10^{-7} sec/m^3 in the WNW section for inhalation and all tritium pathways.

$\overline{D/Q}'$ = annual average deposition parameter for location of controlling (critical) receptor.

$\overline{D/Q}'$ applies to all other pathways.

= 2.763×10^{-9} m^{-2} in WNW sector for all other pathways.

(NOTE: One or both dispersion values ($\overline{X/Q}'$ and/or $\overline{D/Q}'$) may be required in the determination of organ doses to an individual depending upon the organ dose pathway present and applicable to the critical receptor.)

$\tilde{Q}_i'$ = cumulative release of radionuclide i (required by Technical Specification 3.11.2.3) over the period of interest (μCi). (For tritium pathways, the $\tilde{Q}_i'$ source term is limited to tritium.)

R_{aipj} = pathway-specific, individual age-specific, organ dose factor for radionuclide i, pathway p, organ j, and individual age group, a. The controlling individual age group and the dose pathways are determined through the Land Use Census for the site. R_{aipj} is determined as follows:

(NOTE: At Fermi-2 Plant the controlling receptor is an infant. The dose pathways are inhalation, ground-plane, and grass-goat-milk).

Inhalation Pathway Factor

$$R_{aipj} = K'(BR)_a \quad (DFA_{ij})_a \text{ mrem/yr per } \mu Ci/m^3$$

where

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

$(BR)_a$ = the breathing rate for a particular age group in m^3/year from Table 2.2-10. (infant = 1400)

$(DFA_{ij})_a$ = the inhalation dose factor for receptor age group a and for radionuclide i, in mrem/pCi from Tables 2.2.-1 through 2.2-4. (Infant, Table 2.2-1)

Ground-Plane Pathway Factor

$$R_{aipj} = K'K''(SF')(DFG_{ij})((1-e^{-\lambda_i t})/\lambda_i) \text{ (m}^2\text{ mrem/year per }\mu\text{Ci/sec)}$$

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

K" = constant of unit conversion, 8760 hr/yr.

SF' = shielding factor, 0.7 (dimensionless)

DFG_{ij} = ground plane dose conversion factor for radionuclide i (same for all age groups) (mrem/hr per pCi/m^2) Table 2.2-9.

λ_i = decay constant for radionuclide i.

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

Grass-Goat-Milk Pathway Factor

$$R_{aipj} = K' \frac{Q_F(U_{ap})}{\lambda_i + \lambda_w} F_m(r)(DFL_{ij})_a \left[\frac{f_p f_s}{Y_p} + \frac{(1-f_p f_s)e^{-\lambda_i t_h}}{Y_s}\right] e^{-\lambda_i t_f}$$

(m^2mrem/yr per μCi/sec)

where

(NOTE: Fermi-2 Plant Site-Specific values are included in parentheses following each definition.)

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

Q_F = the goat's consumption rate, in kg/day (wet weight).
(6)

U_{ap} = the receptor's milk consumption rate for age group a, in liters/yr from Table 2.2-10.
(infant - 330)

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

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

F_m = The stable element transfer coefficients, in days/liter.
(see Table 2.2-11.)

r = fraction of deposited activity retained on feed grass.
(1.0 for radioiodines; 0.2 for particulates)

$(DFL_{ij})_a$ = the organ ingestion dose factor for the ith radionuclide for the receptor in age group a, in mrem/pCi from Tables 2.2-5 through 2.2-8.
(infant - Table 2.2-5)

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

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

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

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

f_p = fraction of the year that the goat is on pasture (dimensionless).
(.5)

f_s = fraction of the goat feed that is pasture grass while the goat is on pasture (dimensionless).
(.5)

For tritium in milk, the grass-goat-milk pathway factor is a special case due to the fact that the concentration of tritium in milk is based on airborne concentration rather than deposition:

$$R_{aipj} = K'K'''F_m Q_F U_{ap}(DFL_{ij})_a \; [0.75(0.5/H)] \; (\text{mrem/yr per } \mu Ci/m^3)$$

where:

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

H = absolute humidity of the atmosphere, in gm/m^3. (8)

0.75 = the fraction of total feed that is water.

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

and other parameters and values are given above.

2.2.2.c Dose Calculations To Support Other Specific Technical Specifications

For the purpose of implementing STS 6.9.1.9 dose calculations will be performed using the above equations with the substitution of average meteorological parameters for the period of the report, and the appropriate pathway receptor dose factors (R_{aipj}). (Values for R_{aipj} are determined in accordance with Section 2.2.2.d.)

For the purpose of implementing STS 6.9.1.11, dose calculations may be performed using the above equations with the substitution of the dispersion parameters (X/Q, D/Q) which are concurrent with actual releases, and the appropriate pathway receptor dose factors (R_{aipj}). (Values for R_{aipj} are determined in accordance with Section 2.2.2.d).

For the purpose of implementing STS 3.12.2, dose calculations may be performed using the above equations substituting the appropriate pathway receptor dose factors (R_{aipj}) and the appropriate dispersion parameters for the location(s) of interest. Annual average dispersion parameters (6 month average for D/Q) may be used for these calculations. (Values for R_{aipj} are determined in accordance with Section 2.2.2.d).

2.2.2.d Additional Pathway Dose Factors

For the purpose of implementing STS 6.9.1.9, 6.9.1.11 or 3.12.2, it may be necessary to calculate individual doses due to gaseous releases via exposure pathways other than ground plane, inhalation, and grass-goat-milk pathways presented in Section 2.2.2.b. Methodology for calculating doses due to gaseous releases via the grass-cow-milk, grass-cow-meat and the vegetation pathway* is the same as was presented in Section 2.2.2.b. However, R_{aipj} is pathway-dependent and is calculated for the remaining pathways as follows:

Grass-Cow-Milk Pathway Factor

$$R_{aipj} = K' \frac{Q_F(U_{ap})}{\lambda_i + \lambda_w} F_m(r)(DFL_{ij})_a \left[\frac{f_p f_s}{Y_p} + \frac{(1-f_p f_s)e^{-\lambda_i t_h}}{Y_s}\right] e^{-\lambda_i t_f}$$

(m^2 mrem/yr per μCi/sec)

where

(NOTE: Parameter values given in parentheses are to be used in lieu of site-specific values. (Reference 3.))

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

Q_F = the cow's consumption rate, in kg/day (wet weight). (50)

U_{ap} = the receptor's milk consumption rate for age group a , in liters/yr from Table 2.2-10.

*NOTE: These pathways do not presently exist. Methodology is presented for use in the event that subsequent land use census results indicate such a requirement.

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

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

F_m = The stable element transfer coefficients, in days/liter.
(see Table 2.2-11.)

r = fraction of deposited activity retained on feed grass.
(1.0 for radioiodines; 0.2 for particulates)

$(DFL_{ij})_a$ = the organ ingestion dose factor for the ith radionuclide for the receptor in age group a , in mrem/pCi from Tables 2.2-5 through 2.2-8.

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

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

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

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

f_p = fraction of the year that the cow is on pasture (dimensionless).
(0.5)

f_s = fraction of the cow feed that is pasture grass while the cow is on pasture (dimensionless).
(0.5)

For tritium in milk, the grass-cow-milk pathway factor is a special case due to the fact that the concentration of tritium in milk is based on airborne concentration rather than deposition:

$$R_{aipj} = K'K'''F_m Q_F U_{ap} (DFL_{ij})_a \; [0.75(0.5/H)] \text{ (mrem/yr per } \mu Ci/m^3)$$

where:

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

H = absolute humidity of the atmosphere, in gm/m^3. (8)

0.75 = the fraction of total feed that is water.

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

and other parameters and values are given above.

Grass-Cow-Meat Pathway Factor

$$R_{aipj} = K' \frac{Q_F(U_{ap})}{\lambda_i + \lambda_w} F_f(r)(DFL_{ij})_a \left[\frac{f_p f_s}{Y_p} + \frac{(1-f_p f_s)e^{-\lambda_i t_h}}{Y_s} \right] e^{-\lambda_i t_f}$$

(m^2mrem/yr per μCi/sec)

where

(NOTE: Parameter values given in parentheses are to be used in lieu of site-specific values. (Reference 3))

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

Q_F = the cow's consumption rate, in kg/day (wet weight). (50)

U_{ap} = the receptor's meat consumption rate for age group a , in kg/yr from Table 2.2-10.

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

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

F_f = The stable element transfer coefficients, in days/kg.
(see Table 2.2-11.)

r = fraction of deposited activity retained on feed grass.
(1.0 for radioiodines; 0.2 for particulates)

$(DFL_{ij})_a$ = the organ ingestion dose factor for the ith radionuclide for the receptor in age group a , in mrem/pCi from Tables 2.2-5 through 2.2-8.

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

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

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

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

f_p = fraction of the year that the cow is on pasture (dimensionless).
(0.5)

f_s = fraction of the cow feed that is pasture grass while the cow is on pasture (dimensionless). (0.5)

For tritium in meat, the grass-cow-meat pathway factor is a special case due to the fact that the concentration of tritium in meat is based on airborne concentration rather than deposition:

$$R_{aipj} = K'K'''F_f Q_F U_{ap} (DFL_{ij})_a \ [0.75(0.5/H)] \ (\text{mrem/yr per } \mu\text{Ci/m}^3)$$

where:

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

H = absolute humidity of the atmosphere, in gm/m^3. (8)

0.75 = the fraction of total feed that is water.

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

and other parameters and values are given above.

Vegetation Pathway Factor

$$R_{aipj} = K' \frac{r}{Y_v(\lambda_i + \lambda_w)} (DFL_{ij})_a \left[U_{a\ell} f_\ell e^{-\lambda_i t_\ell} + U_{as} f_g e^{-\lambda_i t_h} \right]$$

where

(NOTE: Parameter values given in parentheses are to be used in lieu of site-specific values. (Reference 3))

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

$U_{a\ell}$ = the consumption rate of fresh leafy vegetation by the receptor in age group a, in kg/year.
(See Table 2.2-10))

U_{as} = the consumption rate of stored vegetation by the receptor in age group a, in kg/year.
(See Table 2.2-10))

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

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

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

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

Y_v = the vegetation areal density, in kg/m^2. (2.0)

$(DFL_{ij})_a$ = the organ ingestion dose factor for the ith radionuclide for the receptor in age group (a), in mrem/pCi from Tables 2.2-5 through 2.2-8.

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

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

For tritium in vegetation, the vegetation pathway factor is a special case due to the fact that the concentration of tritium in vegetation is based on air-borne concentration rather than deposition:

$$R_{aipj} = K'K''(U_{a\ell} f_\ell + U_{as} f_g) (DFL_{ij})_a \; [0.75(0.5/H)] \text{ (mrem/yr per } \mu Ci/m^3)$$

where:

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

H = absolute humidity of the atmosphere, in gm/m^3.
(8)

0.75 = the fraction of total vegetation that is water.

0.5 = the ratio of the specific activity of the vegetation water to the atmospheric water.

and other parameters and values are given above.

2.2.3 METHODOLOGY FOR GASEOUS DOSE PROJECTIONS
(To Determine Necessity of Operating Gaseous Radwaste Treatment System)

The NRC requires that dose projections be performed to indicate whether cumulative doses over a thirty-one (31) day period are likely to exceed 25% of the annual design objective dose limit adjusted to a thirty-one (31) day period. The 25% actuation levels of 0.3 mrem to any organ, 0.2 mrad gamma air dose, and 0.4 mrad beta air dose were selected by t'e NRC based on their cost-benefit analysis for operation of radwaste systems. When the thirty-one (31) day projected dose exceeds 0.3 mrem to any organ, 0.2 mrad gamma air dose or 0.4 mrad beta air dose, operation of appropriate portions of the radwaste systems would be required.

When the percent of the quarterly limit exceeds 4% for any organ, gamma air dose or beta air dose (i.e., the cumulative organ dose exceeds 0.3 mrem, the cumulative gamma air dose exceeds 0.2 mrad or the cumulative beta air dose exceeds 0.4 mrad) determine the thirty-one (31) day dose projection as follows:

$$D_{\gamma air(prj)} = \left[\frac{D_{\gamma air(accumulated)}}{X}\right] \times [31]$$

$$D_{\beta air(prj)} = \left[\frac{D_{\beta air(accumulated)}}{X}\right] \times [31]$$

$$D_{tb(prj)} = \left[\frac{D_{tb(accumulated)}}{X}\right] \times [31]$$

$$D_{o(prj)} = \left[\frac{D_{o(accumulated)}}{X}\right] \times [31]$$

where

$D_{\gamma air(accumulated)}$ = the cumulative total air dose due to gamma emissions for the current quarter plus the release under consideration for the particular reactor unit.

$D_{\beta air(accumulated)}$ = the cumulative total air dose due to beta emissions for the current quarter plus the release under consideration for the particular reactor unit.

$D_{tb(accumulated)}$ = the cumulative total body dose for the elapsed portion of the current quarter plus the release under consideration for the particular reactor unit.

$D_{o(accumulated)}$ = the cumulative organ doses for the elapsed portion of the current quarter plus the release under consideration for the particular reactor unit.

X = the number of days into the current quarter to the nearest whole day.

If activities planned during the remainder of the 31-day period are expected to contribute a significant dose and the determination can be reasonably made, this contribution should be included in the equations:

$$D_{\gamma air(prj)} = \left[\frac{D_{\gamma air(accumulated)}}{X}\right] \times [31] + D_{anticipated}$$

$$D_{\beta air(prj)} = \left[\frac{D_{\beta air(accumulated)}}{X}\right] \times [31] + D_{anticipated}$$

$$D_{tb(prj)} = \left[\frac{D_{tb(accumulated)}}{X}\right] \times [31] + D_{anticipated}$$

$$D_{o(prj)} = \left[\frac{D_{o(accumulated)}}{X}\right] \times [31] + D_{anticipated}$$

where

$D_{anticipated}$ = the anticipated organ dose resulting from anticipated operational occurrences which may occur in addition to routine releases over the thirty-one (31) day period.

If,

$D_{\gamma air(prj)} > 0.2$ mrad or $D_{\beta air(prj)} > 0.4$ mrad

then appropriate portions of the Gaseous Radwaste System shall be used to reduce radioactive materials in gaseous waste prior to their discharge.

If,

$D_{tb(prj)} > 0.3$ mrem or $D_{o(prj)} > 0.3$ mrem

then appropriate portions of the Ventilation Exhaust Treatment System shall be used to reduce radioactive materials in gaseous waste prior to their discharge.

INHALATION DOSE FACTORS FOR INFANT*

(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	4.62E-07	4.62E-07	4.62E-07	4.62E-07	4.62E-07	4.62E-07
C 14	1.89E-05	3.79E-06	3.79E-06	3.79E-06	3.79E-06	3.79E-06	3.79E-06
NA 24	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06
P 32	1.45E-03	8.03E-05	5.53E-05	NO DATA	NO DATA	NO DATA	1.15E-05
CR 51	NO DATA	NO DATA	6.37E-08	4.11E-08	9.45E-09	9.17E-06	2.55E-07
MN 54	NO DATA	8.81E-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	5.17E-05
FE 55	1.41E-05	8.39E-06	2.38E-06	NO DATA	NO DATA	6.21E-05	7.82E-07
FE 59	9.69E-06	1.68E-05	6.77E-06	NO DATA	NO DATA	7.25E-04	1.77E-05
CO 58	NO DATA	8.71E-07	1.30E-06	NO DATA	NO DATA	5.55E-04	7.95E-06
CO 60	NO DATA	5.73E-06	8.41E-06	NO DATA	NO DATA	3.22E-03	2.28E-05
NI 63	2.42E-04	1.46E-05	8.29E-06	NO DATA	NO DATA	1.49E-04	1.73E-06
NI 65	1.71E-09	2.03E-10	8.79E-11	NO DATA	NO DATA	5.80E-06	3.58E-05
CU 64	NO DATA	1.34E-09	5.53E-10	NO DATA	2.84E-09	6.64E-06	1.07E-05
ZN 65	1.38E-05	4.47E-05	2.22E-05	NO DATA	2.32E-05	4.62E-04	3.67E-05
ZN 69	3.85E-11	6.91E-11	5.13E-12	NO DATA	2.87E-11	1.05E-06	9.44E-06
BR 83	NO DATA	NO DATA	2.72E-07	NO DATA	NO DATA	NO DATA	LT E-24
BR 84	NO DATA	NO DATA	2.86E-07	NO DATA	NO DATA	NO DATA	LT E-24
BR 85	NO DATA	NO DATA	1.46E-08	NO DATA	NO DATA	NO DATA	LT E-24
RB 86	NO DATA	1.36E-04	6.30E-05	NO DATA	NO DATA	NO DATA	2.17E-06
RB 88	NO DATA	3.98E-07	2.05E-07	NO DATA	NO DATA	NO DATA	2.42E-07
RB 89	NO DATA	2.29E-07	1.47E-07	NO DATA	NO DATA	NO DATA	4.87E-08
SR 89	2.84E-04	NO DATA	8.15E-06	NO DATA	NO DATA	1.45E-03	4.57E-05
SR 90	2.92E-02	NO DATA	1.85E-03	NO DATA	NO DATA	8.03E-03	9.36E-05
SR 91	6.83E-08	NO DATA	2.47E-09	NO DATA	NO DATA	3.76E-05	5.24E-05
SR 92	7.50E-09	NO DATA	2.79E-10	NO DATA	NO DATA	1.70E-05	1.00E-04
Y 90	2.35E-06	NO DATA	6.30E-08	NO DATA	NO DATA	1.92E-04	7.43E-05
Y 91M	2.91E-10	NO DATA	9.90E-12	NO DATA	NO DATA	1.99E-06	1.68E-06
Y 91	4.20E-04	NO DATA	1.12E-05	NO DATA	NO DATA	1.75E-03	5.02E-05
Y 92	1.17E-08	NO DATA	3.29E-10	NO DATA	NO DATA	1.75E-05	9.04E-05

* Reference 3, Table E-10.

TABLE 2.2-1 CONT'D

INHALATION DOSE FACTORS FOR INFANT*

(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	1.07E-07	NO DATA	2.91E-09	NO DATA	NO DATA	5.46E-05	1.19E-04
ZR 95	8.24E-05	1.99E-05	1.45E-05	NO DATA	2.22E-05	1.25E-03	1.55E-05
ZR 97	1.07E-07	1.83E-08	8.36E-09	NO DATA	1.85E-08	7.88E-05	1.00E-04
NB 95	1.12E-05	4.59E-06	2.70E-06	NO DATA	3.37E-06	3.42E-04	9.05E-06
MO 99	NO DATA	1.18E-07	2.31E-08	NO DATA	1.89E-07	9.63E-05	3.48E-05
TC 99M	9.98E-13	2.06E-12	2.66E-11	NO DATA	2.22E-11	5.79E-07	1.45E-06
TC101	4.65E-14	5.98E-14	5.80E-13	NO DATA	6.99E-13	4.17E-07	6.03E-07
RU103	1.44E-06	NO DATA	4.85E-07	NO DATA	3.03E-06	3.94E-04	1.15E-05
RU105	8.74E-10	NO DATA	2.93E-10	NO DATA	6.42E-10	1.12E-05	3.46E-05
RU106	6.20E-05	NO DATA	7.77E-06	NO DATA	7.61E-05	8.26E-03	1.17E-04
AG110M	7,13E-06	5.16E-06	3.57E-06	NO DATA	7.80E-06	2.62E-03	2.36E-05
TE125M	3.40E-06	1.42E-06	4.70E-07	1.16E-06	NO DATA	3.19E-04	9.22E-06
TE127M	1.19E-05	4.93E-06	1.48E-06	3.48E-06	2.68E-05	9.37E-04	1.95E-05
TE127	1.59E-09	6.81E-10	3.47E-10	1.32E-09	3.47E-09	7.39E-06	1.74E-05
TE129M	1.01E-05	4.35E-06	1.59E-06	3.91E-06	2.27E-05	1.20E-03	4.93E-05
TE129	5.63E-11	2.48E-11	1.34E-11	4.82E-11	1.25E-10	2.14E-06	1.88E-05
TE131M	7.62E-08	3.93E-08	2.59E-08	6.38E-08	1.89E-07	1.42E-04	8.51E-05
TE131	1.24E-11	5.87E-12	3.57E-12	1.13E-11	2.85E-11	1.47E-06	5.87E-06
TE132	2.66E-07	1.69E-07	1.26E-07	1.99E-07	7.39E-07	2.43E-04	3.15E-05
I 130	4.54E-06	9.91E-06	3.98E-06	1.14E-03	1.09E-05	NO DATA	1.42E-06
I 131	2.71E-05	3.17E-05	1.40E-05	1.06E-02	3.70E-05	NO DATA	7.56E-07
I 132	1.21E-06	2.53E-06	8.99E-07	1.21E-04	2.82E-06	NO DATA	1.36E-06
I 133	9.46E-06	1.37E-05	4.00E-06	2.54E-03	1.60E-05	NO DATA	1.54E-06
I 134	6.58E-07	1.34E-06	4.75E-07	3.18E-05	1.49E-06	NO DATA	9.21E-07
I 135	2.76E-06	5.43E-06	1.98E-06	4.97E-04	6.05E-06	NO DATA	1.31E-06
CS134	2.83E-04	5.02E-04	5.32E-05	NO DATA	1.36E-04	5.69E-05	9.53E-07
CS136	3.45E-05	9.61E-05	3.78E-05	NO DATA	4.03E-05	8.40E-06	1.02E-06
CS137	3.92E-04	4.37E-04	3.25E-05	NO DATA	1.23E-04	5.09E-05	9.53E-07
CS138	3.61E-07	5.58E-07	2.84E-07	NO DATA	2.93E-07	4.67E-08	6.26E-07
BA139	1.06E-09	7.03E-13	3.07E-11	NO DATA	4.73E-13	4.25E-06	3.64E-05

TABLE 2.2-1 CONT'D

INHALATION DOSE FACTORS FOR INFANT*

(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA140	4.00E-05	4.00E-08	2.07E-06	NO DATA	9.59E-09	1.14E-03	2.74E-05
BA141	1.12E-10	7.70E-14	3.55E-12	NO DATA	4.64E-14	2.12E-06	3.39E-06
BA142	2.84E-11	2.36E-14	1.40E-12	NO DATA	1.36E-14	1.11E-06	4.95E-07
LA140	3.61E-07	1.43E-07	3.68E-08	NO DATA	NO DATA	1.20E-04	6.06E-05
LA142	7.36E-10	2.69E-10	6.46E-11	NO DATA	NO DATA	5.87E-06	4.25E-05
CE141	1.98E-05	1.19E-05	1.42E-06	NO DATA	3.75E-06	3.69E-04	1.54E-05
CE143	2.09E-07	1.38E-07	1.58E-08	NO DATA	4.03E-08	8.30E-05	3.55E-05
CE144	2.28E-03	8.65E-04	1.26E-04	NO DATA	3.84E-04	7.03E-03	1.06E-04
PR143	1.00E-05	3.74E-06	4.97E-07	NO DATA	1.41E-06	3.09E-04	2.66E-05
PR144	3.42E-11	1.32E-11	1.72E-12	NO DATA	4.80E-12	1.15E-06	3.06E-06
ND147	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
NP239	2.65E-07	2.37E-08	1.34E-08	NO DATA	4.73E-08	4.25E-05	1.78E-05

TABLE 2.2-2

INHALATION DOSE FACTORS FOR CHILD*

(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07
C 14	9.70E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06
NA 24	4.35E-06	4.35E-06	4.35E-06	4.35E-06	4.35E-06	4.35E-06	4.35E-06
P 32	7.04E-04	3.09E-05	2.67E-05	NO DATA	NO DATA	NO DATA	1.14E-05
CR 51	NO DATA	NO DATA	4.17E-08	2.31E-08	6.57E-09	4.59E-06	2.93E-07
MN 54	NO DATA	1.16E-05	2.57E-06	NO DATA	2.71E-06	4.26E-04	6.19E-06
MN 56	NO DATA	4.48E-10	8.43E-11	NO DATA	4.52E-10	3.55E-06	3.33E-05
FE 55	1.28E-05	6.80E-06	2.10E-06	NO DATA	NO DATA	3.00E-05	7.75E-07
FE 59	5.59E-06	9.04E-06	4.51E-06	NO DATA	NO DATA	3.43E-04	1.91E-05
CO 58	NO DATA	4.79E-07	8.55E-07	NO DATA	NO DATA	2.99E-04	9.29E-06
CO 60	NO DATA	3.55E-06	6.12E-06	NO DATA	NO DATA	1.91E-03	2.60E-05
NI 63	2.22E-04	1.25E-05	7.56E-06	NO DATA	NO DATA	7.43E-05	1.71E-06
NI 65	8.08E-10	7.99E-11	4.44E-11	NO DATA	NO DATA	2.21E-06	2.27E-05
CU 64	NO DATA	5.39E-10	2.90E-10	NO DATA	1.63E-09	2.59E-06	9.92E-06
ZN 65	1.15E-05	3.06E-05	1.90E-05	NO DATA	1.93E-05	2.69E-04	4.41E-06
ZN 69	1.81E-11	2.61E-11	2.41E-12	NO DATA	1.58E-11	3.84E-07	2.75E-06
BR 83	NO DATA	NO DATA	1.28E-07	NO DATA	NO DATA	NO DATA	LT E-24
BR 84	NO DATA	NO DATA	1.48E-07	NO DATA	NO DATA	NO DATA	LT E-24
BR 85	NO DATA	NO DATA	6.84E-09	NO DATA	NO DATA	NO DATA	LT E-24
RB 86	NO DATA	5.36E-05	3.09E-05	NO DATA	NO DATA	NO DATA	2.16E-06
RB 88	NO DATA	1.52E-07	9.90E-08	NO DATA	NO DATA	NO DATA	4.66E-09
RB 89	NO DATA	9.33E-08	7.83E-08	NO DATA	NO DATA	NO DATA	5.11E-10
SR 89	1.62E-04	NO DATA	4.66E-06	NO DATA	NO DATA	5.83E-04	4.52E-05
SR 90	2.73E-02	NO DATA	1.74E-03	NO DATA	NO DATA	3.99E-03	9.28E-05
SR 91	3.28E-08	NO DATA	1.24E-09	NO DATA	NO DATA	1.44E-05	4.70E-05
SR 92	3.54E-09	NO DATA	1.42E-10	NO DATA	NO DATA	6.49E-06	6.55E-05
Y 90	1.11E-06	NO DATA	2.99E-08	NO DATA	NO DATA	7.07E-05	7.24E-05
Y 91M	1.37E-10	NO DATA	4.98E-12	NO DATA	NO DATA	7.60E-07	4.64E-07
Y 91	2.47E-04	NO DATA	6.59E-06	NO DATA	NO DATA	7.10E-04	4.97E-05
Y 92	5.50E-09	NO DATA	[illegible].37E-10	NO DATA	NO DATA	6.46E-06	6.46E-05

* Reference 3, Table E-9.

TABLE 2.2-2 CONT'D

INHALATION DOSE FACTORS FOR CHILD*

(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	5.04E-08	NO DATA	1.38E-09	NO DATA	NO DATA	2.01E-05	1.05E-04
ZR 95	5.13E-05	1.13E-05	1.00E-05	NO DATA	1.61E-05	6.03E-04	1.65E-05
ZR 97	5.07E-08	7.34E-09	4.32E-09	NO DATA	1.05E-08	3.06E-05	9.49E-05
NB 95	6.35E-06	2.48E-06	1.77E-06	NO DATA	2.33E-06	1.66E-04	1.00E-05
MO 99	NO DATA	4.66E-06	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
TC101	2.19E-14	2.30E-14	2.91E-13	NO DATA	3.92E-13	1.58E-07	4.41E-09
RU103	7.55E-07	NO DATA	2.90E-07	NO DATA	1.90E-06	1.79E-04	1.21E-05
RU105	4.13E-10	NO DATA	1.50E-10	NO DATA	3.63E-10	4.30E-06	2.69E-05
RU106	3.68E-05	NO DATA	4.57E-06	NO DATA	4.97E-05	3.87E-03	1.16E-04
AG110M	4.56E-06	3.08E-06	2.47E-06	NO DATA	5.74E-06	1.48E-03	2.71E-05
TE125M	1.82E-06	6.29E-07	2.47E-07	5.20E-07	NO DATA	1.29E-04	9.13E-06
TE127M	6.72E-06	2.31E-06	8.16E-07	1.64E-06	1.72E-05	4.00E-04	1.93E-05
TE127	7.49E-10	2.57E-10	1.65E-10	5.30E-10	1.91E-09	2.71E-06	1.52E-05
TE129M	5.19E-06	1.85E-06	8.22E-07	1.71E-06	1.36E-05	4.76E-04	4.91E-05
TE129	2.64E-11	9.45E-12	6.44E-12	1.93E-11	6.94E-11	7.93E-07	6.89E-06
TE131M	3.63E-08	1.60E-08	1.37E-08	2.64E-08	1.08E-07	5.56E-05	8.32E-05
TE131	5.87E-12	2.28E-12	1.78E-12	4.59E-12	1.59E-11	5.55E-07	3.60E-07
TE132	1.30E-07	7.36E-08	7.12E-08	8.58E-08	4.79E-07	1.02E-04	3.72E-05
I 130	2.21E-06	4.43E-06	2.28E-06	4.99E-04	6.61E-06	NO DATA	1.38E-06
I 131	1.30E-05	1.30E-05	7.37E-06	4.39E-03	2.13E-05	NO DATA	7.68E-07
I 132	5.72E-07	1.10E-06	5.07E-07	5.23E-05	1.69E-06	NO DATA	8.65E-07
I 133	4.48E-06	5.49E-06	2.08E-06	1.04E-03	9.13E-06	NO DATA	1.48E-06
I 134	3.17E-07	5.84E-07	2.69E-07	1.[illegible]7E-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
CS134	1.76E-04	2.74E-04	6.07E-05	NO DATA	8.93E-05	3.27E-05	1.04E-06
CS136	1.76E-05	4.62E-05	3.14E-05	NO DATA	2.58E-05	3.93E-06	1.13E-06
CS137	2.45E-04	2.23E-04	3.47E-05	NO DATA	7.63E-05	2.81E-05	9.78E-07
CS138	1.71E-07	2.27E-07	1.50E-07	NO DATA	1.68E-07	1.84E-08	7.29E-08
BA139	4.98E-10	2.66E-13	1.45E-11	NO DATA	2.33E-13	1.56E-06	1.56E-05

TABLE 2.2-2 CONT'D

INHALATION DOSE FACTORS FOR CHILD*

(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA140	2.00E-05	1.75E-08	1.17E-06	NO DATA	5.71E-09	4.71E-04	2.75E-05
BA141	5.29E-11	2.95E-14	1.72E-12	NO DATA	2.56E-14	7.89E-07	7.44E-08
BA142	1.35E-11	9.73E-15	7.54E-13	NO DATA	7.87E-15	4.44E-07	7.41E-10
LA140	1.74E-07	6.08E-08	2.04E-08	NO DATA	NO DATA	4.94E-05	6.10E-05
LA142	3.50E-10	1.11E-10	3.49E-11	NO DATA	NO DATA	7.35E-06	2.05E-05
CE141	1.06E-05	5.28E-06	7.83E-07	NO DATA	2.31E-06	1.47E-04	1.53E-05
CE143	9.89E-08	5.37E-08	7.77E-09	NO DATA	2.26E-08	3.12E-05	3.44E-05
CE144	1.83E-03	5.72E-04	9.77E-05	NO DATA	3.17E-04	3.23E-03	1.05E-04
PR143	4.99E-06	1.50E-06	2.47E-07	NO DATA	8.11E-07	1.17E-04	2.63E-05
PR144	1.61E-11	4.99E-12	8.10E-13	NO DATA	2.64E-12	4.23E-07	5.32E-08
ND147	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
NP239	1.26E-07	9.04E-09	6.35E-09	NO DATA	2.63E-08	1.57E-05	1.73E-05

TABLE 2.2-3

INHALATION DOSE FACTORS FOR TEENAGER*

(MREM PER PCI INHALED)

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

* Reference 3, Table E-8.

TABLE 2.2-3 CONT'D

INHALATION DOSE FACTORS FOR TEENAGER*

(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	1.69E-08	NO DATA	4.65E-10	NO DATA	NO DATA	1.04E-05	7.24E-05
ZR 95	1.82E-05	5.73E-06	3.94E-06	NO DATA	6.42E-06	3.36E-04	1.86E-05
ZR 97	1.72E-08	3.40E-09	1.57E-09	NO DATA	5.15E-09	1.62E-05	7.88E-05
NB 95	2.32E-06	1.29E-06	7.08E-07	NO DATA	1.25E-06	9.39E-05	1.21E-05
MO 99	NO DATA	2.11E-08	4.03E-09	NO DATA	5.14E-08	1.92E-05	3.36E-05
TC 99M	1.73E-13	4.83E-13	6.24E-12	NO DATA	7.20E-12	1.44E-07	7.66E-07
TC101	7.40E-15	1.05E-14	1.03E-13	NO DATA	1.90E-13	8.34E-08	1.09E-16
RU103	2.63E-07	NO DATA	1.12E-07	NO DATA	9.29E-07	9.79E-05	1.36E-05
RU105	1.40E-10	NO DATA	5.42E-11	NO DATA	1.76E-10	2.27E-06	1.13E-05
RU106	1.23E-05	NO DATA	1.55E-06	NO DATA	2.38E-05	2.01E-03	1.20E-04
AG110M	1.73E-06	1.64E-06	9.99E-07	NO DATA	3.13E-06	8.44E-04	3.41E-05
TE125M	6.10E-07	2.80E-07	8.34E-08	1.75E-07	NO DATA	6.70E-05	9.38E-06
TE127M	2.25E-06	1.02E-06	2.73E-07	5.48E-07	8.17E-06	2.07E-04	1.99E-05
TE127	2.51E-10	1.14E-10	5.52E-11	1.77E-10	9.10E-10	1.40E-06	1.01E-05
TE129M	1.74E-06	8.23E-07	2.81E-07	5.72E-07	6.49E-06	2.47E-04	5.06E-05
TE129	8.87E-12	4.22E-12	2.20E-12	6.48E-12	3.32E-11	4.12E-07	2.02E-07
TE131M	1.23E-08	7.51E-09	5.03E-09	9.06E-09	5.49E-08	2.97E-05	7.76E-05
TE131	1.97E-12	1.04E-12	6.30E-13	1.55E-12	7.72E-12	2.92E-07	1.89E-09
TE132	4.50E-08	3.03E-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
CS134	6.28E-05	1.41E-04	6.86E-05	NO DATA	4.69E-05	1.83E-05	1.22E-06
CS136	6.44E-06	2.42E-05	1.71E-05	NO DATA	1.38E-05	2.22E-06	1.36E-06
CS137	8.38E-05	1.06E-04	3.89E-05	NO DATA	3.80E-05	1.51E-05	1.06E-06
CS138	5.82E-08	1.07E-07	5.58E-08	NO DATA	8.28E-08	9.84E-09	3.38E-11
BA139	1.67E-10	1.18E-13	4.87E-12	NO DATA	1.11E-13	8.08E-07	8.06E-07

TABLE 2.2-3 CONT'D

INHALATION DOSE FACTORS FOR TEENAGER*

(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA140	6.84E-06	8.38E-09	4.40E-07	NO DATA	2.85E-09	2.54E-04	2.86E-05
BA141	1.78E-11	1.32E-14	5.93E-13	NO DATA	1.23E-14	4.11E-07	9.33E-14
BA142	4.62E-12	4.63E-15	2.84E-13	NO DATA	3.92E-15	2.39E-07	5.99E-20
LA140	5.99E-08	2.95E-08	7.82E-09	NO DATA	NO DATA	2.68E-05	6.09E-05
LA142	1.20E-10	5.31E-11	1.32E-11	NO DATA	NO DATA	1.27E-06	1.50E-06
CE141	3.55E-06	2.37E-06	2.71E-07	NO DATA	1.11E-06	7.67E-05	1.58E-05
CE143	3.32E-08	2.42E-08	2.70E-09	NO DATA	1.08E-08	1.63E-05	3.19E-05
CE144	6.11E-04	2.53E-04	3.28E-05	NO DATA	1.51E-04	1.67E-03	1.08E-04
PR143	1.67E-06	6.64E-07	8.28E-08	NO DATA	3.86E-07	6.04E-05	2.67E-05
PR144	5.37E-12	2.20E-12	2.72E-13	NO DATA	1.26E-12	2.19E-07	2.94E-14
ND147	9.83E-07	1.07E-06	6.41E-08	NO DATA	6.28E-07	4.65E-05	2.28E-05
W 187	1.50E-09	1.22E-09	4.29E-10	NO DATA	NO DATA	5.92E-06	2.21E-05
NP239	4.23E-08	3.99E-09	2.21E-09	NO DATA	1.25E-08	8.11E-06	1.65E-05

TABLE 2.2-4

INHALATION DOSE FACTORS FOR ADULTS*

(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
C 14	2.27E-06	4.26E-07	4.26E-07	4.26E-07	4.26E-07	4.26E-07	4.26E-07
NA 24	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06
P 32	1.65E-04	9.64E-06	6.26E-06	NO DATA	NO DATA	NO DATA	1.08E-05
CR 51	NO DATA	NO DATA	1.25E-08	7.44E-09	2.85E-09	1.80E-06	4.15E-07
MN 54	NO DATA	4.95E-06	7.87E-07	NO DATA	1.23E-06	1.75E-04	9.67E-06
MN 56	NO DATA	1.55 -10	2.29E-11	NO DATA	1.63E-10	1.[illegible]8E-06	2.53E-06
FE 55	3.07E-06	2.12E-06	4.93E-07	NO DATA	NO DATA	9.01E-06	7.54E-07
FE 59	1.47E-06	3.47E-06	1.32E-06	NO DATA	NO DATA	1.27E-04	2.35E-05
CO 58	NO DATA	1.98E-07	2.59E-07	NO DATA	NO DATA	1.16E-04	1.33E-05
CO 60	NO DATA	1.44E-06	1.85E-06	NO DATA	NO DATA	7.46E-04	3.56E-05
NI 63	5.40E-05	3.93E-06	1.81E-06	NO DATA	NO DATA	2.23E-05	1.67E-06
NI 65	1.92E-10	2.62E-11	1.14E-11	NO DATA	NO DATA	7.00E-07	1.54E-06
CU 64	NO DATA	1.83E-10	7.69E-11	NO DATA	5.78E-10	8.48E-07	6.12E-06
ZN 65	4.05E-06	1.29E-05	5.82E-06	NO DATA	8.62E-06	1.08E-04	6.68E-06
ZN 69	4.23E-12	8.14E-12	5.65E-13	NO DATA	5.27E-12	1.15E-07	2.04E-09
BR 83	NO DATA	NO DATA	3.01E-08	NO DATA	NO DATA	NO DATA	2.90E-08
BR 84	NO DATA	NO DATA	3.91E-08	NO DATA	NO DATA	NO DATA	2.05E-13
BR 85	NO DATA	NO DATA	1.60E-09	NO DATA	NO DATA	NO DATA	LT E-24
RB 86	NO DATA	1.69E-05	7.37E-06	NO DATA	NO DATA	NO DATA	2.08E-06
RB 88	NO DATA	4.84E-08	2.41E-08	NO DATA	NO DATA	NO DATA	4.18E-19
RB 89	NO DATA	3.20E-08	2.12E-08	NO DATA	NO DATA	NO DATA	1.16E-21
SR 89	3.80E-05	NO DATA	1.09E-06	NO DATA	NO DATA	1.75E-04	4.37E-05
SR 90	1.24E-02	NO DATA	7.62E-04	NO DATA	NO DATA	1.20E-03	9.02E-05
SR 91	7.74E-09	NO DATA	3.13E-10	NO DATA	NO DATA	4.56E-06	2.39E-05
SR 92	8.43E-10	NO DATA	3.64E-11	NO DATA	NO DATA	2.06E-06	5.38E-06
Y 90	2.61E-07	NO DATA	7.01E-09	NO DATA	NO DATA	2.12E-05	6.32E-05
Y 91M	3.26E-11	NO DATA	1.27E-12	NO DATA	NO DATA	2.40E-07	1.66E-10
Y 91	5.78E-05	NO DATA	1.55E-06	NO DATA	NO DATA	2.13E-04	4.81E-05
Y 92	1.29E-09	NO DATA	3.77E-11	NO DATA	NO DATA	1.96E-06	9.19E-06

* Reference 3, Table E-7.

TABLE 2.2-4 CONT'D

INHALATION DOSE FACTORS FOR ADULTS*

(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	1.18E-08	NO DATA	3.26E-10	NO DATA	NO DATA	6.06E-06	5.27E-05
ZR 95	1.34E-05	4.30E-06	2.91E-06	NO DATA	6.77E-06	2.21E-04	1.88E-05
ZR 97	1.21E-08	2.45E-09	1.13E-09	NO DATA	3.71E-09	9.84E-06	6.54E-05
NB 95	1.76E-06	9.77E-07	5.26E-07	NO DATA	9.67E-07	6.31E-05	1.30E-05
MO 99	NO DATA	1.51E-08	2.87E-09	NO DATA	3.64E-08	1.14E-05	3.10E-05
TC 99M	1.29E-13	3.64E-13	4.63E-12	NO DATA	5.52E-12	9.55E-08	5.20E-07
TC101	5.22E-15	7.52E-15	7.38E-14	NO DATA	1.35E-13	4.99E-08	1.36E-21
RU103	1.91E-07	NO DATA	8.23E-08	NO DATA	7.29E-07	6.31E-05	1.38E-05
RU105	9.88E-11	NO DATA	3.89E-11	NO DATA	1.27E-10	1.37E-06	6.02E-06
RU106	8.64E-06	NO DATA	1.09E-06	NO DATA	1.67E-05	1.17E-03	1.14E-04
AG110M	1.35E-06	1.25E-06	7.43E-07	NO DATA	2.46E-06	5.79E-04	3.78E-05
TE125M	4.27E-07	1.98E-07	5.84E-08	1.31E-07	1.55E-06	3.92E-05	8.83E-06
TE127M	1.58E-06	7.21E-07	1.96E-07	4.11E-07	5.72E-06	1.20E-04	1.87E-05
TE127	1.75E-10	8.03E-11	3.87E-11	1.32E-10	6.37E-10	6.14E-07	7.17E-06
TE129M	1.22E-06	5.64E-07	1.98E-07	4.30E-07	4.57E-06	1.45E-04	4.79E-05
TE129	6.22E-12	2.99E-12	1.55E-12	4.87E-12	2.34E-11	2.42E-07	1.96E-08
TE131M	8.74E-09	5.45E-09	3.63E-09	6.88E-09	3.86E-08	1.82E-05	6.95E-05
TE131	1.39E-12	7.44E-13	4.49E-13	1.17E-12	5.46E-12	1.74E-07	2.30E-09
TE132	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	9.6'E-07
I 131	3.15E-06	4.47E-06	2.56E-06	1.49E-03	7.66E-06	NO DATA	7.85E-07
I 132	1.45E-07	4.07E-07	1.45E-07	1.43E-05	6.48E-07	NO DATA	5.08E-08
I 133	1.08E-06	1.85E-06	5.65E-07	2.69E-04	3.23E-06	NO DATA	1.11E-06
I 134	8.05E-08	2.16E-07	7.69E-08	3.73E-06	3.44E-07	NO DATA	1.26E-10
I 135	3.35E-07	8.73E-07	3.21E-07	5.60E-05	1.39E-06	NO DATA	6.56E-07
CS134	4.66E-05	1.06E-04	9.10E-05	NO DATA	3.59E-05	1.22E-05	1.30E-06
CS136	4.88E-06	1.83E-05	1.38E-05	NO DATA	1.07E-05	1.50E-06	1.46E-06
CS137	5.98E-05	7.76E-05	5.35E-05	NO DATA	2.78E-05	9.40E-06	1.05E-06
CS138	4.14E-08	7.76E-08	4.05E-08	NO DATA	6.00E-08	6.07E-09	2.33E-13
BA139	1.17E-10	8.32E-14	3.42E-12	NO DATA	7.78E-14	4.70E-07	1.12E-07

TABLE 2.2-4 CONT'D

INHALATION DOSE FACTORS FOR ADULTS*

(MREM PER PCI INHALED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA140	4.88E-06	6.13E-09	3.21E-07	NO DATA	2.09E-09	1.59E-04	2.73E-05
BA141	1.25E-11	9.41E-15	4.20E-13	NO DATA	8.75E-15	2.42E-07	1.45E-17
BA142	3.29E-12	3.38E-15	2.07E-13	NO DATA	2.86E-15	1.49E-07	1.96E-26
LA140	4.30E-08	2.17E-08	5.73E-09	NO DATA	NO DATA	1.70E-05	5.73E-05
LA142	8.54E-11	3.88E-11	9.65E-12	NO DATA	NO DATA	7.91E-07	2.64E-07
CE141	2.49E-06	1.69E-06	1.91E-07	NO DATA	7.83E-07	4.52E-05	1.50E-05
CE143	2.33E-08	1.72E-08	1.91E-09	NO DATA	7.60E-09	9.97E-06	2.83E-05
CE144	4.29E-04	1.79E-04	2.30E-05	NO DATA	1.06E-04	9.72E-04	1.02E-04
PR143	1.17E-06	4.69E-07	5.80E-08	NO DATA	2.70E-07	3.51E-05	2.50E-05
PR144	3.76E-12	1.56E-12	1.91E-13	NO DATA	8.81E-13	1.27E-07	2.69E-18
ND147	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
NP239	2.87E-08	2.82E-09	1.55E-09	NO DATA	8.75E-09	4.70E-06	1.49E-05

TABLE 2.2-5

INGESTION DOSE FACTORS FOR INFANT*

(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07
C 14	2.37E-05	5.06E-06	5.06E-06	5.06E-06	5.06E-06	5.06E-06	5.06E-06
NA 24	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05
P 32	1.70E-03	1.06E-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	8.93E-06	NO DATA	NO DATA	NO DATA	8.97E-06
CO 60	NO DATA	1.08E-05	2.55E-05	NO DATA	NO DATA	NO DATA	2.57E-05
NI 63	6.34E-04	3.92E-05	2.20E-05	NO DATA	NO DATA	NO DATA	1.95E-06
NI 65	4.70E-06	5.32E-07	2.42E-07	NO DATA	NO DATA	NO DATA	4.05E-05
CU 64	NO DATA	6.09E-07	2.82E-07	NO DATA	1.03E-06	NO DATA	1.25E-05
ZN 65	1.84E-05	6.31E-05	2.91E-05	NO DATA	3.06E-05	NO DATA	5.33E-05
ZN 69	9.33E-08	1.68E-07	1.25E-08	NO DATA	6.98E-08	NO DATA	1.37E-05
BR 83	NO DATA	NO DATA	3.63E-07	NO DATA	NO DATA	NO DATA	LT E-24
BR 84	NO DATA	NO DATA	3.82E-07	NO DATA	NO DATA	NO DATA	LT E-24
BR 85	NO DATA	NO DATA	1.94E-08	NO DATA	NO DATA	NO DATA	LT E-24
RB 86	NO DATA	1.70E-04	8.40E-05	NO DATA	NO DATA	NO DATA	4.35E-06
RB 88	NO DATA	4.98E-07	2.73E-07	NO DATA	NO DATA	NO DATA	4.85E-07
RB 89	NO DATA	2.86E-07	1.97E-07	NO DATA	NO DATA	NO DATA	9.74E-08
SR 89	2.51E-03	NO DATA	7.20E-05	NO DATA	NO DATA	NO DATA	5.16E-05
SR 90	1.85E-02	NO DATA	4.71E-03	NO DATA	NO DATA	NO DATA	2.31E-04
SR 91	5.00E-05	NO DATA	1.81E-06	NO DATA	NO DATA	NO DATA	5.92E-05
SR 92	1.92E-05	NO DATA	7.13E-07	NO DATA	NO DATA	NO DATA	2.07E-04
Y 90	8.69E-08	NO DATA	2.33E-09	NO DATA	NO DATA	NO DATA	1.20E-04
Y 91M	8.10E-10	NO DATA	2.76E-11	NO DATA	NO DATA	NO DATA	2.70E-06
Y 91	1.13E-06	NO DATA	3.01E-08	NO DATA	NO DATA	NO DATA	8.10E-05
Y 92	7.65E-09	NO DATA	2.15E-10	NO DATA	NO DATA	NO DATA	1.46E-04

* Reference 3, Table E-14.

TABLE 2.2-5 CONT'D

INGESTION DOSE FACTORS FOR INFANT*

(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	2.43E-08	NO DATA	6.62E-10	NO DATA	NO DATA	NO DATA	1.92E-04
ZR 95	2.06E-07	5.02E-08	3.56E-08	NO DATA	5.41E-08	NO DATA	2.50E-05
ZR 97	1.48E-08	2.54E-09	1.16E-09	NO DATA	2.56E-09	NO DATA	1.62E-04
NB 95	4.20E-08	1.73E-08	1.00E-08	NO DATA	1.74E-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
TC101	2.27E-09	2.86E-09	2.83E-08	NO DATA	3.40E-08	1.56E-09	4.86E-07
RU103	1.48E-06	NO DATA	4.95E-07	NO DATA	3.08E-06	NO DATA	1.80E-05
RU105	1.36E-07	NO DATA	4.58E-08	NO DATA	1.00E-06	NO DATA	5.41E-05
RU106	2.41E-05	NO DATA	3.01E-06	NO DATA	2.85E-05	NO DATA	1.83E-04
AG110M	9.96E-07	7.27E-07	4.81E-07	NO DATA	1.04E-06	NO DATA	3.77E-05
TE125M	2.33E-05	7.79E-06	3.15E-06	7.84E-06	NO DATA	NO DATA	1.11E-05
TE127M	5.85E-05	1.94E-05	7.08E-06	1.69E-05	1.44E-04	NO DATA	2.36E-05
TE127	1.00E-06	3.35E-07	2.15E-07	8.14E-07	2.44E-06	NO DATA	2.10E-05
TE129M	1.00E-04	3.43E-05	1.54E-05	3.84E-05	2.50E-04	NO DATA	5.97E-05
TE129	2.84E-07	9.79E-08	6.63E-08	2.38E-07	7.07E-07	NO DATA	2.27E-05
TE131M	1.52E-05	6.12E-06	5.05E-06	1.24E-05	4.21E-05	NO DATA	1.03E-04
TE131	1.76E-07	6.50E-08	4.94E-08	1.57E-07	4.50E-07	NO DATA	7.11E-06
TE132	2.08E-05	1.03E-05	9.61E-06	1.52E-05	6.44E-05	NO DATA	3.81E-05
I 130	6.00E-06	1.32E-05	5.30E-06	1.48E-03	1.45E-05	NO DATA	2.83E-06
I 131	3.59E-05	4.23E-05	1.86E-05	1.39E-02	4.94E-05	NO DATA	1.51E-06
I 132	1.66E-06	3.37E-06	1.20E-06	1.58E-04	3.76E-06	NO DATA	2.73E-06
I 133	1.25E-05	1.82E-05	5.33E-06	3.31E-03	2.14E-05	NO DATA	3.08E-06
I 134	8.69E-07	1.78E-06	6.33E-07	4.15E-05	1.99E-06	NO DATA	1.84E-06
I 135	3.64E-06	7.24E-06	2.64E-06	6.49E-04	8.07E-06	NO DATA	2.62E-06
CS134	3.77E-04	7.03E-04	7.10E-05	NO DATA	1.81E-04	7.42E-05	1.91E-06
CS136	4.59E-05	1.35E-04	5.04E-05	NO DATA	5.38E-05	1.10E-05	2.05E-06
CS137	5.22E-04	6.11E-04	4.33E-05	NO DATA	1.64E-04	6.64E-05	1.91E-06
CS138	4.81E-07	7.82E-07	3.79E-07	NO DATA	3.90E-07	6.09E-08	1.25E-06
BA139	8.81E-07	5.84E-10	2.55E-08	NO DATA	3.51E-10	3.54E-10	5.58E-05

TABLE 2.2-5 CONT'D

INGESTION DOSE FACTORS FOR INFANT*

(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA140	1.71E-04	1.71E-07	8.81E-06	NO DATA	4.06E-08	1.05E-07	4.20E-05
BA141	4.25E-07	2.91E-10	1.34E-08	NO DATA	1.75E-10	1.77E-10	5.19E-06
BA142	1.84E-07	1.53E-10	9.06E-09	NO DATA	8.81E-11	9.26E-11	7.59E-07
LA140	2.11E-08	8.32E-09	2.14E-09	NO DATA	NO DATA	NO DATA	9.77E-05
LA142	1.10E-09	4.04E-10	9.67E-11	NO DATA	NO DATA	NO DATA	6.86E-05
CE141	7.87E-08	4.80E-08	5.65E-09	NO DATA	1.48E-08	NO DATA	2.48E-05
CE143	1.48E-08	9.82E-06	1.17E-09	NO DATA	2.96E-09	NO DATA	5.73E-05
CE144	2.98E-06	1.22E-06	1.67E-07	NO DATA	4.93E-07	NO DATA	1.71E-04
PR143	8.13E-08	3.04E-08	4.03E-09	NO DATA	1.13E-08	NO DATA	4.29E-05
PR144	2.74E-10	1.06E-10	1.38E-11	NO DATA	3.84E-11	NO DATA	4.93E-06
ND147	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	3.59E-05
NP239	1.11E-08	9.93E-10	5.61E-10	NO DATA	1.98E-09	NO DATA	2.87E-05

TABLE 2.2-6

INGESTION DOSE FACTORS FOR CHILD*

(MREM PER PCI INGESTED)

Page 1 of 3

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	8.75E-04	3.86E-05	3.18E-05	NO DATA	NO DATA	NO DATA	2.28E-05
CR 51	NO DATA	NO DATA	8.90E-09	4.94E-09	1.35E-09	9.02E-09	4.72E-07
MN 54	NO DATA	1.07E-05	2.85E-06	NO DATA	3.00E-06	NO DATA	8.98E-06
MN 56	NO DATA	3.34E-07	7.54E-08	NO DATA	4.04E-07	NO DATA	4.84E-05
FE 55	1.15E-05	6.10E-06	1.89E-06	NO DATA	NO DATA	3.45E-06	1.13E-06
FE 59	1.65E-05	2.67E-05	1.33E-05	NO DATA	NO DATA	7.74E-06	2.78E-05
CO 58	NO DATA	1.80E-06	5.51E-06	NO DATA	NO DATA	NO DATA	1.05E-05
CO 60	NO DATA	5.29E-06	1.56E-05	NO DATA	NO DATA	NO DATA	2.93E-05
NI 63	5.38E-04	2.88E-05	1.83E-05	NO DATA	NO DATA	NO DATA	1.94E-06
NI 65	2.22E-06	2.09E-07	1.22E-07	NO DATA	NO DATA	NO DATA	2.56E-05
CU 64	NO DATA	2.45E-07	1.48E-07	NO DATA	5.92E-07	NO DATA	1.15E-05
ZN 65	1.37E-05	3.65E-05	2.27E-05	NO DATA	2.30E-05	NO DATA	6.41E-06
ZN 69	4.38E-08	6.33E-08	5.85E-09	NO DATA	3.84E-08	NO DATA	3.99E-06
BR 83	NO DATA	NO DATA	1.71E-07	NO DATA	NO DATA	NO DATA	LT E-24
BR 84	NO DATA	NO DATA	1.98E-07	NO DATA	NO DATA	NO DATA	LT E-24
BR 85	NO DATA	NO DATA	9.12E-09	NO DATA	NO DATA	NO DATA	LT E-24
RB 86	NO DATA	6.70E-05	4.12E-05	NO DATA	NO DATA	NO DATA	4.31E-06
RB 88	NO DATA	1.90E-07	1.32E-07	NO DATA	NO DATA	NO DATA	9.32E-09
RB 89	NO DATA	1.17E-07	1.04E-07	NO DATA	NO DATA	NO DATA	1.02E-09
SR 89	1.32E-03	NO DATA	3.77E-05	NO DATA	NO DATA	NO DATA	5.11E-05
SR 90	1.70E-02	NO DATA	4.31E-03	NO DATA	NO DATA	NO DATA	2.29E-04
SR 91	2.40E-05	NO DATA	9.06E-07	NO DATA	NO DATA	NO DATA	5.30E-05
SR 92	9.03E-06	NO DATA	3.62E-07	NO DATA	NO DATA	NO DATA	1.71E-04
Y 90	4.11E-08	NO DATA	1.10E-09	NO DATA	NO DATA	NO DATA	1.17E-04
Y 91M	3.82E-10	NO DATA	1.39E-11	NO DATA	NO DATA	NO DATA	7.48E-07
Y 91	6.02E-07	NO DATA	1.61E-08	NO DATA	NO DATA	NO DATA	8.02E-05
Y 92	3.60E-09	NO DATA	1.03E-10	NO DATA	NO DATA	NO DATA	1.04E-04

* Reference 3, Table E-13.

INGESTION DOSE FACTORS FOR CHILD*

(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	1.14E-08	NO DATA	3.13E-10	NO DATA	NO DATA	NO DATA	1.70E-04
ZR 95	1.16E-07	2.55E-08	2.27E-08	NO DATA	3.65E-08	NO DATA	2.66E-05
ZR 97	6.99E-09	1.01E-09	5.96E-10	NO DATA	1.45E-09	NO DATA	1.53E-04
NB 95	2.25E-08	8.76E-09	6.26E-09	NO DATA	8.23E-09	NO DATA	1.62E-05
MO 99	NO DATA	1.33E-05	3.29E-06	NO DATA	2.84E-05	NO DATA	1.10E-05
TC 99M	9.23E-10	1.81E-09	3.00E-08	NO DATA	2.63E-08	9.19E-10	1.03E-06
TC101	1.07E-09	1.12E-09	1.42E-08	NO DATA	1.91E-08	5.92E-10	3.56E-09
RU103	7.31E-07	NO DATA	2.81E-07	NO DATA	1.84E-06	NO DATA	1.89E-05
RU105	6.45E-08	NO DATA	2.34E-08	NO DATA	5.67E-07	NO DATA	4.21E-05
RU106	1.17E-05	NO DATA	1.46E-06	NO DATA	1.58E-05	NO DATA	1.82E-04
AG110M	5.39E-07	3.64E-07	2.91E-07	NO DATA	6.78E-07	NO DATA	4.33E-05
TE125M	1.14E-05	3.09E-06	1.52E-06	3.20E-06	NO DATA	NO DATA	1.10E-05
TE127M	2.89E-05	7.78E-06	3.43E-06	6.91E-06	8.24E-05	NO DATA	2.34E-05
TE127	4.71E-07	1.27E-07	1.01E-07	3.26E-07	1.34E-06	NO DATA	1.84E-05
TE129M	4.87E-05	1.36E-05	7.56E-06	1.57E-05	1.43E-04	NO DATA	5.94E-05
TE129	1.34E-07	3.74E-08	3.18E-08	9.56E-08	3.92E-07	NO DATA	8.34E-06
TE131M	7.20E-06	2.49E-06	2.65E-06	5.12E-06	2.41E-05	NO DATA	1.01E-04
TE131	8.30E-08	2.53E-08	2.47E-08	6.35E-08	2.51E-07	NO DATA	4.36E-07
TE132	1.01E-05	4.47E-06	5.40E-06	6.51E-06	4.15E-05	NO DATA	4.50E-05
I 130	2.92E-06	5.90E-06	3.04E-06	6.50E-04	8.82E-06	NO DATA	2.76E-06
I 131	1.72E-05	1.73E-05	9.83E-06	5.72E-03	2.84E-05	NO DATA	1.54E-06
I 132	8.00E-07	1.47E-06	6.76E-07	6.82E-05	2.25E-06	NO DATA	1.73E-06
I 133	5.92E-06	7.32E-06	2.77E-06	1.36E-03	1.22E-05	NO DATA	2.95E-06
I 134	4.19E-07	7.78E-07	3.58E-07	1.79E-05	1.19E-06	NO DATA	5.16E-07
I 135	1.75E-06	3.15E-06	1.49E-06	2.79E-04	4.83E-06	NO DATA	2.40E-06
CS134	2.34E-04	3.84E-04	8.10E-05	NO DATA	1.19E-04	4.27E-05	2.07E-06
CS136	2.35E-05	6.46E-05	4.18E-05	NO DATA	3.44E-05	5.13E-06	2.27E-06
CS137	3.27E-04	3.13E-04	4.62E-05	NO DATA	1.02E-04	3.67E-05	1.96E-06
CS138	2.28E-07	3.17E-07	2.01E-07	NO DATA	2.23E-07	2.40E-08	1.46E-07
BA139	4.14E-07	2.21E-10	1.20E-08	NO DATA	1.93E-10	1.30E-10	2.39E-05

INGESTION DOSE FACTORS FOR CHILD*

(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA140	8.31E-05	7.28E-08	4.85E-06	NO DATA	2.37E-08	4.34E-08	4.21E-05
BA141	2.00E-07	1.12E-10	6.51E-09	NO DATA	9.69E-11	6.58E-10	1.14E-07
BA142	8.74E-08	6.29E-11	4.88E-09	NO DATA	5.09E-11	3.70E-11	1.14E-09
LA140	1.01E-08	3.53E-09	1.19E-09	NO DATA	NO DATA	NO DATA	9.84E-05
LA142	5.24E-10	1.67E-10	5.23E-11	NO DATA	NO DATA	NO DATA	3.31E-05
CE141	3.97E-08	1.98E-08	2.94E-09	NO DATA	8.68E-09	NO DATA	2.47E-05
CE143	6.99E-09	3.79E-06	5.49E-10	NO DATA	1.59E-09	NO DATA	5.55E-05
CE144	2.08E-06	6.52E-07	1.11E-07	NO DATA	3.61E-07	NO DATA	1.70E-04
PR143	3.93E-08	1.18E-08	1.95E-09	NO DATA	6.39E-09	NO DATA	4.24E-05
PR144	1.29E-10	3.97E-11	6.47E-12	NO DATA	2.11E-11	NO DATA	8.59E-08
ND147	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
NP239	5.25E-09	3.77E-10	2.65E-10	NO DATA	1.09E-09	NO DATA	2.79E-05

TABLE 2.2-7

INGESTION DOSE FACTORS FOR TEENAGER*

(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07
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	2.60E-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	3.67E-10	NO DATA	NO DATA	NO DATA	1.13E-04
Y 91M	1.29E-10	NO DATA	4.93E-12	NO DATA	NO DATA	NO DATA	6.09E-09
Y 91	2.01E-07	NO DATA	5.39E-09	NO DATA	NO DATA	NO DATA	8.24E-05
Y 92	1.21E-09	NO DATA	3.50E-11	NO DATA	NO DATA	NO DATA	3.32E-05

* Reference 3, Table E-12.

TABLE 2.2-7 CONT'D

INGESTION DOSE FACTORS FOR TEENAGER*

(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	3.83E-09	NO DATA	1.05E-10	NO DATA	NO DATA	NO DATA	1.17E-04
ZR 95	4.12E-08	1.30E-08	8.94E-09	NO DATA	1.91E-08	NO DATA	3.00E-05
ZR 97	2.37E-09	4.69E-10	2.16E-10	NO DATA	7.11E-10	NO DATA	1.27E-04
NB 95	8.22E-09	4.56E-09	2.51E-09	NO DATA	4.42E-09	NO DATA	1.95E-05
MO 99	NO DATA	6.03E-06	1.15E-06	NO DATA	1.38E-05	NO DATA	1.08E-05
TC 99M	3.32E-10	9.26E-10	1.20E-08	NO DATA	1.38E-08	5.14E-10	6.08E-07
TC101	3.60E-10	5.12E-10	5.03E-09	NO DATA	9.26E-09	3.12E-10	8.75E-17
RU103	2.55E-07	NO DATA	1.09E-07	NO DATA	8.99E-07	NO DATA	2.13E-05
RU105	2.18E-08	NO DATA	8.46E-09	NO DATA	2.75E-07	NO DATA	1.76E-05
RU106	3.92E-06	NO DATA	4.94E-07	NO DATA	7.56E-06	NO DATA	1.88E-04
AG110M	2.05E-07	1.94E-07	1.18E-07	NO DATA	3.70E-07	NO DATA	5.45E-05
TE125M	3.83E-06	1.38E-06	5.12E-07	1.07E-06	NO DATA	NO DATA	1.13E-05
TE127M	9.67E-06	3.43E-06	1.15E-06	2.30E-06	3.92E-05	NO DATA	2.41E-05
TE127	1.58E-07	5.60E-08	3.40E-08	1.09E-07	6.40E-07	NO DATA	1.22E-05
TE129M	1.63E-05	6.05E-06	2.58E-06	5.26E-06	6.82E-05	NO DATA	6.12E-05
TE129	4.48E-08	1.67E-08	1.07E-08	3.20E-08	1.88E-07	NO DATA	2.45E-07
TE131M	2.44E-06	1.17E-06	9.76E-07	1.76E-06	1.22E-05	NO DATA	9.39E-05
TE131	2.79E-08	1.15E-08	8.72E-09	2.15E-08	1.22E-07	NO DATA	2.29E-09
TE132	3.49E-06	2.21E-06	2.06E-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
I 135	6.10E-07	1.57E-06	5.82E-07	1.01E-04	2.48E-06	NO DATA	1.74E-06
CS134	8.37E-05	1.97E-04	9.14E-05	NO DATA	6.26E-05	2.39E-05	2.45E-06
CS136	8.59E-06	3.38E-05	2.27E-05	NO DATA	1.84E-05	2.90E-06	2.72E-06
CS137	1.12E-04	1.49E-04	5.19E-05	NO DATA	5.07E-05	1.97E-05	2.12E-06
CS138	7.76E-08	1.49E-07	7.45E-08	NO DATA	1.10E-07	1.28E-08	6.76E-11
BA139	1.39E-07	9.78E-11	4.05E-09	NO DATA	9.22E-11	6.74E-11	1.24E-06

TABLE 2.2-7 CONT'D

INGESTION DOSE FACTORS FOR TEENAGER*

(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA140	2.84E-05	3.48E-08	1.83E-06	NO DATA	1.18E-08	2.34E-08	4.38E-05
BA141	6.71E-08	5.01E-11	2.24E-09	NO DATA	4.65E-11	3.43E-11	1.43E-13
BA142	2.99E-08	2.99E-11	1.84E-09	NO DATA	2.53E-11	1.99E-11	9.18E-20
LA140	3.48E-09	1.71E-09	4.55E-10	NO DATA	NO DATA	NO DATA	9.82E-05
LA142	1.79E-10	7.95E-11	1.98E-11	NO DATA	NO DATA	NO DATA	2.42E-06
CE141	1.33E-08	8.88E-09	1.02E-09	NO DATA	4.18E-09	NO DATA	2.54E-05
CE143	2.35E-09	1.71E-06	1.91E-10	NO DATA	7.67E-10	NO DATA	5.14E-05
CE144	6.96E-07	2.88E-07	3.74E-08	NO DATA	1.72E-07	NO DATA	1.75E-04
PR143	1.31E-08	5.23E-09	6.52E-10	NO DATA	3.04E-09	NO DATA	4.31E-05
PR144	4.30E-11	1.76E-11	2.18E-12	NO DATA	1.01E-11	NO DATA	4.74E-14
ND147	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
NP239	1.76E-09	1.66E-10	9.22E-11	NO DATA	5.21E-10	NO DATA	2.67E-05

TABLE 2.2-8

INGESTION DOSE FACTORS FOR ADULTS*

(MREM PER PCI INGESTED)

Page 1 of 3

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

* Reference 3, Table E-11.

TABLE 2.2-8 CONT'D

INGESTION DOSE FACTORS FOR ADULTS*

(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	2.68E-09	NO DATA	7.40E-11	NO DATA	NO DATA	NO DATA	8.50E-05
ZR 95	3.04E-08	9.75E-09	6.60E-09	NO DATA	1.53E-08	NO DATA	3.09E-05
ZR 97	1.68E-09	3.39E-10	1.55E-10	NO DATA	5.12E-10	NO DATA	1.05E-04
NB 95	6.22E-09	3.46E-09	1.86E-09	NO DATA	3.42E-09	NO DATA	2.10E-05
MO 99	NO DATA	4.31E-06	8.20E-07	NO DATA	9.76E-06	NO DATA	9.99E-06
TC 99M	2.47E-10	6.98E-10	8.89E-09	NO DATA	1.06E-08	3.42E-10	4.13E-07
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	2.69E-06	9.71E-07	3.59E-07	8.06E-07	1.09E-05	NO DATA	1.07E-05
TE127M	6.77E-06	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-06	1.82E-06	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-06	7.53E-07	3.63E-04	4.31E-06	NO DATA	2.22E-06
I 134	1.06E-07	2.88E-07	1.03E-07	4.99E-06	4.58E-07	NO DATA	2.51E-10
I 135	4.43E-07	1.16E-06	4.28E-07	7.65E-05	1.86E-06	NO DATA	1.31E-06
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	2.84E-09	NO DATA	6.46E-11	3.92E-11	1.72E-07

TABLE 2.2-8 CONT'D

INGESTION DOSE FACTORS FOR ADULTS*

(MREM PER PCI INGESTED)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
BA140	3.03E-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

TABLE 2.2-9

EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND*

(mrem/hr per pci/m^2)

ELEMENT	TOTAL BODY	SKIN
H-3	0.0	0.0
C-14	0.0	0.0
NA-24	2.50E-08	2.90E-08
P-32	0.0	0.0
Cr-51	2.20E-10	2.60E-10
Mn-54	5.80E-09	6.80E-09
Mn-56	1.10E-08	1.30E-08
Fe-55	0.0	0.0
Fe-59	8.00E-09	9.40E-09
Co-58	7.00E-09	8.20E-09
Co-60	1.70E-08	2.00E-08
Ni-63	0.0	0.0
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	[illegible]0E-08
Sr-89	5.60E-13	6.50E-13
Sr-91	7.10E-09	8.30E-09
Sr-92	9.00E-09	1.00E-08
Y-90	2.20E-12	2.60E-12
Y-91M	3.80E-09	4.40E-09
Y-91	2.40E-11	2.70E-11
Y-92	1.60E-09	1.90E-09
Y-93	5.70E-10	7.80E-10
Zr-95	5.00E-09	5.80E-09
Zr-97	5.50E-09	6.40E-09
Nb-95	5.10E-09	6.00E-09
Mo-99	1.90E-09	2.20E-09
Tc-99M	9.60E-10	1.10E-09
Tc-101	2.70E-09	3.00E-09
Ru-103	3.60E-09	4.20E-09
Ru-105	4.50E-09	5.10E-09
Ru-106	1.50E-09	1.80E-09
Ag-110M	1.80E-08	2.10E-08
Te-125M	3.50E-11	4.80E-11
Te-127M	1.10E-12	1.30E-12
Te-127	1.00E-11	1.10E-11
Te-129M	7.70E-10	9.00E-10
Te-129	7.10E-10	8.40E-10

*Reference 3, Table E-6

TABLE 2.2-9 (Continued)

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

TABLE 2.2-10

INDIVIDUAL USAGE FACTORS*

	INFANT	CHILD	TEENAGER	ADULT
Milk Consumption Rate, U_{ap} (liters/year)	330	330	400	310
Meat Consumption Rate, U_{ap} (kg/year)	0	41	65	110
Fresh Leafy Vegetation Consumption Rate, $U_{a\ell}$ (kg/year)	0	26	42	64
Stored Vegetation Consumption Rate, U_{as} (kg/year)	0	520	630	520
Breathing Rate (m^3/year)	1400	3700	8000	8000

*Reference 3, Table E-5.

TABLE 2.2-11

STABLE ELEMENT TRANSFER DATA*

ELEMENT	F_m - MILK (COW)	F_m - MILK (GOAT)	F_f - MEAT
H	1.0E-02	1.7E-01	1.2E-02
C	1.2E-02	1.0E-01	3.1E-02
Na	4.0E-02	4.0E-02	3.0E-02
P	2.5E-02	2.5E-01	4.6E-02
Cr	2.2E-03	2.2E-03	2.4E-03
Mn	2.5E-04	2.5E-04	8.0E-04
Fe	1.2E-03	1.3E-04	4.0E-02
Co	1.0E-03	1.0E-03	1.3E-02
Ni	6.7E-03	6.7E-03	5.3E-02
Cu	1.4E-02	1.3E-02	8.0E-03
Zn	3.9E-02	3.9E-02	3.0E-02
Rb	3.0E-02	3.0E-02	3.1E-02
Sr	8.0E-04	1.4E-02	6.0E-04
Y	1.0E-05	1.0E-05	4.6E-03
Zr	5.0E-06	5.0E-06	3.4E-02
Nb	2.5E-03	2.5E-03	2.8E-01
Mo	7.5E-03	7.5E-03	8.0E-03
Tc	2.5E-02	2.5E-02	4.0E-01
Ru	1.0E-06	1.0E-06	4.0E-01
Rh	1.0E-02	1.0E-02	1.5E-03
Ag	5.0E-02	5.0E-02	1.7E-02
Te	1.0E-03	1.0E-03	7.7E-02
I	6.0E-03	6.0E-02	2.9E-03
Cs	1.2E-02	3.0E-02	4.0E-03
Ba	4.0E-04	4.0E-04	3.2E-03
La	5.0E-06	5.0E-06	2.0E-04
Ce	1.0E-04	1.0E-04	1.2E-03
Pr	5.0E-06	5.0E-06	4.7E-03
Nd	5.0E-06	5.0E-06	3.3E-03
W	5.0E-04	5.0E-04	1.3E-03
Np	5.0E-06	5.0E-06	2.0E-04

*References 3, Table E-1.

2.3 METEOROLOGICAL MODEL

2.3.1 ATMOSPHERIC DISPERSION

Atmospheric dispersion for releases is calculated using a mixed-mode form of the straight line flow Gaussian model.

X/Q = average atmospheric dispersion (sec/m^3) for a given wind direction (sector) and distance.

$$= 2.03\,\delta\,K \sum_{jk} \left\{ \frac{n_{jk}}{Nr} \left[\frac{E}{u_{jk}\Sigma_j} + \frac{(1-E)}{U_{jk}\sigma_j} \exp\left(-1/2\,(h/\sigma_j)^2\right) \right] \right\}$$

2.03 = $(2/\pi)^{1/2}$ divided by the width in radians of a 22.5° sector (0.3927 radians).

n_{jk} = number of hours meteorological conditions are observed to be in a given wind direction, windspeed class k, and atmospheric stability class j.

NOTE: If periodic data (hourly) are used instead of the joint frequency data, all variable subscripts are dropped, the $n_{j,k}$ is set equal to 1 and the hourly averaged meteorological variables are entered into the model.

N = total hours of valid meteorological data throughout the period of effluent release.

r = distance from the release point to location of interest (meters)

u_{jk} = wind speed (midpoint of windspeed class k) measured at the 10 meter level (m/sec) during atmospheric stability class j

U_{jk} = wind speed extrapolated to the effective release height using the wind power law with the site-specific wind power law exponent.

Σ_j = the lesser of $\begin{bmatrix} (\sigma_j^2 + b^2/2\pi)^{1/2} \\ \text{or} \\ (\sqrt{3}\,\sigma_j) \end{bmatrix}$ where

σ_j = vertical standard deviation of the plume (meters) at distance r for releases under the stability category j indicated by ΔT, from Figure 2.3-1.

K = terrain recirculation factor from Table 2.3-1.

δ = plume depletion factor (radiciodines and particulates) at distance r for the applicable stability class. Normally a factor of 1 is assumed or, if appropriate, may be obtained from one of Figures 2.3-2 through 2.3-5.

π = 3.1416

b = maximum height of adjacent building either upwind or downwind from the release point.

ΔT = vertical temperature gradient (°C/100m).

E = fraction considered as ground level releases

$$E = \begin{cases} 1.0 & \text{for } \frac{W_o}{u} \le 1.0 \\ 2.58 - 1.58 \left(\frac{W_o}{u}\right) & \text{for } 1.0 < \frac{W_o}{u} \le 1.5 \\ 0.3 - 0.06 \left(\frac{W_o}{u}\right) & \text{for } 1.5 < \frac{W_o}{u} \le 5.0 \\ 0 & \text{for } \frac{W_o}{u} > 5.0 \end{cases}$$

W_o = vertical exit velocity from the vent.

u = horizontal wind speed at the point of release.

h = effective height of release (m)

$h = h_v + h_{pr} - c_v$

h_v = height of release point

h_{pr} = additional height due to plume rise (m):
for neutral or unstable conditions ($\Delta T < -0.5$ °C/100m)

h_{pr} = the lesser of

$$1.44 \left(\frac{W_o}{u}\right)^{2/3} \left(\frac{r}{d}\right)^{1/3} d$$

or

$$3 \frac{W_o}{u} d$$

for stable conditions ($\Delta T \geq -0.5$ °C/100m):

h_{pr} = the lesser of

$$4 \left(\frac{F'_m}{S}\right)^{1/4}$$

or

$$1.5 \left(\frac{F'_m}{u}\right)^{1/3} S^{-1/6}$$

or

h_{pr} for neutral or unstable conditions (in the event that h_{pr} for neutral or unstable conditions is less than h_{pr} for stable conditions)

d = diameter of plant vent

c_v = correction for low vent exit velocity (m)

$$c_v = \begin{cases} 3(1.5 - \frac{W_o}{u})\, d & \text{for } \frac{W_o}{u} \le 1.5 \\ 0 & \text{for } \frac{W_o}{u} > 1.5 \end{cases}$$

F_m' = momentum flux parameter (m^4/sec^2)

$F_m' = (W_o)^2 (d/2)^2$

S = restoring acceleration per unit displacement

$$S = \begin{cases} 8.75 \times 10^{-4}\ sec^{-2} & \text{for } -0.5 \le \Delta T < 1.5 \\ 1.75 \times 10^{-3}\ sec^{-2} & \text{for } 1.5 \le \Delta T < 4.0 \\ 2.45 \times 10^{-3}\ sec^{-2} & \text{for } \Delta T \ge 4.0 \end{cases}$$

2.3.2 RELATIVE DEPOSITION

Relative deposition per unit area is calculated for a mixed-mode release.

D/Q = relative deposition per unit area (m^{-2}), for a given wind direction and at a given distance.

$= \frac{2.55K}{r} [(E)(D_g) + (1 - E) D_e]$, where

D_g = relative deposition mode for the ground-level portion of mixed-mode releases from Figure 2.3-6.

D_e = relative deposition rate for the elevated portion of mixed-mode releases obtained from one of Figures 2.3-7 through 2.3-9.

2.55 = [radians per 22.5° Sector]$^{-1}$

	SITE BOUNDARY	(DISTANCE-METERS)	0.8km 0.5mi	1.2 km 0.75mi	1.6km 1.0mi	2.4km 1.5mi	3.2km 2 mi	4.0km 2.5mi	4.8km 3.0mi	5.6km 3.5mi	6.4km 4.0mi	7.2km 4.5mi	8.0km 5.0mi
N	1.13	(1249)	1.11	1.13	1.14	1.15	1.16	1.18	1.20	1.14	1.08	1.06	1.04
NNE	1.32	(1646)	1.23	1.27	1.32	1.35	1.34	1.40	1.39	1.35	1.32	1.29	1.26
SSE	1.58	(610)	1.61	1.67	1.73	1.79	1.76	1.69	1.66	1.51	1.44	1.46	1.37
S	1.57	(1417)	1.39	1.51	1.62	1.67	1.60	1.69	1.65	1.60	1.51	1.39	1.32
SSW	1.14	(1542)	1.07	1.11	1.14	1.21	1.25	1.24	1.28	1.24	1.15	1.07	1.01
SW	1.43	(1920)	1.31	1.35	1.40	1.48	1.56	1.61	1.10	1.59	1.57	1.53	1.46
WSW	1.25	(1798)	1.17	1.21	1.24	1.29	1.32	1.38	1.38	1.31	1.23	1.18	1.18
W	1.20	(1390)	1.12	1.18	1.23	1.30	1.34	1.32	1.38	1.38	1.31	1.23	1.27
WNW	1.08	(1082)	1.05	1.09	1.12	1.16	1.16	1.20	1.26	1.30	1.26	1.14	1.08
NW	1.18	(915)	1.16	1.22	1.27	1.29	1.26	1.40	1.44	1.41	1.34	1.27	1.26
NNW	1.35	(990)	1.34	1.36	1.37	1.40	1.43	1.49	1.64	1.57	1.44	1.34	1.27

Linear interpolation within a sector at distances lying between those shwon in the table is given by:

$$F_x = R_x \left(\frac{F_2 - F_1}{R_2 - R_1}\right) + \left(\frac{F_1 R_2 - F_2 R_1}{R_2 - R_1}\right)$$

Where R_x is that distance lying between the distances (R_1 & R_2) specified in the table. F_1 & F_2 are the values at these specified distances.

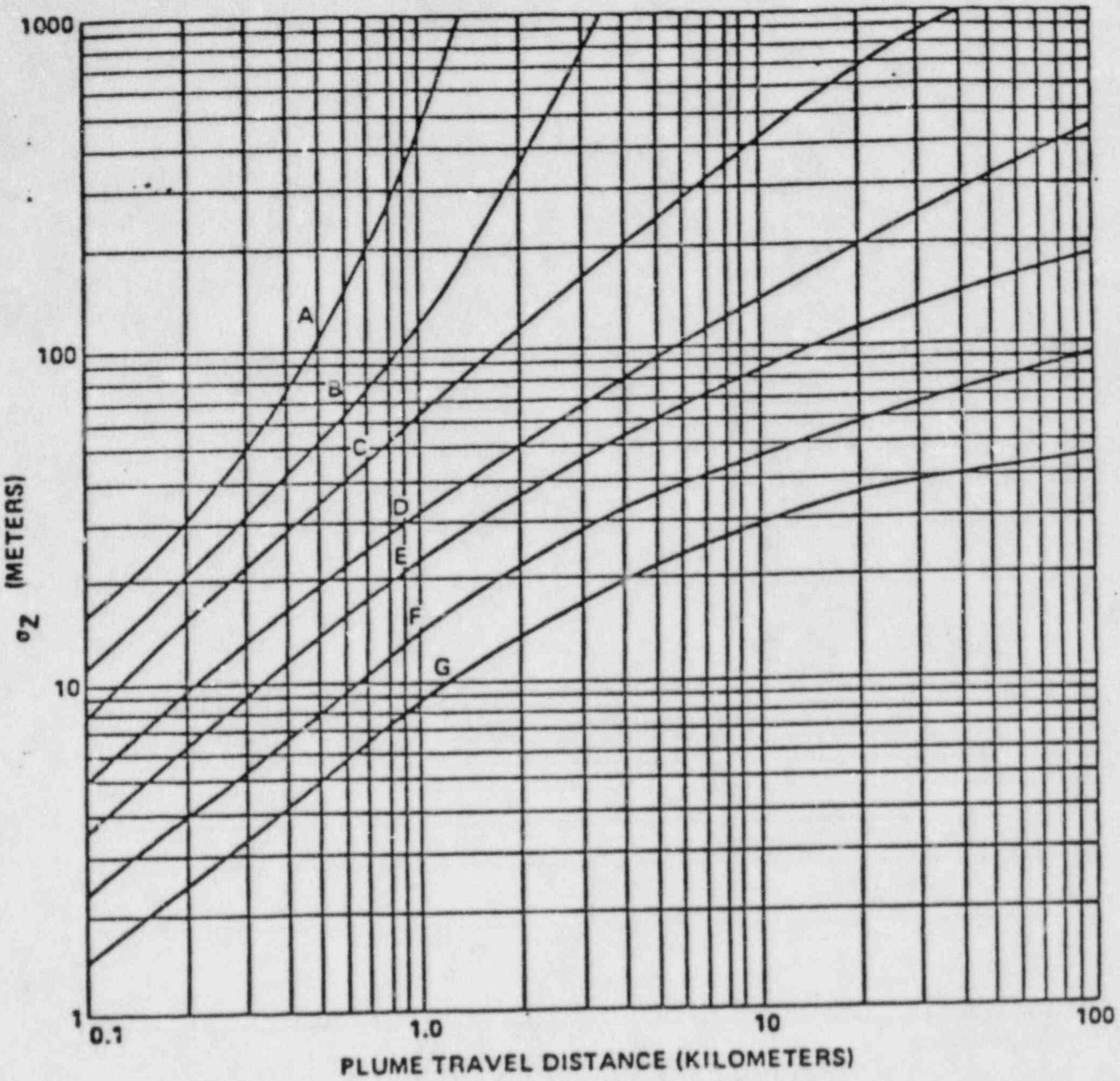
TABLE 2.3-1

Open Terrain Recirculation Factor

FIGURE 2.3-1

Vertical Standard Deviation of Material in a Plume (σ_Z)*

(Letters denote Pasquill Stability Class)



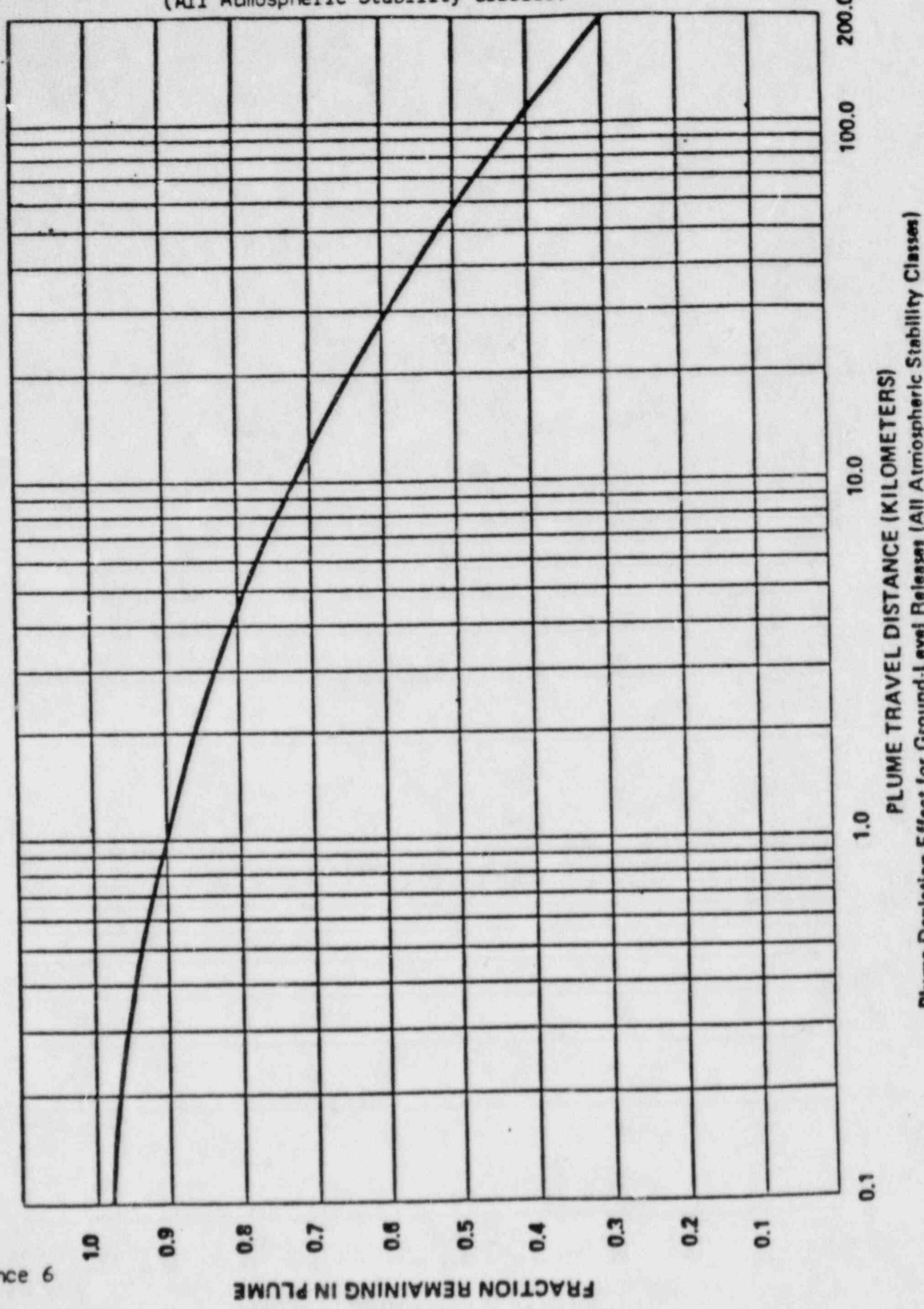
Temperature Change with Height ($\dot{T}$)(^{0}K/100m)	Pasquill Categories	Stability Classification
<-1.9	A	Extremely unstable
-1.9 to -1.7	B	Moderately unstable
-1.7 to -1.5	C	Slightly unstable
-1.5 to -0.5	D	Neutral
-0.5 to 1.5	E	Slightly stable
1.5 to 4.0	F	Moderately stable
> 4.0	G	Extremely stable

*Reference 6

FIGURE 2.3-2

Plume Depletion Effect for Ground-Level Releases*

(All Atmospheric Stability Classes)

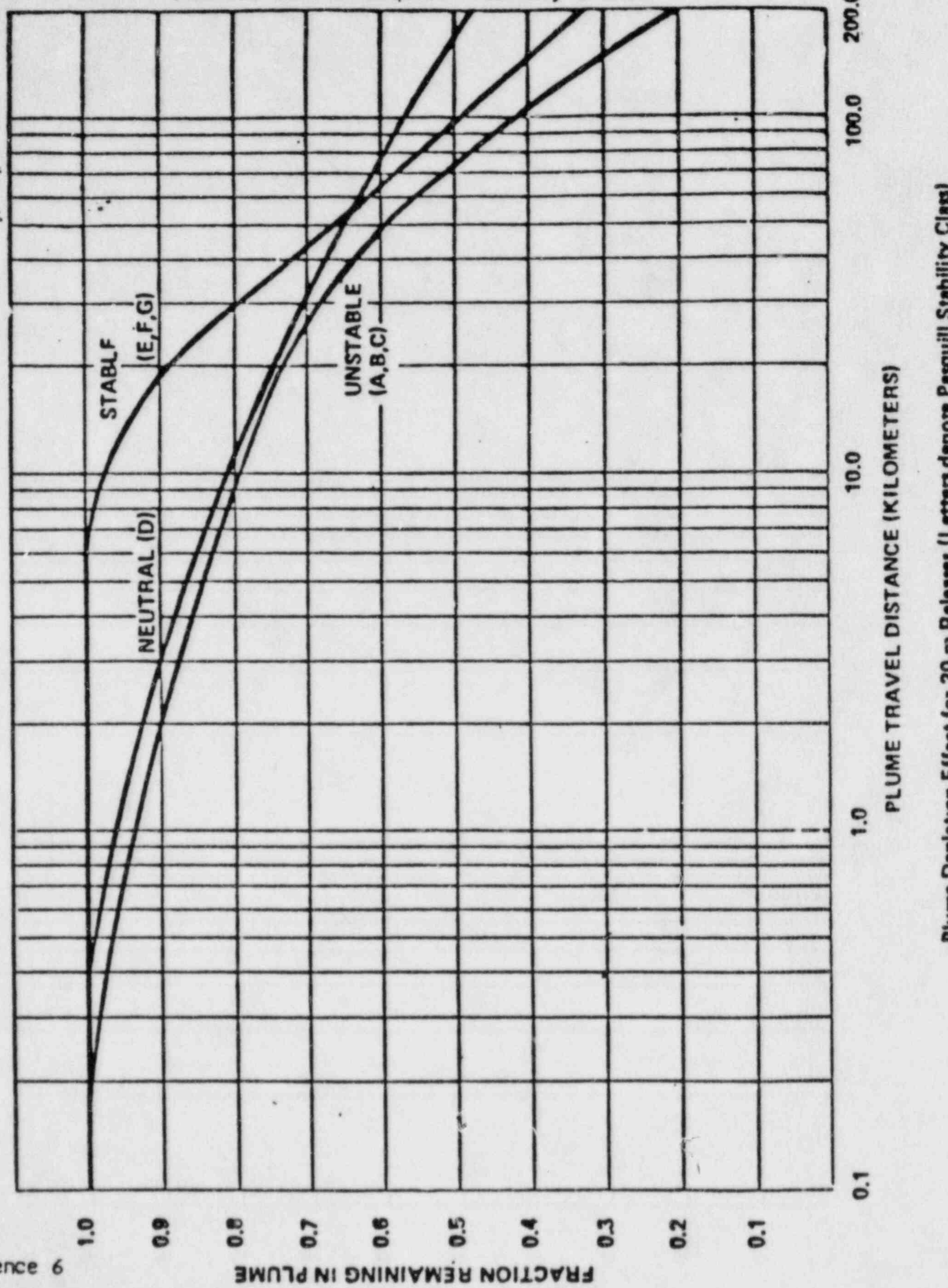


*Reference 6

FIGURE 2.3-3

Plume Depletion Effect for 30-m Releases*

(Letters denote Pasquill Stability Class)

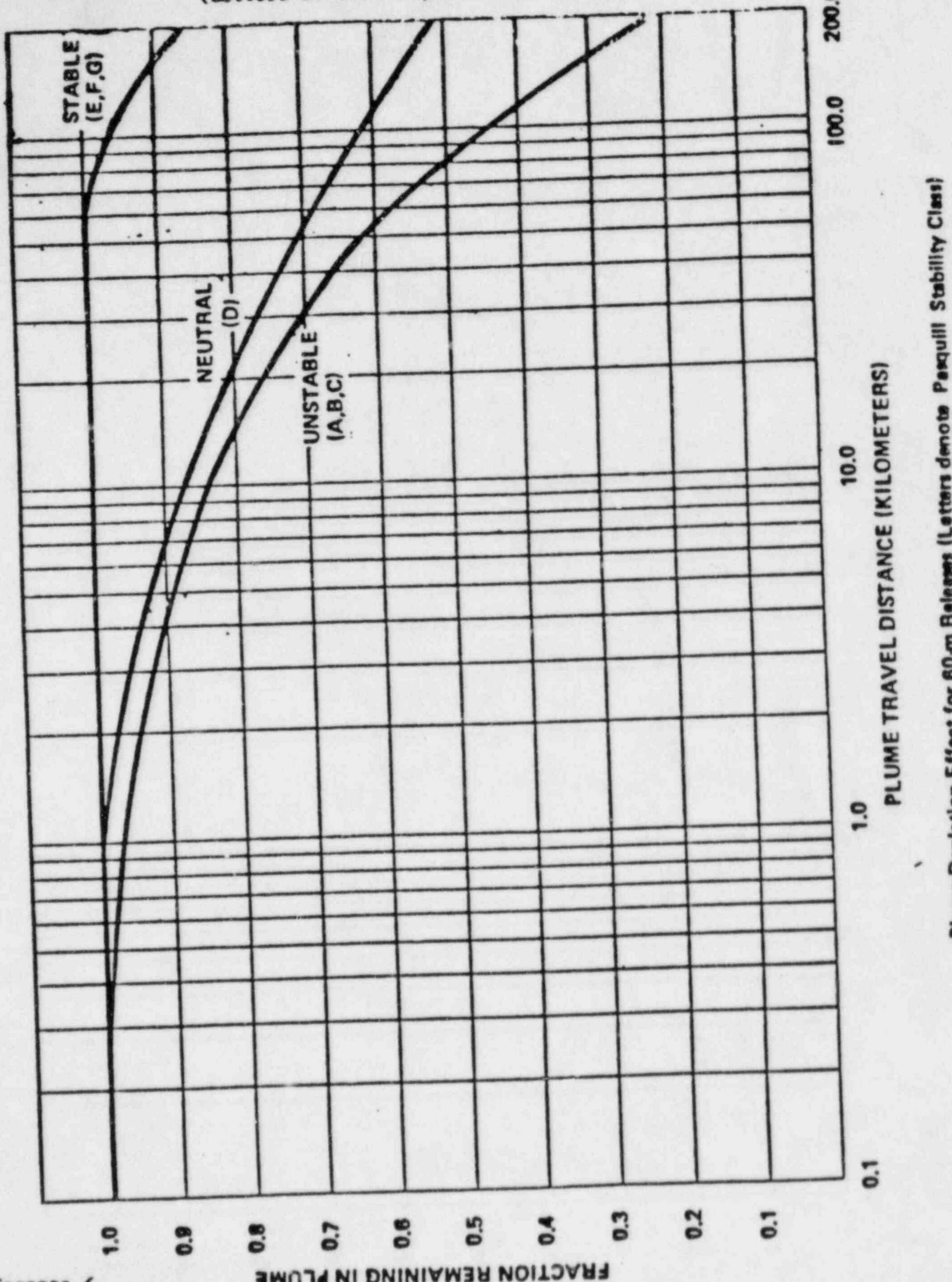


*Reference 6

FIGURE 2.3-4

Plume Depletion Effect for 60-m Releases*

(Letters denote Pasquill Stability Class)

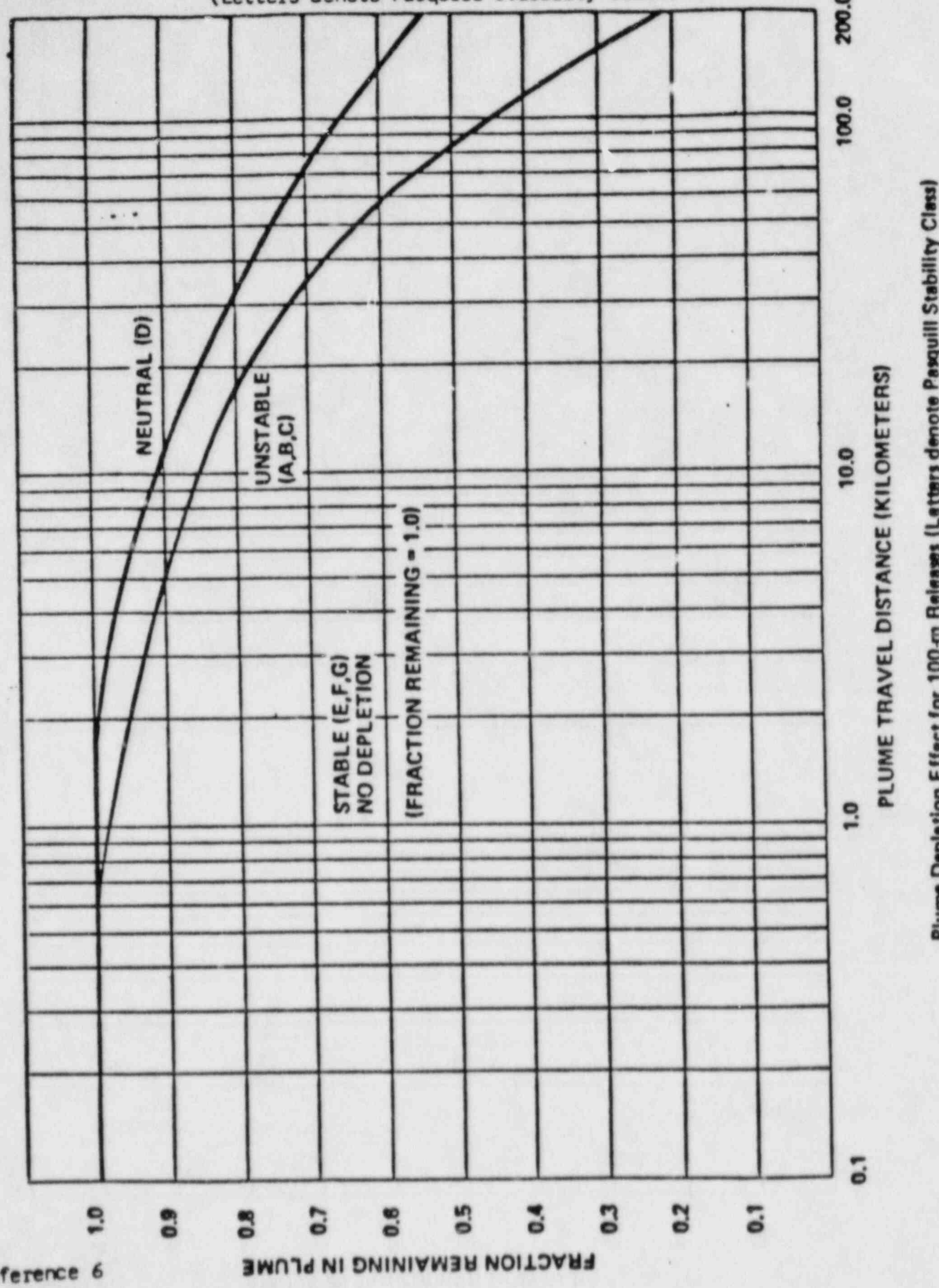


* Reference 6

FIGURE 2.3-5

Plume Depletion Effect for 100-m Releases*

(Letters denote Pasquill Stability Class)

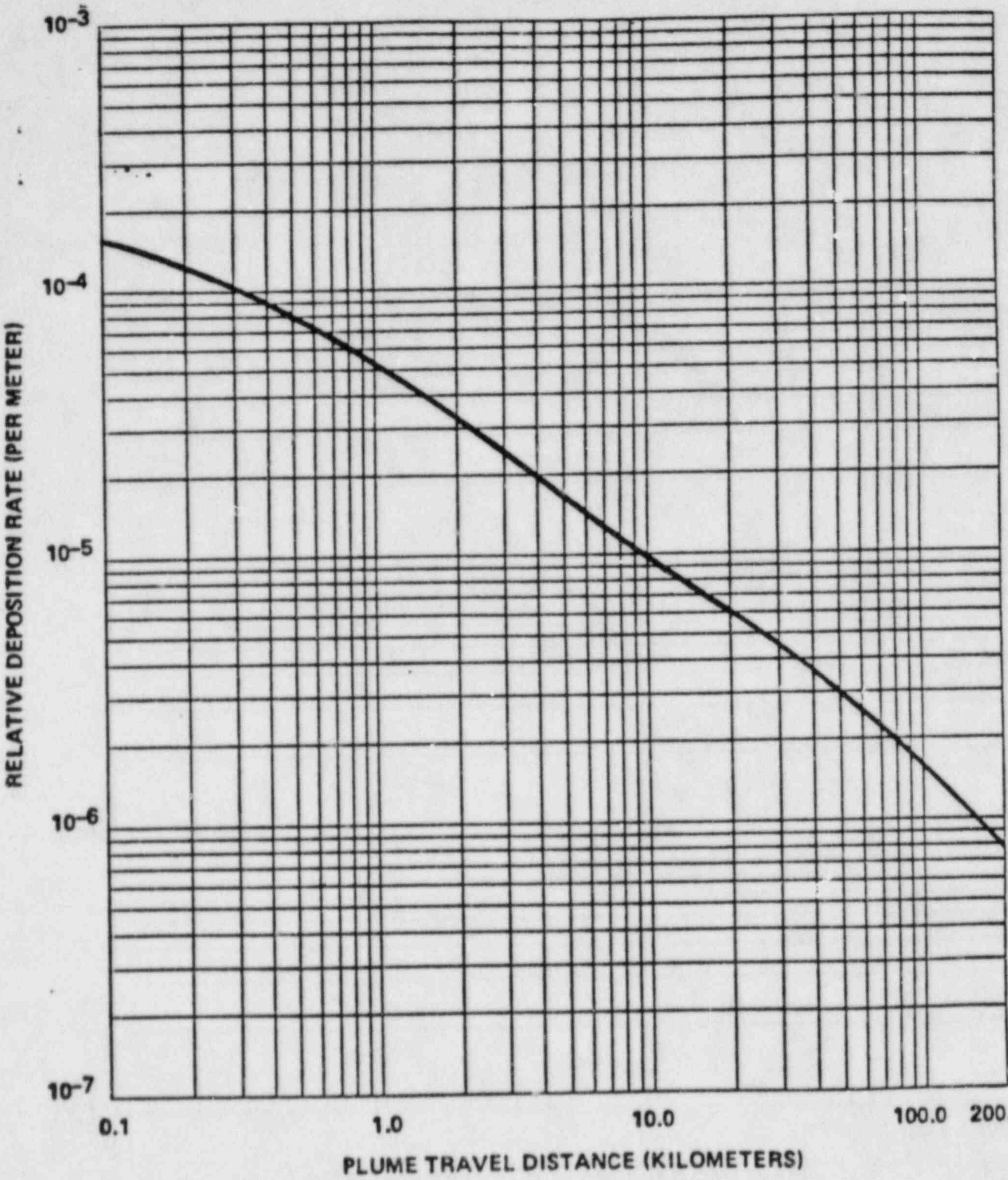


* Reference 6

FIGURE 2.3-6

Relative Deposition for Ground-Level Releases*

(All Atmospheric Stability Classes)



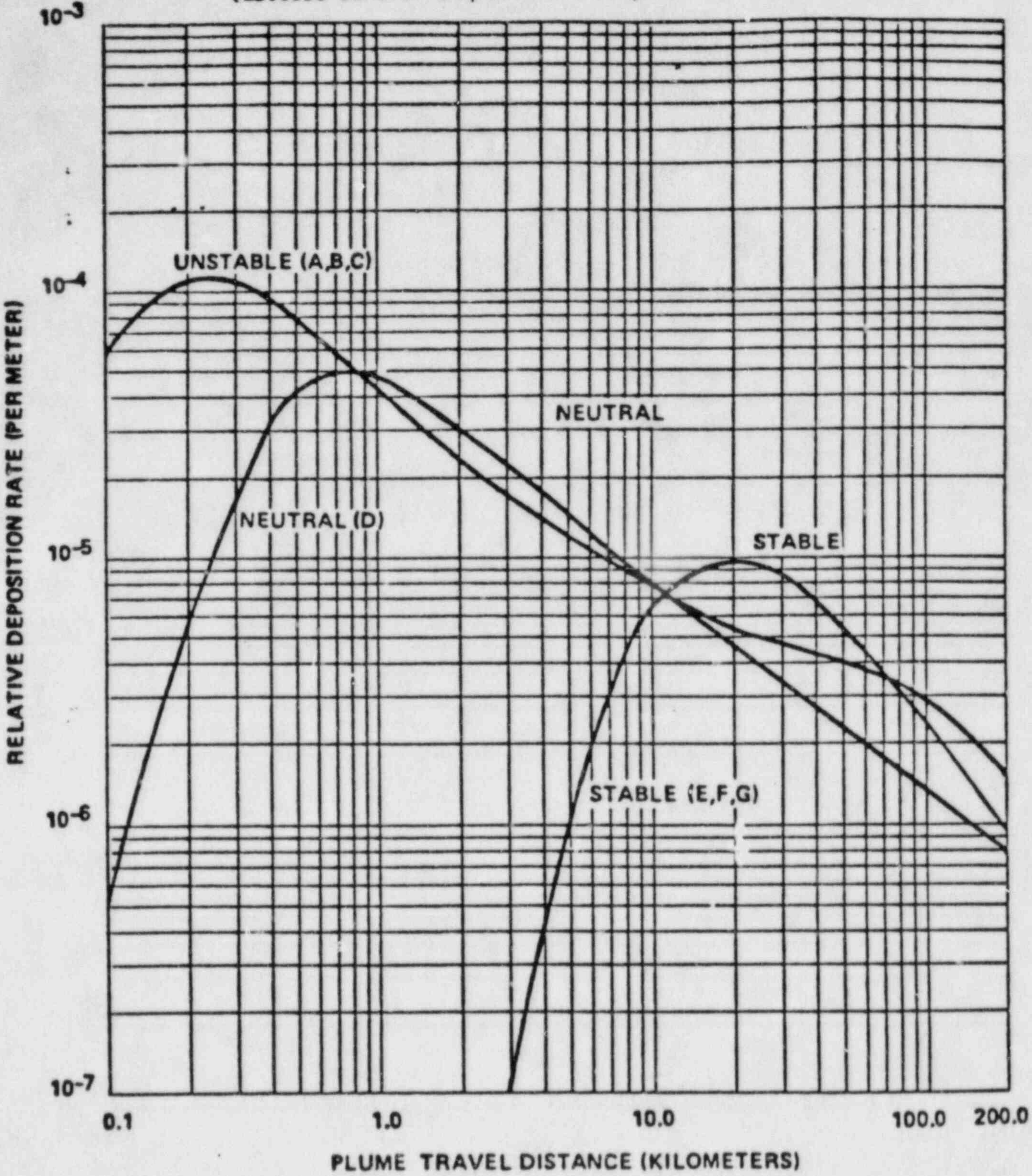
Relative Deposition for Ground-Level Releases (All Atmospheric Stability Classes)

* Reference 6

FIGURE 2.3-7

Re[illegible]e Deposition for 30-m Releases*

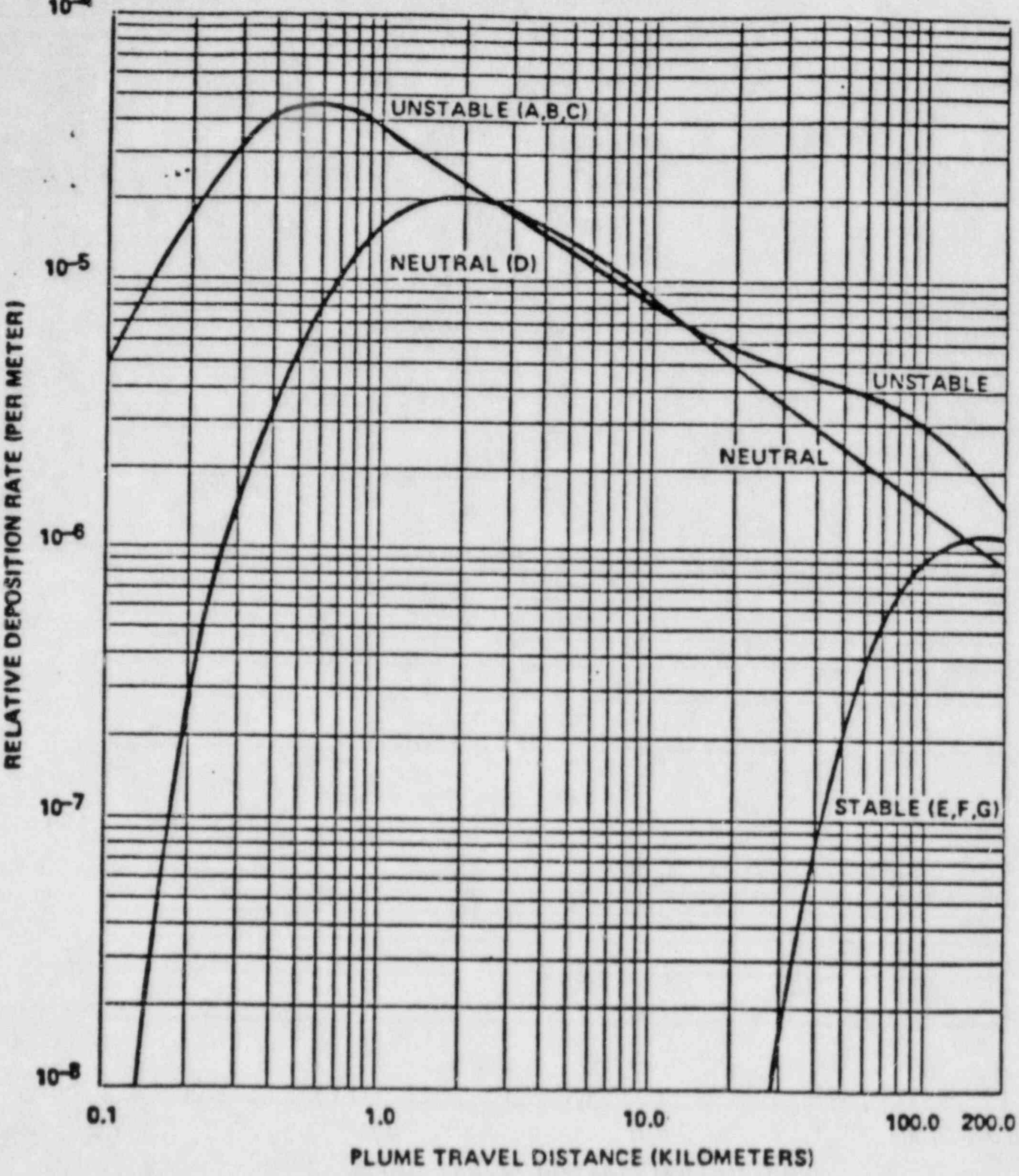
(Letters denote Pasquill Stability Class)



Relative Deposition for 30-m Releases (Letters denote Pasquill Stability Class)

* Reference 6

FIGURE 2.3-8
Relative Deposition for 60-m Releases*
(Letters denote Pasquill Stability Class)



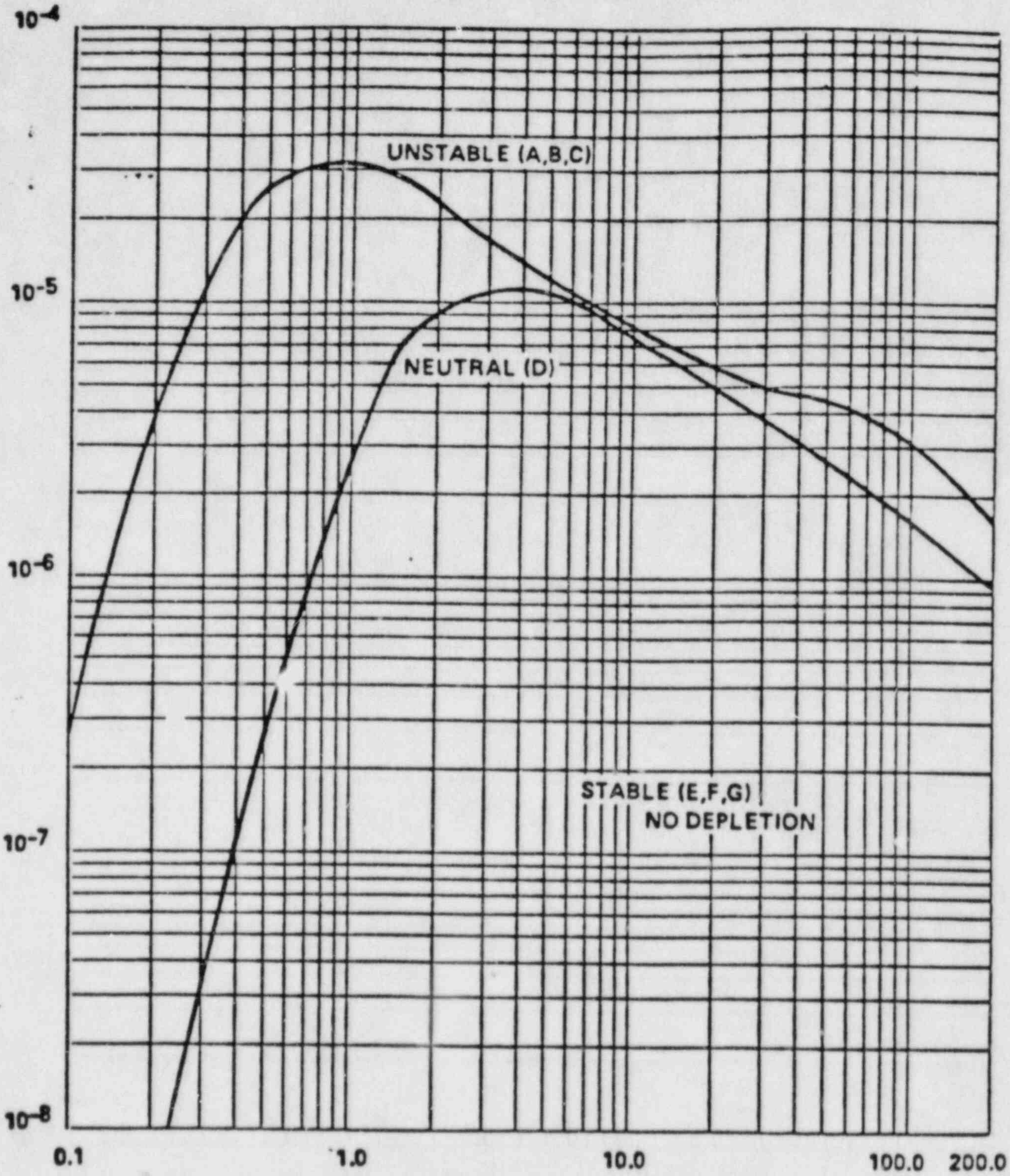
Relative Deposition for 60-m Releases (Letters denote Pasquill Stability Class)

* Reference 6

FIGURE 2.3-9

Relative Deposition for 100-m Releases *

(Letters denote Pasquill Stability Class)



Relative Deposition for 100-m Releases (Letters denote Pasquill Stability Class)

* Reference 6

2.4 DEFINITIONS OF GASEOUS EFFLUENTS PARAMETERS

Term		Definition	Section of Initial Use
B	=	administrative allocation factor for gaseous effluent pathways.	2.1.1
b	=	maximum height of the adjacent building.	2.3.1
C	=	monitor reading of a gaseous effluent monitor corresponding to associated sample radionuclide concentrations.	2.1.1
D_o	=	organ dose rate at time of release (mrem/yr)	2.2.1.b
D_p	=	dose to an individual from radioiodines, tritium, and radionuclides in particulate form with half-lives greater than eight days (mrem).	2.2.2.b
D_s	=	skin dose rate at time of release (mrem/yr)	2.2.1.a
D_t	=	total body dose rate at time of release (mrem/yr)	2.2.1.a
D_β	=	air dose due to beta emissions from noble gases (mrad)	2.2.2.a
D_γ	=	air dose due to gamma emissions from noble gases (mrad)	2.2.2.a
D/Q	=	the sector averaged relative deposition for any distance in a given sector.	2.3.2
$\overline{D/Q'}$	=	annual average relative deposition at the location of the maximum exposed individual.	2.2.2.b
	=	2.763×10^{-9} m^{-2} in the WNW sector	

Term		Definition	Section of Initial Use
δ	=	plume depletion factor at distance r for the appropriate stability class (radioiodines and particulates).	2.3.1
K_i	=	total body dose factor due to gamma emissions from radionuclide (mrem/year per $\mu Ci/m^3$) from Table 2.1-1.	2.1.1
L_i	=	Skin dose factor due to beta emissions from radionuclide i (mrem/yr per $\mu Ci/m^3$) from Table 2.1-1	2.1.1
M_i	=	air dose factor due to gamma emissions from radionuclide i (mrad/yr per $\mu Ci/m^3$) from Table 2.1-1.	2.1.1
N_i	=	air dose factor due to beta emissions from noble gas radionuclide i (mrad/yr per $\mu Ci/m^3$) from Table 2.1-1.	2.2.2.a
n_j	=	number of hours meteorological conditions are observed to be in a given wind direction, wind-speed class k, and atmospheric stability class j.	2.3.1
N	=	total hours of valid meteorological data.	2.3.1
P_i	=	dose parameter for radionuclide i, (mrem/yr per $\mu Ci/m^3$) for the inhalation pathway from Table 2.2-1.	2.2.1.b
Q_i	=	rate of release of noble gas radionuclide i (μCi/sec)	2.1.1
Q_i'	=	release rate of radionuclide i for the combined source terms of routine Reactor Building Exhaust Plenum plus Containment Drywell Purge Release.	2.1.2
$\tilde{Q}_i$	=	cumulative release of noble gas radionuclide i over the period of interest (μCi).	2.2.2.a

Term		Definition	Section of Initial Use
Q_i'	=	cumulative release of radioiodine, tritium or material in particulate form over the period of interest (μCi).	2.2.2.b
Q_i	=	rate of release of noble gas radionuclide i (μCi/sec) from the Containment Drywell Purge.	2.1.3
R_i	=	dose factor for radionuclide i, (mrem/yr per $\mu Ci/m^3$) or (m^2-mrem/yr per μCi/sec).	2.2.2.b
R_s	=	monitor reading per mrem/yr to the skin.	2.1.1
R_t	=	monitor reading per mrem/yr to the total body.	2.1.1
D_B	=	limiting dose rate to the total body = 500 mrem/year.	2.1.1
D_{ss}	=	limiting dose rate to the skin = 3000 mrem/year.	2.1.1
r	=	distance from the point of release to the location of interest for dispersion calculations (meters).	2.3.1
C_S	=	monitor reading of the noble gas monitor at the alarm setpoint for the release pathway under consideration.	2.1.1
Σ_j	=	vertical standard deviation of the plume with building wake correction.	2.3.1
σ_j	=	vertical standard deviation of the plume (in meters), at distance r for ground level releases under the stability category j indicated by ΔT, from Figure 2.3-1.	2.3.1
ΔT	=	vertical temperature gradient (°C/100m).	2.3.1

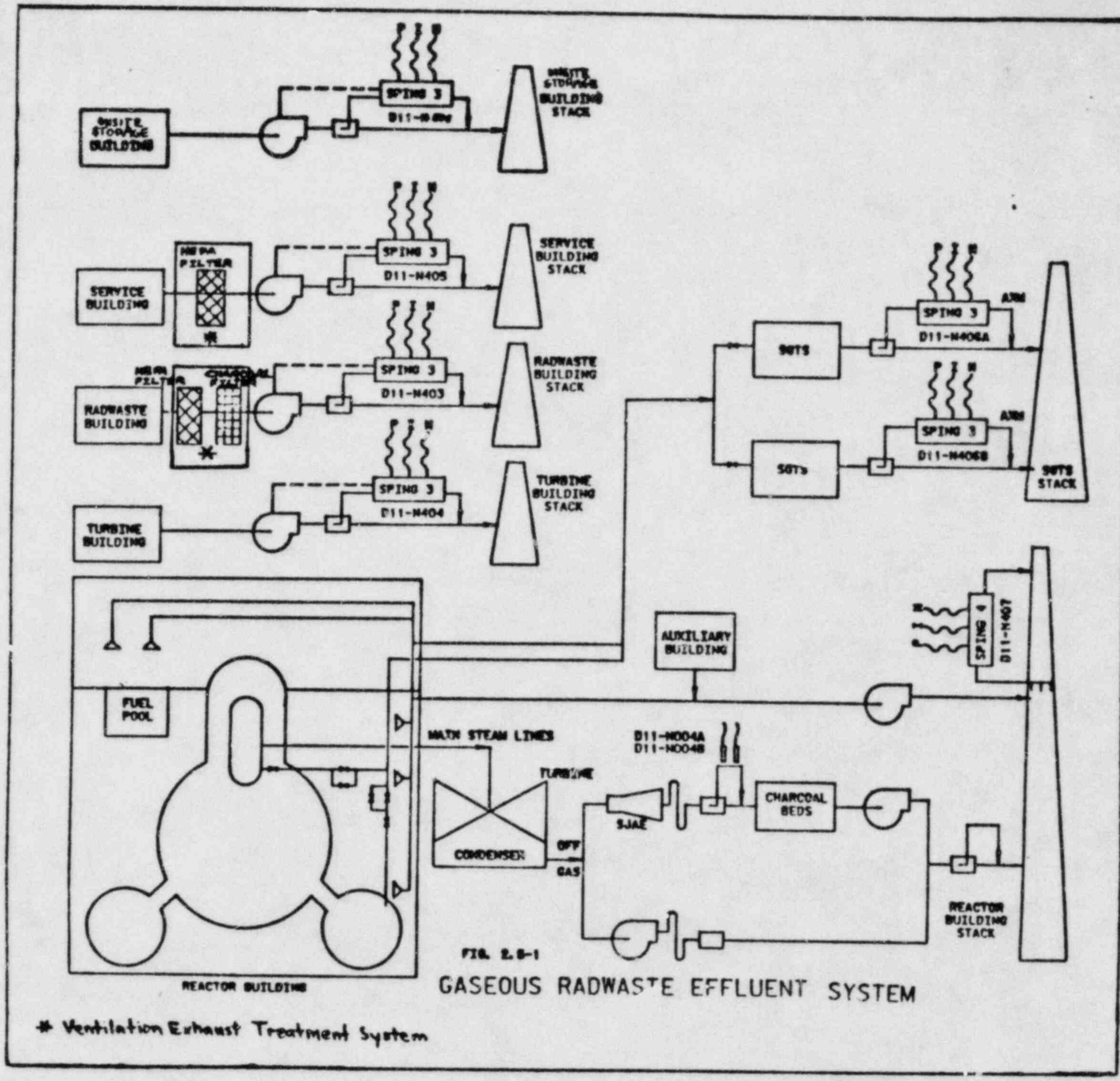
Term		Definition	Section of Initial Use
K	=	terrain recirculation factor.	2.3.1
u_{jk}	=	wind speed (midpoint of windspeed class k) at ground level (m/sec) during atmospheric stability class j.	2.3.1
W'_p	=	relative dispersion for unrestricted areas at the controlling receptor.	2.2.2.b
X/Q	=	the sector-averaged relative concentration at any distance r in a given sector. (sec/m^3)	2.3.1
$\overline{X/Q}$	=	the highest annual average relative concentration in any sector, at the site boundary. sec/m^3	2.1.1
	=	4.186×10^{-6} sec/m^3 in the NW sector	
$\overline{X/Q}'$	=	relative concentration for the location occupied by the controlling receptor.	2.2.2.b
	=	2.686×10^{-7} sec/m^3 in the WNW sector	
U_{jk}	=	windspeed u_{jk} extrapolated to the effective release height using the wind-height power law.	2.3.1
E	=	fraction of release considered as ground-level	2.3.1
F_m'	=	momentum flux parameter (m^4 sec^{-2})	2.3.1
h	=	effective release height (m)	2.3.1
h_v	=	height of release point (m)	2.3.1

Term	Definition	Section of Initial Use
h_{pr}	= additional height due to plume rise (m)	2.3.1
W_o	= stack exit velocity (m sec^{-1})	2.3.1
S	= restoring acceleration per unit displacement for adiabatic motion in the atmosphere. (sec^{-2})	2.3.1
u	= horizontal wind speed at the point of release	2.3.1

2.5 GASEOUS RADWASTE EFFLUENT SYSTEM AND VENTILATION EXHAUST TREATMENT SYSTEM

Figure 2.5-1 is a schematic of the Gaseous Radwaste Effluent System showing the release points to unrestricted areas. The Ventilation Exhaust Treatment System is also presented in Figure 2.5-1. The Ventilation Exhaust Treatment System consists of HEPA filters installed in the Service Building Ventilation System and HEPA and charcoal filters installed in Radwaste Building Ventilation System.

FIGURE 2.5-1 Gaseous Radwaste Effluent System



SECTION 3.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

3.1 SAMPLING LOCATIONS

Sampling locations as required in Technical Specification 3/4.12.1 are described in Table 3.0-1 and shown on the maps in Figures 3.0-1, 3.0-2, and 3.0-3.

NOTE: For the purpose of implementing Technical Specification 3.12.2, sampling locations will be modified as required to reflect the findings of the Land Use Census.

TABLE 3.0-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM

(Sampling Locations)

Station Number	Direcion	Distance from Reactor (Approx)	Description	Media	Frequency
1	NE	1.3 mi.	Estral Beach (community) Pole on Lakeshore, 18 Poles S. of Lakeview	Direct Radiation Radioiodine Particulates	Q W W
2	NNE	1.1 mi.	Tree at the termination Brancho Street (private residence)	Direct Radiation	Q
3	N	1.1 mi.	Pole at NW corner of Swan Boat Club Fence (Community)	Direct Radiation	Q
4	NNW	0.6 mi.	Site Boundary and Toll Road, on Site Fence by APS #4	Direct Radiation Radioiodine	Q W
5	NW	0.6 mi.	Site Boundary and Toll Road on Site Fence by APS #5	Direct Radiation Radioiodine Particulates	Q W W
6	WNW	0.6 mi.	Pole NE corner of bridge over Toll Road	Direct Radiation	Q
7	W	15 mi.	Pole, behind Doty Farm, 7512 N. Custer Road (control)	Direct Radiation Radioiodine Particulates Milk	Q W W M
S-1	NW	2.4 mi.	Pole NE corner Dixie Highway and Post Road	Direct Radiation	Q
S-2	NNW	2.4 mi.	Pole NW corner Trombley Road and Swan View Road	Direct Radiation	Q
S-3	N	2.6 mi.	Pole on S side Massarant - 2 Poles W of Cinavarre	Direct Radiation	Q
S-4	NNE	6.5 mi.	Pointe Mouillee - W. Jefferson and Campau Road, Pole on SE corner of Bridge	Direct Radiation	Q
S-5	NE	5.1 mi.	Pointe Mouillee Game Area - Field Office, Pole near tree north area of parking lot	Direct Radiation	Q

TABLE 3.0-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM

(CONTINUED)

Station Number	Direcion	Distance from Reactor (Approx)	Description	Media	Frequency
S-6	N	4.5 mi.	Labo and Dixie Highway - Pole on Sw corner with light	Direct Radiation	Q
S-7	NNW	5.0 mi.	Labo and Brandon - Pole on SE corner near RR	Direct Radiation	Q
S-8	NW	4.0 mi.	Pole NW corner Newport and Brandon Roads	Direct Radiation	Q
S-9	WNW	4.9 mi.	Pole on SE of War and Post Roads	Direct Radiation	Q
S-10	W	5.5 mi.	Pole on NE corner Nadeau and Laprad near mobile home park	Direct Radiation	Q
S-11	SW	4.5 mi.	Pole on NW corner Mentel and Hurd	Direct Radiation	Q
S-12	SW	4.9 mi.	Pole in parking lot of Department Natural Resources Office Building - Sterling State Park	Direct Radiation	Q
S-13	W	2.8 mi.	Pole S side Williams Rd. - 8 Poles W of Dixie Hwy. (Special Area)	Direct Radiation	Q
S-14	WSW	2.8 mi.	Pole N side of Pearl at Parkview - Woodland Bch. (populated area)	Direct Radiation	Q
S-15	S	0.9 mi.	Pole N side of Point Aux Peaux 2 Poles W of Long (site boundary)	Direct Radiation	Z
S-16	SSW	1.0 mi.	Pole S side of Point Aux Peaux - 1 Pole W of Huron next to vent pipe (site boundary)	Direct Radiation	Q
S-17	SW	0.9 mi.	Fermi gate along Point Aux, Peaux Road - on fence post W of gate (site boundary)	Direct Radiation	Q

TABLE 3.0-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM

(CONTINUED)

Station Number	Direcion	Distance from Reactor (Approx)	Description	Media	Frequency
S-18	WSW mi	1.2 mi.	Pole on Toll Road - 13 Poles S of Fermi Drive	Direct Radiation	Q
S-19	W	1.0 mi.	Pole on Toll Rd., 6 Poles S of Fermi Drive	Direct Radiation	Q
S-20	SSW	6.2 mi.	Pole NE corner McMillan and East Front Street (Special Area)	Direct Radiation	Q
S-21	SW	10.1 mi.	Pole SE corner of Mortar Creek and Laplaisance	Direct Radiation	Q
S-22	SWS	9.9 mi.	Pole E side of S. Dixie 1 Pole S of Albain	Direct Radiation	Q
S-23	WSW	8.0 mi.	Pole Cluster (St. Mary's) Park corner of N Custer and Dixie (Monroe St.) (N side, next to river) (Special Area)	Direct Radiation	Q
S-24	WSW	9.2 mi.	Pole Milton "Pat" Munson Recreational Reserve - N Custer Road (Control)	Direct Radiation	Q
S-25	WNW	10.1 mi.	Pole corner Stony Creek and Finzel Roads	Direct Radiation	Q
S-26	NW	8.7 mi.	Pole W side Grafton Road 1 Pole N of Ash/Grafton intersection	Direct Radiation	Q
S-27	NNW	9.9 mi.	Pole E side of Port Creek, 1 Pole S of Will-Carlton Road	Direct Radiation	Q
S-28	N	6.9 mi.	Pole on S side of S. Huron River Dr. across from Pace Street (Special Area)	Direct Radiation	Q
S-29	N	9.5 mi.	Pole NE corner of Gibraltar and Cahill Roads	Direct Radiation	Q

TABLE 3.0-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM

(CONTINUED)

Station Number	Direcion	Distance from Reactor (Approx)	Description	Media	Frequency
S-30	NNE	9.9 mi.	Pole S corner of Adams and Gibraltar (across from Humbug Marina)	Direct Radiation	Q
8	S	0.9 mi.	Point Aux Peaux, 100-300 ft. offshore sighting directly to land based water tower	Sediment	SA
9	E	0.2 mi.	Fermi-2 discharge, approx. 200 ft. offshore	Sediment	SA
10	NE	1.1 mi.	Estral Beach, approx. 200 ft. offshore sighting directly to land based windmill	Sediment	SA
11	NNE	9.5 mi.	Control in vicinity of Celeron Island	Fish	SA
12	SSE	0.4 mi.	Fermi Unit I Raw Lake Water Intake Structure	Surface Water	M
13	S	1.2 mi.	Monroe Water Station N side of Pointe Aux Peaux 1/2 block W of Long Rd.	Drinking Water	M
14	NE	13 mi.	DECo's Trenton Channel Power Plant Intake Structure (Screenhouse #2)	Surface Water	M
15	NNE	20 mi.	Detroit (Allen Park) Water Station 14700 Moran Rd.	Drinking Water	M
16	E	0.4 mi.	Fermi-2 discharge (approx. 1200 ft. offshore)	Fish	SA
17	SW	1.0 mi.	Corner of Erie St. and Point Aux Peaux Rds.	Radioiodine Particulates	W W
18	WSW	2.0 mi.	L. Burns Farm 4352 Pointe Aux Peaux	Milk	M-SM
20	NW	5.7 mi.	Reaume Farm 2705 East Labo	Milk	M-SM

TABLE 3.0-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM

(CONTINUED)

Station Number	Direcion	Distance from Reactor (Approx)	Description	Media	Frequency
22	W	0.6 mi.	Outlet Fermi-2 Storm Drains	Sediment	SA
31	NW	4.5 mi.	Yoas Farm 3239 Newport Rd.	Milk	M-SM
32	NNE	4.0 mi.	Roland Farm 9501 Turnpike Hwy.	Milk	M-SM
W1	S	0.4 mi.	Approx. 100 ft. W of Lake Erie, S end of former plant clubhouse site	Groundwater	On flow reversal
W2	SSW	1.0 mi.	4 ft. S of Pointe Aux Peaux (PAP) Rd. fence, 427 ft. W of where PAP crosses over Stoney Point's western dike	Groundwater	On flow reversal
W3	SW	1.0 mi.	143 ft. W of PAP Rd. gate, 62 ft. N of PAP Rd. fence	Groundwater	On flow reversal
W4	WNW	0.6 mi.	42 ft. N of Langton Rd., 8 ft., E of Toll Rd. fence	Groundwater	On flow reversal

TABLE 3.0-1

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM

(CONTINUED)

Station Number	Direcion	Distance from Reactor (Approx)	Description	Media	Frequency
22	W	0.6 mi.	Outlet Fermi-2 Storm Drains	Sediment	SA
31	NW	4.5 mi.	Yoas Farm 3239 Newport Rd.	Milk	M-SM
32	NNE	4.0 mi.	Roland Farm 9501 Turnpike Hwy.	Milk	M-SM
W1	S	0.4 mi.	Approx. 100 ft. W of Lake Erie, S end of former plant clubhouse site	Groundwater	On flow reversal
W2	SSW	1.0 mi.	4 ft. S of Pointe Aux Peaux (PAP) Rd. fence, 427 ft. W of where PAP crosses over Stoney Point's western dike	Groundwater	On flow reversal
W3	SW	1.0 mi.	143 ft. W of PAP Rd. gate, 62 ft. N of PAP Rd. fence	Groundwater	On flow reversa
W4	WNW	0.6 mi.	42 ft. N of Langton Rd., 8 ft., E of Toll Rd. fence	Groundwater	On flow reverse

FIGURE 3.0-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM -

SAMPLING LOCATIONS BY STATION NUMBER (IMMEDIATE AREA)

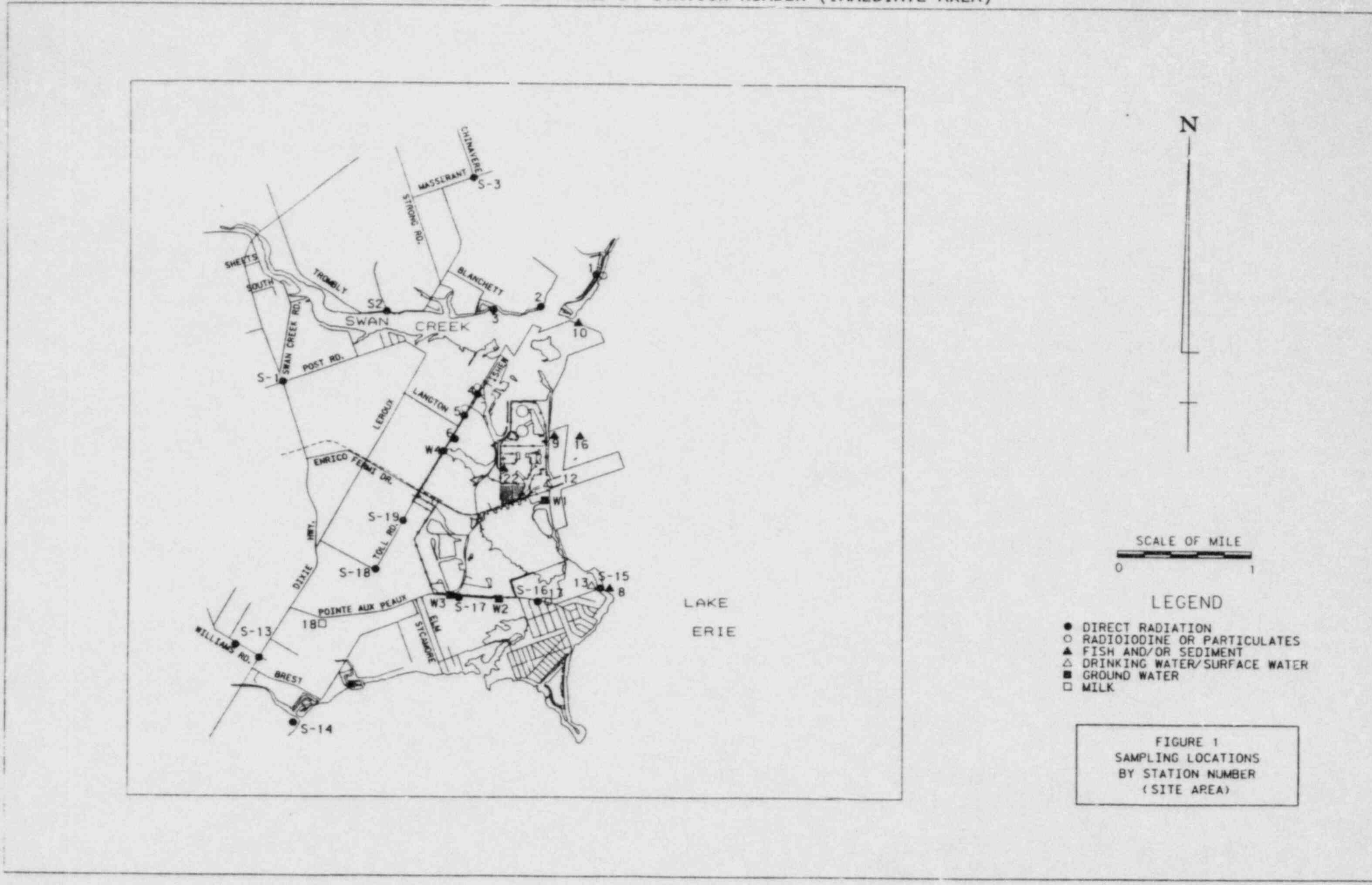
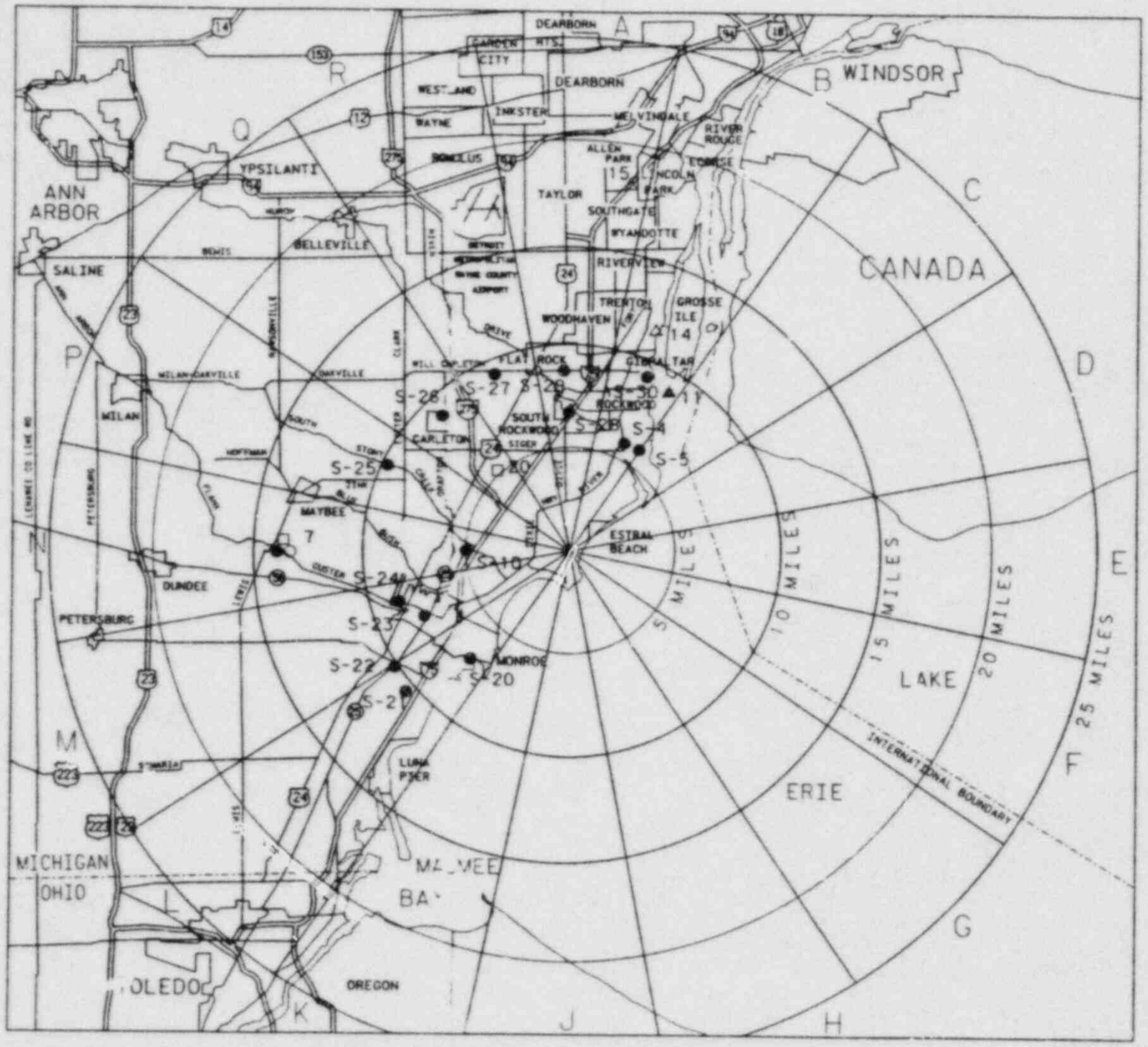


FIGURE 3.0-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM -

SAMPLING LOCATIONS BY STATION NUMBER (GREATER THAN 5 MILES)



N

SCALE OF MILES

4 3 2 1 0 4 8

LEGEND

- ● DIRECT RADIATION
- ○ RADIOIODINE OR PARTICULATES
- ▲ FISH AND/OR SEDIMENT
- △ DRINKING WATER/SURFACE WATER
- ◘ GROUND WATER
- □ MILK

FIGURE 2
SAMPLING LOCATIONS
BY STATION NUMBER
(GREATER THAN 5 MILES)

FIGURE 3.0-3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SUPPLEMENTARY TLD LOCATIONS - BY STATION NUMBER

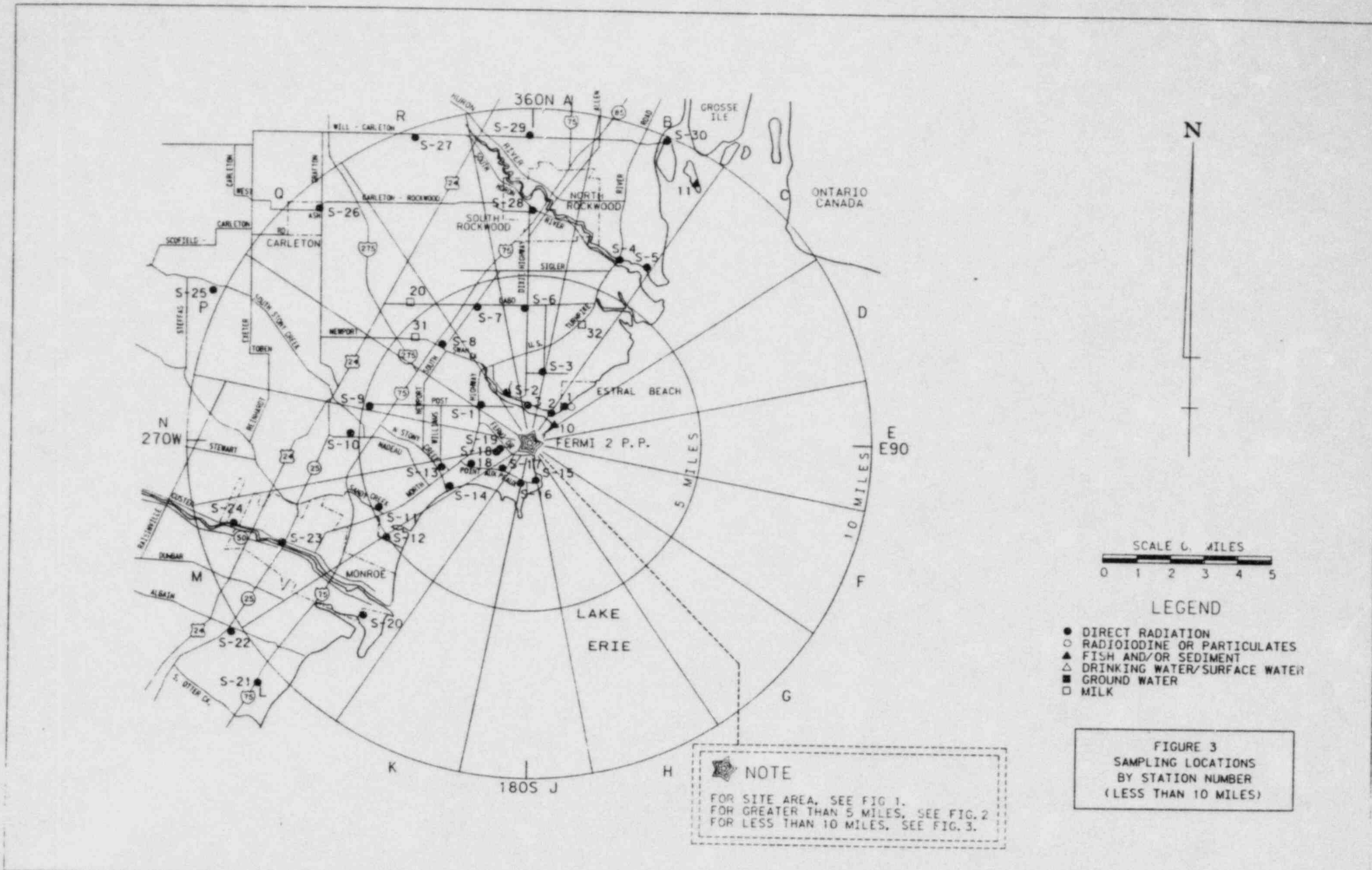


FIGURE 3
SAMPLING LOCATIONS
BY STATION NUMBER
(LESS THAN 10 MILES)

3.2 INTERLABORATORY COMPARISON PROGRAM DESCRIPTION

The REMP Contractor is required to participate in a Commission approved Interlaboratory Comparison Program and to submit QA Program Progress summary reports to DECo on a bi-monthly or quarterly basis. These reports contain summary descriptions and performance data summaries on reference standards, blank, blind, spiked, and duplicate analyses as well as the USEPA and other laboratory Intercomparison Programs, as applicable. A summary of the Interlaboratory Comparison Program results obtained is required to be included in the Annual Radiological Environmental Operating Report pursuant to Specification 6.9.1.7.

Participation in an approved Interlaboratory Comparison Program ensures that an independent check on the precision and accuracy of the measurements of radioactive material in environmental sample matrices is performed as part of the QA program for environmental monitoring in order to demonstrate that the results are valid for the purpose of Section IV. B.2 of Appendix I to 10 CFR Part 50.

SECTION 4.

TOTAL DOSE FROM URANIUM FUEL CYCLE

4.1 CALCULATION OF TOTAL DOSE FROM URANIUM FUEL CYCLE

In the event that calculations of total dose from the uranium fuel cycle are required to be performed in support of the action statement 3.11.4.a as a result of exceeding twice the referenced limits, a combination of measurements will be incorporated. Direct radiation doses will be inferred from the evaluation of environmental monitoring devices (e.g., thermoluminescent dosimeters or ion chambers listed in Table 3.0-1). This component will be summed with the doses calculated from effluents dose calculations performed according to Sections 1.0 and 2.0 of the ODCM to assess the annual dose or dose committment to any Member of the Public.

FIGURE 4.0-1

Unrestricted Area Boundaries and Release Points for Liquid and Gaseous Effluents