OFFSITE DOSE CALCULATION MANUAL

GRAND GULF NUCLEAR STATION

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GRAND GULF NUCLEAR STATION

OFFSITE DOSE CALCULATION MANUAL

SAFETY RELATED

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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. A minimum OPERABLE configuration of the liquid and gaseous radwaste treatment systems is also included.

The ODCM will be maintained at the Station 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 this ODCM.

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LIST OF REFERENCES

1. Boegli, T. S., R. R. Bellamy, W. L. Britz, and R. L. Waterfield, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", NUREG-01-33 (October 1978).

2. Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR50, 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 10CFR50, Appendix I, U.S. NRC Regulatory Guide 1.109, Rev. 1 (October 1977).

4. "Environmental Report", Mississippi Power and Light Company, Grand Gulf Nuclear Station, Units 1 and 2.

5. "Final Safety Analysis Report", Mississippi Power and Light Company, Grand Gulf Nuclear Station.

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. 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).

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1.0 LIQUID EFFLUENTS

1.1 Liquid Effluent Monitor Setpoints

1.1 Liquid Radwaste Effluent Line Monitors

Liquid Radwaste Effluent Line Monitors provide alarm and automatic termination of release prior to exceeding the concentration limits specified in 10CFR20, Appendix B, Table II, Column 2 at the release point to the unrestricted area. To meet this specification and for the purpose of implementation of specification 3.3.7.11 of the RETS, the alarm/trip setpoints for liquid effluent monitors and flow measurement devices are set to assure that the following equation is satisfied:

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

where:

C = the effluent concentration limit (RETS Specification 3.11.1.1) implementing 10CFR20 for the site, in uCi/ml.

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

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

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

At Grand Gulf Unit 1, the available dilution water flow (F) is constant for a given release, and the waste tank flow (f) and monitor setpoint (c) are set to meet the condition of equation 1 for a given effluent concentration, C. The method by which this is accomplished is as follows:

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

$$\sum_i Ci = \sum_g Cg + \left(\sum_a C_a + C_s + C_t \right) \qquad (2)$$

where:

$\sum C_g$ = the sum of concentrations C_g of each measured gamma emitter observed by gamma-ray spectroscopy of the waste sample.

$\sum C_a$ = the sum of concentrations C_a of alpha emitters in liquid waste as measured in the monthly composite sample.

C_s = the measured concentrations of Sr-89 and Sr-90 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 waste tank batch to be released; terms for alpha, strontiums, and tritium may be included if analysis of reactor water has shown the presence of these isotopes.

Step 2) The measured radionuclide concentrations are used to calculate a Dilution Factor, D.F., which is the ratio of total dilution flow rate to waste tank effluent flow rate required to assure that the limiting concentration of 10CFR20, Appendix B, Table II, Column 2 are met at the point of discharge.

$$DF = \left[\sum_i \frac{C_i}{MPC_i}\right] \times S.F.$$

$$= \left[\sum_g \frac{C_i}{MPC_g} + \left(\sum_a \frac{C_a}{MPC_a} + \frac{C_s}{MPC_s} + \frac{C_t}{MPC_t}\right)\right] \times S.F. \quad (3)$$

Where:

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

MPC_i = MPC_g, MPC_s, and MPC_t are limiting concentrations of the appropriate radionuclide from 10CFR20, Appendix B, Table II, Column 2. For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-4 uCi/ml total activity.

S.F. = an administrative safety factor normally applied at Grand Gulf which causes the calculated Dilution Factor to be two (2) times larger than the dilution factor required for compliance with 10CFR20 limits.

Step 3) The maximum permissible waste tank effluent flow rate prior to dilution, f_d, is calculated based on a fixed fraction of the dilution flow rate, F_d:

$$f_d \leq \frac{F_d + f_d}{D.F.} \approx \frac{F_d}{D.F.} \qquad \text{for } F_d \gg f_d \tag{4}$$

where:

F_d = 0.9 x actual dilution flow rate

f_d = maximum permissible waste tank effluent flow rate

D.F. = Dilution Factor from Step 2.

NOTE: Equation 4 is valid only for D.F.>1; for D.F.≤ 1, the waste tank effluent concentration meets the limits of 10CFR20 without dilution, and f_d may take on any desired value.

Step 4) The dilution flow rate setpoint for minimum dilution flow rate, F, and waste tank flow rate setpoint for maximum waste tank effluent flow rate, f are calculated as follows:

$F = F_d$ = 0.9 x actual dilution flow rate (5)

$f = 0.9 \times f_d$ = 0.9 x calculated maximum waste tank flow rate for the stated release conditions. (6)

Thus, a control room alarm occurs if the dilution flow rate falls below the assumed flow rate of 90 percent of the actual dilution flow, or if the waste tank effluent flow rate exceeds 90 percent of the calculated maximum waste tank effluent flow rate, and the release is terminated.

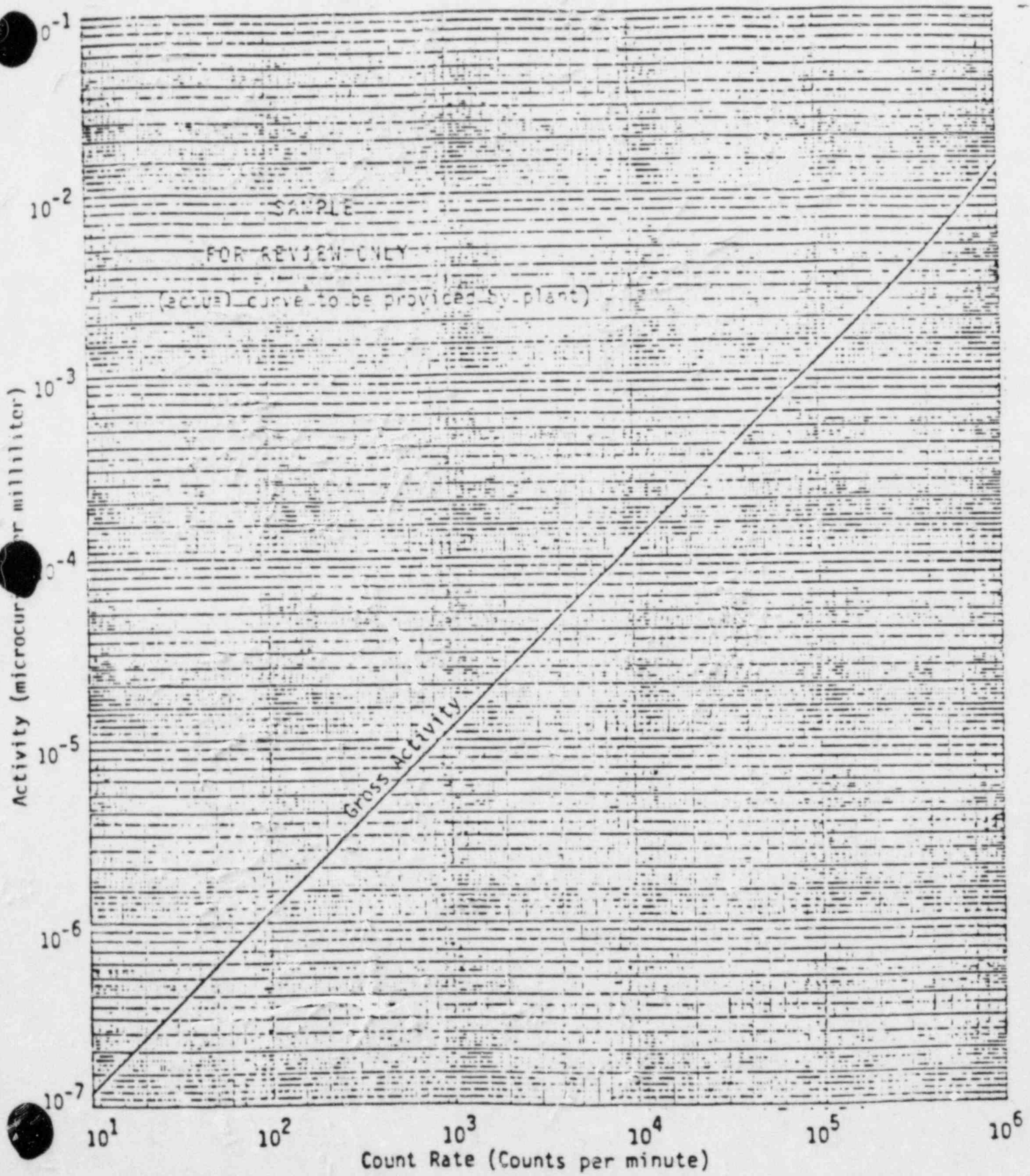
Step 5) The radioactivity monitor setpoint may now be specified based on the values of $\sum C_i$, F, and f which were specified to provide compliance with the limits of 10CFR20, Appendix B, Table II, Column 2. The monitor response is primarily to gamma radiation; therefore, the actual setpoint is based on $\sum_g C_g$. The setpoint concentration, C_m is determined as follows:

$$C_m = \left(\frac{f_d}{f_a}\right) \sum_g C_g \ (uCi/ml) \qquad (7)$$

where f_a is the actual (or maximum expected) effluent flow rate. The value of C_m (uCi/ml) is used to determine the monitor setpoint (CPM) from the calibration curve of Figure 1.0-1.

NOTE: The setpoint contains a factor of conservatism, even if the calculated maximum waste tank flow rate is attainable, since the calculated rate contains the safety factor margin, waste tank effluent flow rate margin, and the dilution flow rate margin. In practice, the actual waste tank effluent flow rate normally is many times less than the calculated tank flow rate, thus providing an additional conservatism during release.

Figure 1.0-1 Calibration Curve for Liquid Effluent Monitor



1.2 Dose Calculation for Liquid Effluents

1.2.1 The dose contribution to the maximum exposed individual from all radionuclides identified in waste tank liquid effluents released to unrestricted areas is calculated for the purpose of implementing RETS Specification 3.11.1.2 using the following expression:

$$D_{Tau} = \sum_i \left[A_{iTau} \sum_{1=1}^{m} \Delta t_1 \; C_{i1} \; F_1 \right] \quad \text{(millirem)} \quad (8) \qquad (1)$$

where:

A_{iTau} = Site-related ingestion dose commitment factor, in millirem/hr per uCi/ml.

$= K_o \; U_F \; BF_i \; DF_i$

Δt_1 = length of the 1 th time period over which C_{i1} and F_1 are averaged for all waste tank liquid releases, in hours.

C_{i1} = average concentration of radionuclide i observed in the undiluted waste tank liquid effluent during time period Δt_1 from any liquid release from the waste tank, in uCi/ml. Concentrations are determined primarily from a gamma isotopic analysis of the waste tank liquid effluent sample. For Sr-89, Sr-90, H-3, the last measured value from the most recent monthly and quarterly composite samples will be used in the dose calculation. Note: LLD values are not used in dose calculations.

F_1 = near field average dilution factor for C_i during any liquid effluent release. Defined as the ratio of the average undiluted liquid waste flow during release to the product of the average flow from the site discharge structure to unrestricted receiving waters times the applicable factor of 5[2].

= $\frac{\text{average undiluted liquid waste flow}}{\text{average flow from site discharge} \times 5}$

K_o = units conversion factor 1.14×10^5

= $\left(10^6 \frac{pCi}{uCi} \times 10^3 \frac{ml}{Kg} \div 8766 \frac{hr}{yr}\right)$

U_F = adult fish consumption (21 kg/yr)[3].

BF_i = Bioaccumulation factor for each nuclide, 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 each nuclide, i, for adults in preselected organ, Tau, in mrem/pCi, from Table 1.2-2 (taken from Reference 3, Table E-11).

Calculated values of A_{iTau} for radionuclides which might be observed in liquid effluents is given in Table 1.2-3.

TABLE 1.2-1

BIOACCUMULATION FACTORS (BFi)

(pCi/kg per pCi/liter)*

FRESHWATER

ELEMENT	FISH	INVERTEBRATE
H	9.0E-01	9.0E-01
C	4.6E-03	9.1E-03
NA	1.0E-02	2.0E-02
P	1.0E-05	2.0E-04
CR	2.0E-02	2.0E-03
MN	4.0E-02	9.0E-04
FE	1.0E-02	3.2E-03
CO	5.0E-01	2.0E-02
NI	1.0E-02	1.0E-02
CU	5.0E-01	4.0E-02
ZN	2.0E-03	1.0E-04
BR	4.2E-02	3.3E-02
RB	2.0E-03	1.0E-03
SR	3.0E-01	1.0E-02
Y	2.5E-01	1.0E-03
ZR	3.3E-00	6.7E-00
NB	3.0E-04	1.0E-02
MO	1.0E-01	1.0E-01
TC	1.5E-01	5.0E-00
RU	1.0E-01	3.0E-02
RH	1.0E-01	3.0E-02
TE	4.0E-02	6.1E-03
I	1.5E-01	5.0E-00
CS	2.0E-03	1.0E-03
BA	4.0E-00	2.0E-02
LA	2.5E-01	1.0E-03
CE	1.0E-00	1.0E-03
PR	2.5E-01	1.0E-03
ND	2.5E-01	1.0E-03
W	1.2E-03	1.0E-01
NP	1.0E-01	4.0E-02

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

TABLE 1.2-2
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INGESTION DOSE CONVERSION FACTORS FOR ADULTS (DFi)
(mrem per pCi ingested) *

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07
C 14	2.84E-06	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07
NA 24	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06
P 32	1.93E-04	1.20E-05	7.46E-06	NO DATA	NO DATA	NO DATA	2.17E-05
CR 51	NO DATA	NO DATA	2.66E-09	1.59E-09	5.86E-10	3.53E-09	6.69E-07
MN 54	NO DATA	4.57E-06	8.72E-07	NO DATA	1.36E-06	NO DATA	1.40E-05
MN 56	NO DATA	1.15E-07	2.04E-08	NO DATA	1.45E-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	1.T 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

* Values taken from Reference 3, Table E-11.

TABLE 1.2-2 (Continued)
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INGESTION DOSE CONVERSION FACTORS FOR ADULTS (DFi)
(mrem per pCi ingested) *

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Y 93	2.58E-09	NO DATA	7.40E-11	NO DATA	NO DATA	NO DATA	8.50E-05
ZR 95	3.04E-08	9.75E-09	6.60E-09	NO DATA	1.53E-08	NO DATA	3.09E-05
ZR 97	1.68E-09	3.39E-10	1.55E-10	NO DATA	5.12E-10	NO DATA	1.05E-04
NB 95	6.22E-09	3.46E-09	1.86E-09	NO DATA	3.42E-09	NO DATA	2.10E-05
MO 99	NO DATA	4.31E-06	8.20E-07	NO DATA	9.76E-06	NO DATA	9.99E-06
TC 99M	2.47E-10	6.98E-10	8.89E-09	NO DATA	1.06E-08	3.42E-10	4.13E-07
TC101	2.54E-10	3.66E-10	3.59E-09	NO DATA	6.59E-09	1.87E-10	1.10E-21
RU103	1.85E-07	NO DATA	7.97E-08	NO DATA	7.06E-07	NO DATA	2.16E-05
RU105	1.54E-08	NO DATA	6.08E-09	NO DATA	1.99E-07	NO DATA	9.42E-06
RU106	2.75E-06	NO DATA	3.48E-07	NO DATA	5.31E-06	NO DATA	1.78E-04
AG110M	1.60E-07	1.48E-07	8.79E-08	NO DATA	2.91E-07	NO DATA	6.04E-05
TE125M	2.68E-06	9.71E-07	3.59E-07	8.06E-07	1.09E-05	NO DATA	1.07E-05
TE127M	6.77E-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	1.09E-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

* Values taken from Reference 3, Table E-11.

TABLE 1.2-2 (Continued)
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INGESTION DOSE CONVERSION FACTORS FOR ADULTS (DFi)
(mrem per pci ingested) *

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
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	1.22E-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

* Values taken from Reference 3, Table E-11.

TABLE 1.2-3
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GRAND GULF SITE RELATED INGESTION DOSE COMMITMENT FACTOR, A_{iTau}
(mrem/hr per uCi/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
Cy-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+08	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	1.48E+02	0.00E+00	3.51E+03
Fe-55	6.38E+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+00	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+01
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

* Calculated from Equation 8.

TABLE 1.2-3 (Continued)

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GRAND GULF SITE RELATED INGESTION DOSE COMMITMENT FACTOR, A_{iTau}

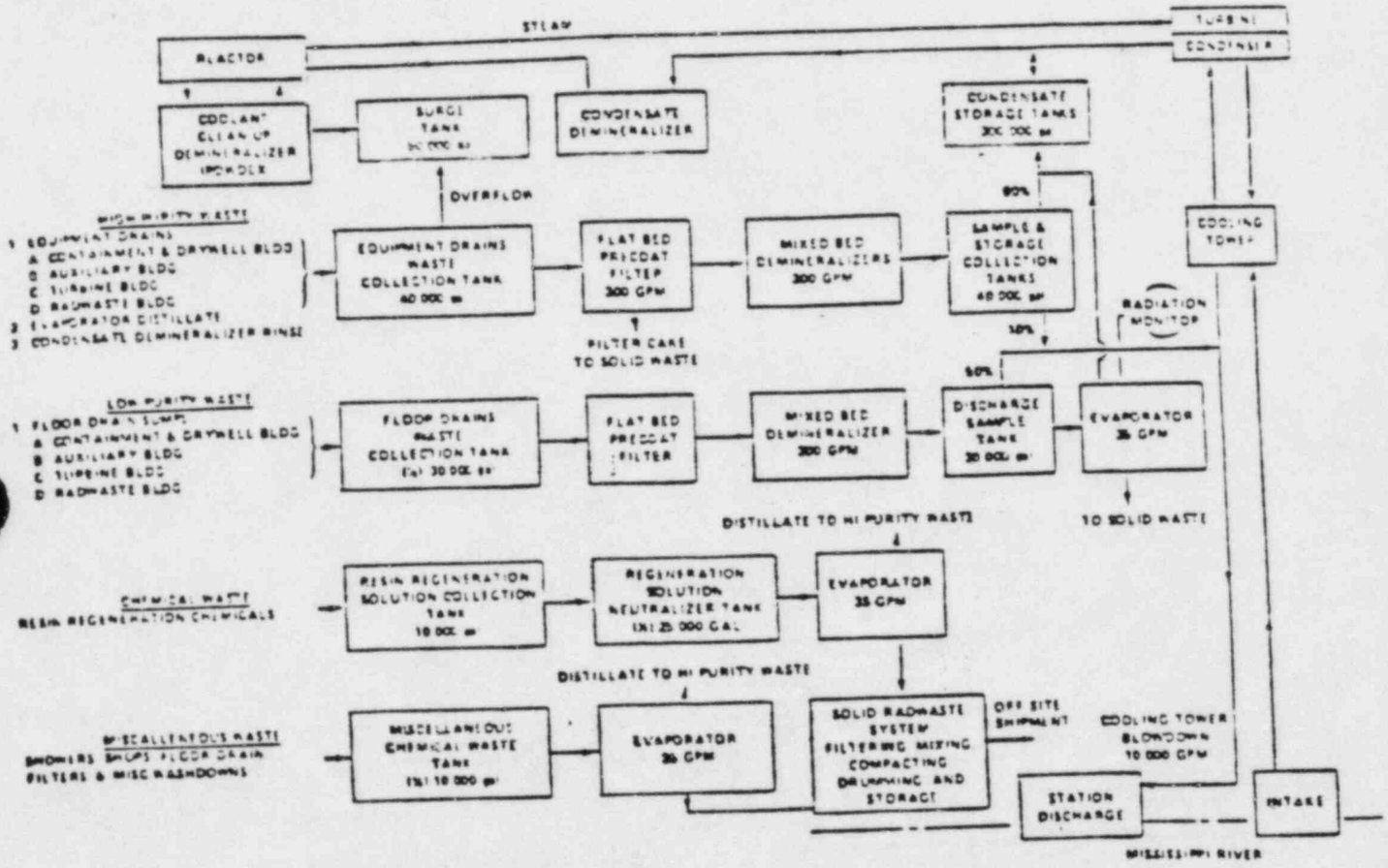
(mrem/hr per uCi/ml) *

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	3.30E+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	2.23E+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

* Calculated from Equation 8.

1.3 Liquid Radwaste Treatment System

The essential components of the liquid radwaste treatment system for the OPERABILITY requirement of RETS Specification 3/4.11.1.3 are indicated below.



(A COMMON SYSTEM SCALED TO A PER UNIT BASIS)

Taken from Reference 4, Figure 3-7.

2.0 GASEOUS EFFLUENTS

2.1 Gaseous Effluent Monitor Setpoints

2.1.1 For the purpose of implementation of Specification 3.3.7.12 of the RETS, the alarm setpoint level for continuous ventilation noble gas monitors will be calculated as follows:

S_V = Count rate of vent noble gas monitor at alarm setpoint level

$$= \text{the lesser of} \begin{cases} 0.25 \times R_t \times D_{TB} \\ \text{or} \\ 0.25 \times R_s \times D_{ss} \end{cases} \quad (1)$$

Where,

0.25 = safety factor allowing for cumulative uncertainties of measurements

D_{TB} = Dose rate limit to the total body of an individual in an unrestricted area required to limit dose to 500 mrem in one year.

$$= \frac{500 - F\left[(\overline{X/Q})\ \sum_i K_i\ \overline{Q}_i\right]}{(1 - F)}$$

D_{ss} = Dose rate limit to the skin of the body of an individual in an unrestricted area required to limit dose to 3000 mrem in one year.

$$= \frac{3000 - F\left[(\overline{X/Q})\ \sum_i (L_i + 1.1\ M_i)\ \overline{Q}_i\right]}{(1 - F)}$$

R_t = count rate per mrem/yr to the total body

$$= C \div \left[\overline{X/Q}\ \sum_i K_i\ \dot{Q}_i\right]$$

See Note 2

Where,

C = count rate of the vent monitor corresponding to grab sample radionuclide concentrations

$\overline{X/Q}$ = highest sector annual average atmospheric dispersion at the unrestricted area boundary

= 5.176×10^{-6}* sec/m^3 in the WSW sector.

K_i = total body dose factor due to gamma emissions from each noble gas radionuclide i (mrem/yr per uCi/m^3) from Table 2.1-1.

$\dot{Q}_i$ = rate of release of noble gas radionuclide, i (uCi/sec), from release point

F = fraction of current year elapsed at time of calculation

$\overline{Q}_i$ = average rate of release of noble gas radionuclide i for the elapsed fraction of the year F (uCi/sec) from release point

R_s = count rate per mrem/yr to the skin

$$= C \div \left[\overline{X/Q} \sum_i (L_i + 1.1\, M_i)\, \dot{Q}_i \right]$$ See note 2

L_i = skin dose factor due to beta emissions from isotope i (mrem/yr per uCi/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 isotope i (mrad/yr per uCi/m^3) from Table 2.1-1

* Value taken from Reference 4, Table 6.1.26.

2.1.2 Containment Purge Monitor

The setpoint level for discharge through the containment purge system monitor, S_d, will be calculated in a corresponding manner:

$$S_d = \text{the lesser of} \begin{cases} 0.25 \times r_t \times D'_{TB} \\ \text{or} \\ 0.25 \times r_s \times D'_{ss} \end{cases} \quad (2)$$

Where,

$$D'_{TB} = \frac{500 - F\left[(\overline{X/Q}) \sum_i K_i \overline{q}_i\right]}{(1 - F)}$$

$$D'_{ss} = \frac{3000 - F\left[(\overline{X/Q}) \sum_i (L_i + 1.1\, M_i)\, \overline{q}_i\right]}{(1 - F)}$$

r_t = count rate per mrem/yr to the total body

$$= c \div \left[\overline{X/Q} \sum_i K_i \dot{q}_i\right]$$ See Note 2

c = count rate of the containment purge monitor for radionuclide concentrations to be discharged.

$\dot{q}_i$ = rate of release of noble gas radionuclide i (uCi/sec)

$\overline{q}_i$ = average rate of release of noble gas radionuclide i from the ventilation system for the elapsed fraction of the year F (uCi/sec).

r_s = count rate per mrem/yr to the skin

$$= c \div \left[\overline{X/Q} \sum_i (L_i + 1.1\, M_i)\, \dot{q}_i\right]$$ See Note 2

NOTES

1) The calculated setpoint values 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.

2) For ease of implementation, the count rate setpoints may be calculated by applying the methodologies presented in Sections 2.1.1 and 2.1.2 with the more restrictive assumption of continuous release at the limiting rate for a year as follows:

$$D''_{TB} = D_{TB} = D'_{TB} = 500 \text{ mrem/year}$$

$$D''_{ss} = D_{ss} = D'_{ss} = 3000 \text{ mrem/year}$$

3) A more conservative setpoint may be calculated to minimize requirements for adjustment of the monitor as follows:

D''_{TB} = 500 mrem/yr

D''_{ss} = 3000 mrem/yr

R_t'' = conservative count rate per mrem/yr to the total body (Xe-133 detection, Kr-89 dose)

$$= C' \div (\overline{X/Q} \times K \times \dot{Q}'')$$

Where,

$\dot{Q}''$ = Assigned release rate value of, for example, 1.0 uCi/sec, Xe-133. (See definition of C' below.)

C' = count rate of vent monitor for an effluent concentration of Xe-133 corresponding to a 1.0 uCi/sec release rate of Xe-133, (Note: Calculate the related concentration based on dilution flow.)

K = total body dose factor for Kr-89, the most restrictive isotope, from Table 2.1-1.

R_s'' = conservative count rate per mrem/yr to the skin

$$= C' \div \left[\overline{X/Q} \times (L + 1.1M) \times \dot{Q}'' \right]$$

Where

L = skin dose factor for Kr-89, the most restrictive isotope, from Table 2.1-1,

M = air dose factor for Kr-89, the most restrictive isotope, from Table 2.1-1.

D''_{TB} = 500 mrem/yr

D''_{ss} = 3000 mrem/yr

r_t'' = conservative count rate per mrem/yr to the total body for containment purge only

$$= c' \div \left[\overline{X/Q} \times K \times \dot{q}'' \right]$$

Where,

$\dot{q}''$ = release rate from the containment purge (may be determined for maximum flow from the system and the concentration specified for c' above).

c' = count rate of the containment purge monitor corresponding to a 1.0 uCi/ml concentration of Xe-133,

r_s'' = conservative count rate per mrem/yr to the skin for containment purge only,

$$= c' \div \left[\overline{X/Q} \times (L + 1.1M) \times \dot{q}'' \right]$$

TABLE 2.1-1

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

Nuclide	Y-Body** (K) i	B-Skin** (L) i	Y-Air* (M) i	B-Air* (N) i
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

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

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

*** 1.17E+03 = 1.17×10^3

2.2 Gaseous Effluent Dose Calculations

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

D_{tb} = average total body dose rate in current year (mrem/yr)

$$= \overline{X/Q} \sum_i K_i \overline{Q}_i$$

D_s = average skin dose rate in current year (mrem/yr)

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

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

D_o = average organ dose rate in current year (mrem/yr)

$$= W \sum_i P_i \overline{Q'}_i \qquad \text{where}$$

W = controlling sector annual average atmospheric dispersion at the unrestricted area boundary for the appropriate pathway.

$$= \begin{cases} \overline{X/Q} & \text{for inhalation (Section 2.1.1)} \\ \overline{D/Q} = 1.301 \times 10^{-8*}\ m^{-2} & \text{for other pathways in the SSE* sector} \end{cases}$$

* Value taken from Reference 4, Table 6.1.26.

P_i = dose parameter for radionuclide i, (mrem/yr per uCi/m^3) for inhalation and (M^2 • mrem/yr per uCi/sec) for other pathways, from Table 2.2-1.

$\overline{Q'}_i$ = average release rate of isotope i of radioiodine or other radionuclide in particulate form, with half-life greater than eight (8) days in the current year (uCi/sec).

2.2.2.a For the purpose of implementation of Specification 3.11.2.2, 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)

$$= 3.17 \times 10^{-8} \sum_i M_i \overline{X/Q'} \tilde{Q}_i$$

Where,

$\overline{X/Q'}$ = relative concentration for unrestricted areas

$= 5.176 \times 10^{-6*}$ sec/m^3, in the WSW sector

M_i = air dose factor due to gamma emissions from noble gas radionuclide i (mrad/yr per uCi/m^3) from Table 2.1-1

$\tilde{Q}_i$ = cumulative release of noble gas radionuclide i over the period of interest (uCi)

Note: 3.17×10^{-8} is the inverse of the number of seconds per year, and

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

* Value taken from Reference 4, Table 6.1.26.

$$= 3.17 \times 10^{-8} \sum_i N_i \overline{X/Q'} \tilde{Q}_i$$

Where,

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

$\overline{X/Q'}$ = relative concentration for unrestricted areas

= $5.176 \times 10^{-6*}$ sec/m^3, in the WSW sector

$\tilde{Q}_i$ = cumulative release of noble gas radionuclide i over the period of interest (uCi).

2.2.2.b Dose to an individual from tritium, radioiodines and radioactive materials in particulate form, with half-lives greater than eight (8) days will be calculated for the purpose of implementation of Specification 3.11.2.3 as follows:

D_P = dose to an individual from radioiodines and radionuclides in particulate form, with half-life greater than eight days (mrem)

$$= 3.17 \times 10^{-8} \sum_i R_i \quad W' \tilde{Q}'_i$$

Where,

W' = relative concentration for unrestricted areas

$$= \begin{cases} \overline{X/Q'} = \underline{3.001 \times 10^{-6*}} \text{ for inhalation} \\ \overline{D/Q'} = \underline{4.440 \times 10^{-9*}} \ m^{-2} \text{ for other pathways in the } \underline{SW} \text{ Sector} \end{cases}$$

* Values taken from Reference 4, Table 6.1.26

R_i = dose factor for radionuclide i, (mrem/yr per uCi/m^3) or (m^2 . mrem/yr per uCi/sec) from Table 2.2-2a

$\tilde{Q}'_i$ = cumulative release of radionuclide i of iodine or material in particulate form over the period of interest (uCi)

2.2.2.c For the purpose of implementing Specification 6.9.1.13, of the RETS dose calculations will be performed using the above equations with the substitution of average meteorological parameters which prevailed for the period of the report.

* Values taken from Reference 4, Table 6.1.26.

TABLE 2.2-1

PATHWAY DOSE FACTORS (Pi) FOR SECTION 2.2.1.b

AGE GROUP	(INFANT)	(N.A.)	(INFANT)
ISOTOPE	INHALATION	GROUND PLANE	FOOD
H-3	6.468E+02	0.000E+00	2.382E+03
C-14	2.646E+04	0.000E+00	2.340E+09
NA-24	1.056E+04	1.979E+07	1.542E+07
P-32	2.030E+06	0.000E+00	1.602E+11
CR-51	1.284E+04	7.864E+06	4.700E+06
MN-54	9.996E+05	1.287E+09	3.900E+07
MN-56	7.168E+04	1.525E+06	2.862E+00
FE-55	8.694E+04	0.000E+00	1.351E+08
FE-59	1.015E+06	4.562E+08	3.919E+08
CO-58	7.770E+05	6.194E+08	6.055E+07
CO-60	4.508E+06	5.172E+09	2.098E+08
NI-63	3.388E+05	0.000E+00	3.498E+10
NI-65	5.012E+04	4.930E+05	3.020E+01
CU-64	1.498E+04	9.823E+05	3.807E+06
ZN-65	6.468E+05	7.907E+08	1.904E+10
ZN-69	1.322E+04	0.000E+00	3.855E-09
BR-83	3.808E+02	1.011E+04	9.339E-01
BR-84	4.004E+02	3.376E+05	1.256E-22
BR-85	2.044E+01	0.000E+00	0.000E+00
RB-86	1.904E+05	1.478E+07	2.234E+10
RB-88	5.572E+02	5.399E+04	1.874E-44
RB-89	3.206E+02	2.075E+05	4.193E-53
SR-89	2.030E+06	3.560E+04	1.258E+10
SR-90	4.088E+07	0.000E+00	1.216E+11
SR-91	7.336E+04	3.587E+06	3.215E+05
SR-92	1.400E+05	1.233E+06	5.005E+01
Y-90	2.688E+05	7.583E+03	9.406E+05
Y-91M	2.786E+03	1.658E+05	1.876E-15
Y-91	2.450E+06	1.702E+06	5.251E+06
Y-92	1.266E+05	3.060E+05	1.026E+01
Y-93	1.666E+05	3.620E+05	1.776E+04
ZR-95	1.750E+06	3.975E+08	8.257E+05
ZR-97	1.400E+05	4.921E+06	4.446E+04
NB-95	4.788E+05	2.291E+08	2.062E+08
MO-99	1.348E+05	6.608E+06	3.108E+08
TC-99M	2.030E+03	3.013E+05	1.646E+04
TC-101	8.442E+02	3.253E+04	1.423E-56
RU-103	5.516E+05	1.804E+08	1.055E+05
RU-105	4.844E+04	1.030E+06	3.204E+00
RU-106	1.156E+07	3.590E+08	1.445E+06
AG-110M	3.668E+06	3.649E+09	1.461E+10

TABLE 2.2-1 (Continued)

PATHWAY DOSE FACTORS (Pi) FOR SECTION 2.2.1.b

AGE GROUP	(INFANT)	(N.A.)	(INFANT)
ISOTOPE	INHALATION	GROUND PLANE	FOOD
TE-125M	4.466E+05	3.001E+06	1.508E+08
TE-127M	1.312E+06	1.395E+05	1.037E+09
TE-127	2.436E+04	4.704E+03	1.359E+05
TE-129M	1.680E+06	3.290E+07	1.392E+09
TE-129	2.632E+04	4.395E+04	1.678E-07
TE-131M	1.988E+05	1.351E+07	2.288E+07
TE-131	8.218E+03	4.929E+07	1.384E-30
TE-132	3.402E+05	7.098E+06	6.513E+07
I-130	1.596E+06	9.560E+06	8.754E+08
I-131	1.484E+07	2.985E+07	1.053E+12
I-132	1.694E+05	2.075E+06	1.188E+02
I-133	3.556E+06	4.259E+06	9.601E+09
I-134	4.452E+04	7.578E+05	8.402E-10
I-135	6.958E+05	4.210E+06	2.002E+07
CS-134	7.028E+05	3.282E+09	6.801E+10
CS-136	1.345E+05	2.432E+08	5.795E+09
CS-137	6.118E+05	1.337E+09	6.024E+10
CS-138	8.764E+02	5.860E+05	2.180E-22
BA-139	5.096E+04	1.705E+05	2.874E-05
BA-140	1.596E+06	3.352E+07	2.410E+08
BA-141	4.746E+03	6.762E+04	3.141E-44
BA-142	1.554E+03	7.234E+04	0.000E+00
LA-140	1.680E+05	3.114E+07	1.880E+05
LA-142	5.950E+04	1.269E+06	6.019E-06
CE-141	5.166E+05	2.199E+07	1.366E+07
CE-143	1.162E+05	3.753E+06	1.536E+06
CE-144	9.842E+06	6.761E+07	1.334E+08
PR-143	4.326E+05	0.000E+00	7.845E+05
PR-144	4.284E+03	3.017E+03	1.171E-48
ND-147	3.220E+05	1.441E+07	5.743E+05
W-187	3.962E+04	3.915E+06	2.501E+06
NP-239	5.950E+04	2.823E+06	9.400E+04

Units: Inhalation - mrem/yr per uCi/m³
Others - m² . mrem/yr per uCi/sec

Values based on standard NUREG-0133, Section 5.2.1 assumptions unless otherwise indicated.

TABLE 2.2-2a

PATHWAY DOSE FACTORS (Ri) FOR SECTION 2.2.2.b

AGE GROUP	(CHILD)	(N. A.)	(CHILD)
ISOTOPE	INHALATION	GROUND PLANE	GRS/ANI/MEAT
H-3	1.125E+03	0.000E+00	1.826E+02
C-14	3.589E+04	0.000E+00	2.991E+08
NA-24	1.610E+04	1.385E+07	1.345E-03
P-32	2.605E+06	0.000E+00	5.781E+09
CR-51	1.698E+04	5.506E+06	3.636E+05
MN-54	1.576E+06	1.625E+09	6.249E+06
MN-56	1.232E+05	1.068E+06	1.901E-51
FE-55	1.110E+05	0.000E+00	3.566E+08
FE-59	1.269E+06	3.204E+08	4.943E+08
CO-58	1.106E+06	4.464E+08	7.485E+07
CO-60	7.067E+06	2.532E+10	2.993E+08
NI-63	8.214E+05	0.000E+00	2.272E+10
NI-65	8.399E+04	3.451E+05	3.167E-51
CU-64	3.670E+04	6.876E+05	1.087E-05
ZN-65	9.953E+05	8.583E+08	7.801E+08
ZN-69	1.018E+04	0.000E+00	0.000E+00
BR-83	4.736E+02	7.079E+03	7.425E-57
BR-84	5.476E+02	2.363E+05	0.000E+00
BR-85	2.531E+01	0.000E+00	0.000E+00
RB-86	1.983E+05	1.035E+07	4.536E+08
RB-88	5.624E+02	3.779E+04	0.000E+00
RB-89	3.452E+02	1.452E+05	0.000E+00
SR-89	2.157E+06	2.509E+04	3.756E+08
SR-90	1.010E+08	0.000E+00	8.111E+09
SR-91	1.739E+05	2.511E+06	4.128E-10
SR-92	2.424E+05	8.631E+05	2.724E-48
Y-90	2.679E+05	5.308E+03	3.806E+05
Y-91M	2.812E+03	1.161E+05	0.000E+00
Y-91	2.627E+06	1.207E+06	1.872E+08
Y-92	2.390E+05	2.142E+05	5.428E-35
Y-93	3.885E+05	2.534E+05	1.207E-07
ZR-95	2.231E+06	2.837E+08	4.763E+08
ZR-97	3.511E+05	3.445E+06	5.471E-01
NB-05	6.142E+05	1.605E+08	1.738E+09
MO-99	1.354E+05	4.626E+06	1.915E+05
TC-99M	4.810E+03	2.109E+05	5.394E-18
TC-101	5.846E+02	2.277E+04	0.000E+00
RU-103	6.623E+05	1.265E+08	3.127E+09
RU-105	9.953E+04	7.212E+05	4.590E-25
RU-106	1.432E+07	5.049E+08	5.384E+10
AG-110M	5.476E+06	4.019E+09	5.259E+08

TABLE 2.2-2a (Continued)

PATHWAY DOSE FACTORS (Ri) FOR SECTION 2.2.2.b

AGE GROUP	(CHILD)	(N. A.)	(CHILD)*
ISOTOPE	INHALATION	GROUND PLANE	GRS/ANL/MEAT
TE-125M	4.773E+05	2.128E+06	4.438E-06
TE-127M	1.480E+06	1.083E+05	3.947E+09
TE-127	5.624E+04	3.293E+03	1.254E-08
TE-129M	1.761E+06	2.305E+07	4.091E+09
TE-129	2.549E+04	3.076E+04	0.000E+00
TE-131M	3.078E+05	9.459E+06	7.656E+03
TE-131	2.054E+03	3.450E+07	0.000E+00
TE-132	3.774E+05	4.968E+06	7.274E+06
I-130	1.846E+06	6.692E+06	5.271E-04
I-131	1.624E+07	2.089E+07	4.293E+09
I-132	1.935E+05	1.452E+06	1.895E-57
I-133	3.848E+06	2.981E+06	1.017E+02
I-134	5.069E+04	5.305E+05	0.000E+00
I-135	7.918E+05	2.947E+06	8.104E-15
CS-134	1.014E+06	8.007E+09	1.180E+09
CS-136	1.709E+05	1.702E+08	3.452E+07
CS-137	9.065E+05	1.201E+10	1.040E+09
CS-138	8.399E+02	4.102E+05	0.000E+00
BA-139	5.772E+04	1.194E+05	0.000E+00
BA-140	1.743E+06	2.346E+07	3.420E+07
BA-141	2.919E+03	4.734E+04	0.000E+00
BA-142	1.643E+03	5.064E+04	0.000E+00
LA-140	2.257E+05	2.180E+07	4.284E+02
LA-142	7.585E+04	8.886E+05	0.000E+00
CE-141	5.439E+05	1.540E+07	1.078E+07
CE-143	1.273E+05	2.627E+06	1.963E+02
CE-144	1.195E+07	8.032E+07	1.476E+08
PR-143	4.329E+05	0.000E+00	2.815E+07
PR-144	1.565E+03	2.112E+03	0.000E+00
ND-147	3.282E+05	1.009E+07	1.174E+07
W-187	9.102E+04	2.740E+06	2.176E+00
NP-239	6.401E+04	1.976E+06	1.741E+03

Units: Inhalation - mrem/yr per uCi/m³
Others - m² . mrem/yr per uCi/sec

Values based on standard NUREG-0133, Section 5.3.1 assumptions unless otherwise indicated.

* Meat consumption assumed 75 percent beef and 25 percent mutton.

TABLE 2.2-2b

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3

AGE GROUP	(INFANT)	(N.A.)	(INFANT)	(INFANT)	(INFANT)
ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
H-3	6.468E+02	0.000E+00	2.382E+03	0.000E+00	0.000E+00
C-14	2.646E+04	0.000E+00	2.340E+09	0.000E+00	0.000E+00
NA-24	1.056E+04	1.385E+07	1.542E+07	0.000E+00	0.000E+00
P-32	2.030E+06	0.000E+00	1.602E+11	0.000E+00	0.000E+00
CR-51	1.284E+04	5.506E+06	4.700E+06	0.000E+00	0.000E+00
MN-54	9.996E+05	1.625E+09	3.900E+07	0.000E+00	0.000E+00
MN-56	7.168E+04	1.068E+06	2.862E+00	0.000E+00	0.000E+00
FE-55	8.694E+04	0.000E+00	1.351E+08	0.000E+00	0.000E+00
FE-59	1.015E+06	3.204E+08	3.919E+08	0.000E+00	0.000E+00
CO-58	7.770E+05	4.464E+08	6.055E+07	0.000E+00	0.000E+00
CO-60	4.508E+06	2.532E+10	2.098E+08	0.000E+00	0.000E+00
NI-63	3.388E+05	0.000E+00	3.493E+10	0.000E+00	0.000E+00
NI-65	5.012E+04	3.451E+05	3.020E+01	0.000E+00	0.000E+00
CU-64	1.498E+04	6.876E+05	3.807E+06	0.000E+00	0.000E+00
ZN-65	6.468E+05	8.583E+08	1.904E+10	0.000E+00	0.000E+00
ZN-69	1.322E+04	0.000E+00	3.855E-09	0.000E+00	0.000E+00
BR-83	3.808E+02	7.079E+03	9.339E-01	0.000E+00	0.000E+00
BR-84	4.004E+02	2.363E+05	1.256E-22	0.000E+00	0.000E+00
BR-85	2.044E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
RB-86	1.904E+05	1.035E+07	2.234E+10	0.000E+00	0.000E+00
RB-88	5.572E+02	3.779E+04	1.874E-44	0.000E+00	0.000E+00
RB-89	3.206E+02	1.452E+05	4.193E-53	0.000E+00	0.000E+00
SR-89	2.030E+06	2.509E+04	1.258E+10	0.000E+00	0.000E+00
SR-90	4.088E+07	0.000E+00	1.216E+11	0.000E+00	0.000E+00
SR-91	7.336E+04	2.511E+06	3.215E+05	0.000E+00	0.000E+00
SR-92	1.400E+05	8.631E+05	5.005E+01	0.000E+00	0.000E+00
Y-90	2.688E+05	5.308E+03	9.406E+05	0.000E+00	0.000E+00
Y-91M	2.786E+03	1.161E+05	1.876E-15	0.000E+00	0.000E+00
Y-91	2.450E+06	1.207E+06	5.251E+06	0.000E+00	0.000E+00
Y-92	1.266E+05	2.142E+05	1.026E+01	0.000E+00	0.000E+00
Y-93	1.666E+05	2.534E+05	1.776E+04	0.000E+00	0.000E+00
ZR-95	1.750E+06	2.837E+08	8.257E+05	0.000E+00	0.000E+00
ZR-97	1.400E+05	3.445E+06	4.446E+04	0.000E+00	0.000E+00
NB-95	4.788E+05	1.605E+08	2.062E+08	0.000E+00	0.000E+00
MO-99	1.348E+05	4.626E+06	3.108E+08	0.000E+00	0.000E+00
TC-99M	2.030E+03	2.109E+05	1.646E+04	0.000E+00	0.000E+00
TC-101	8.442E+02	2.277E+04	1.423E-56	0.000E+00	0.000E+00
RU-103	5.516E+05	1.265E+08	1.005E+05	0.000E+00	0.000E+00
RU-105	4.844E+04	7.212E+05	3.204E+00	0.000E+00	0.000E+00
RU-106	1.156E+07	5.049E+08	1.445E+06	0.000E+00	0.000E+00
AG-110M	3.668E+06	4.019E+09	1.461E+10	0.000E+00	0.000E+00

TABLE 2.2-2b (Continued)

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3

AGE GROUP	(INFANT)	(N.A.)	(INFANT)	(INFANT)	(INFANT)
ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
TE-125M	4.466E+05	2.128E+06	1.508E+08	0.000E+00	0.000E+00
TE-127M	1.312E+06	1.083E+05	1.037E+09	0.000E+00	0.000E+00
TE-127	2.436E+04	3.293E+03	1.359E+05	0.000E+00	0.000E+00
TE-129M	1.680E+06	2.305E+07	1.392E+09	0.000E+00	0.000E+00
TE-129	2.632E+04	3.076E+04	1.678E-07	0.000E+00	0.000E+00
TE-131M	1.988E+05	9.459E+06	2.288E+07	0.000E+00	0.000E+00
TE-131	8.218E+03	3.450E+07	1.384E-30	0.000E+00	0.000E+00
TE-132	3.403E+05	4.968E+06	6.513E+07	0.000E+00	0.000E+00
I-130	1.596E+06	6.692E+06	8.754E+08	0.000E+00	0.000E+00
I-131	1.484E+07	2.089E+07	1.053E+12	0.000E+00	0.000E+00
I-132	1.694E+05	1.452E+06	1.188E+02	0.000E+00	0.000E+00
I-133	3.556E+06	2.981E+06	9.601E+09	0.000E+00	0.000E+00
I-134	4.452E+04	5.305E+05	8.402E-10	0.000E+00	0.000E+00
I-135	6.958E+05	2.947E+06	2.002E+07	0.000E+00	0.000E+00
CS-134	7.028E+05	8.007E+09	6.801E+10	0.000E+00	0.000E+00
CS-136	1.345E+05	1.702E+08	5.795E+09	0.000E+00	0.000E+00
CS-137	6.118E+05	1.201E+10	6.024E+10	0.000E+00	0.000E+00
CS-138	8.764E+02	4.102E+05	2.180E-22	0.000E+00	0.000E+00
BA-139	5.096E+04	1.194E+05	2.874E-05	0.000E+00	0.000E+00
BA-140	1.596E+06	2.346E-07	2.410E+08	0.000E+00	0.000E+00
BA-141	4.746E+03	4.734E+04	3.141E-44	0.000E+00	0.000E+00
BA-142	1.554E+03	5.064E+04	0.000E+00	0.000E+00	0.000E+00
LA-140	1.680E+05	2.180E+07	1.880E+05	0.000E+00	0.000E+00
LA-142	5.950E+04	8.886E+05	6.019E-06	0.000E+00	0.000E+00
CE-141	5.166E+05	1.540E+07	1.366E+07	0.000E+00	0.000E+00
CE-143	1.162E+05	2.627E+06	1.536E+06	0.000E+00	0.000E+00
CE-144	9.842E+06	8.032E+07	1.334E+08	0.000E+00	0.000E+00
PR-143	4.326E+05	0.000E+00	7.845E+05	0.000E+00	0.000E+00
PR-144	4.284E+03	2.112E+03	1.171E-48	0.000E+00	0.000E+00
ND-147	3.220E+05	1.009E+07	5.743E+05	0.000E+00	0.000E+00
W-187	3.962E+04	2.740E+06	2.501E+06	0.000E+00	0.000E+00
NP-239	5.950E+04	1.976E+06	9.400E+04	0.000E+00	0.000E+00

Units: Inhalation - mrem/yr per uCi/m^3
Others - m^2 . mrem/yr per uCi/sec

Values based on standard NUREG-0133, Section 5.3.1 assumptions unless otherwise indicated.

TABLE 2.2-2c

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3

AGE GROUP	(CHILD)	(N.A.)	(CHILD)	(CHILD)	(CHILD)
ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
H-3	1.125E+03	0.000E+00	1.570E-03	2.341E-02	4.008E-03
C-14	3.589E+04	0.000E+00	1.195E+09	3.834E+08	8.894E-08
NA-24	1.610E+04	1.385E+07	8.853E+06	1.725E-03	3.729E+05
P-32	2.605E+06	0.000E+00	7.775E+10	7.411E+09	3.366E+09
CR-51	1.698E+04	5.506E+06	5.398E+06	4.661E+05	6.213E+06
MN-54	1.576E+06	1.625E+09	2.097E+07	8.011E+06	6.648E+08
MN-56	1.232E+05	1.068E+06	1.865E+00	2.437E-51	2.723E+03
FE-55	1.110E+05	0.000E+00	1.118E+08	4.571E+08	8.012E+08
FE-59	1.269E+06	3.204E+08	2.025E+08	6.338E+08	6.693E+08
CO-58	1.106E+06	4.464E+08	7.080E+07	9.596E+07	3.771E+08
CO-60	7.067E+06	2.532E+10	2.391E+08	3.838E+08	2.095E+09
NI-63	8.214E+05	0.000E+00	2.964E+10	2.912E+10	3.949E+10
NI-65	8.399E+04	3.451E+05	1.909E+01	4.061E-51	1.211E+03
CU-64	3.670E+04	6.876E+05	3.502E+06	1.393E-05	5.159E+05
ZN-65	9.953E+05	8.583E+08	1.101E+10	1.000E+09	2.164E+09
ZN-69	1.018E+04	0.000E+00	1.123E-09	0.000E+00	9.893E-04
BR-83	4.736E+02	7.079E+03	4.399E-01	9.519E-57	5.369E+00
BR-84	5.476E+02	2.363E+05	6.508E-23	0.000E+00	3.822E-11
BR-85	2.531E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
RB-86	1.983E+05	1.035E+07	8.804E+09	5.816E+08	4.584E+08
RB-88	5.624E+02	3.779E+04	7.150E-45	0.000E+00	4.374E-22
RB-89	3.452E+02	1.452E+05	1.715E-53	0.000E+00	1.642E-26
SR-89	2.157E+06	2.509E+04	6.618E+09	4.815E+08	3.593E+10
SR-90	1.010E+06	0.000E+00	1.117E+11	1.040E+10	1.243E+12
SR-91	1.739E+05	2.511E+06	2.878E+05	5.292E-10	1.157E+06
SR-92	2.424E+05	8.631E+05	4.134E+01	3.492E-48	1.378E+04
Y-90	2.679E+05	5.308E+03	9.171E+05	4.879E+05	6.569E+07
Y-91M	2.812E+03	1.161E+05	5.198E-16	0.000E+00	1.737E-05
Y-91	2.627E+06	1.207E+06	5.199E+06	2.400E+08	2.484E+09
Y-92	2.390E+05	2.142E+05	7.310E+00	6.959E-35	4.576E+04
Y-93	3.885E+05	2.534E+05	1.573E+04	1.547E-07	4.482E+06
ZR-95	2.231E+06	2.837E+08	8.786E+05	6.106E+08	8.843E+08
ZR-97	3.511E+05	3.445E+06	4.199E+04	7.015E-01	1.248E+07
NB-95	6.142E+05	1.605E+08	2.287E+08	2.228E+09	2.949E+08
MO-99	1.354E+05	4.626E+06	1.738E+08	2.456E+05	1.647E+07
TC-99M	4.810E+03	2.109E+05	1.474E+04	6.915E-18	5.255E-03
TC-101	5.846E+02	2.277E+04	5.593E-58	0.000E+00	4.123E-29
RU-103	6.623E+05	1.265E+08	1.108E+05	4.009E+09	3.971E+08
RU-105	9.953E+04	7.212E+05	2.493E+00	5.885E-25	5.981E+04
RU-106	1.432E+07	5.049E+08	1.437E+06	6.902E+10	1.159E+10
AG-110M	5.476E+06	4.019E+09	1.678E+10	6.742E+08	2.581E+09

TABLE 2.2-2c (Continued)

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3

AGE GROUP	(CHILD)	(N.A.)	(CHILD)	(CHILD)	(CHILD)
ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
TE-125M	4.773E+05	2.128E-06	7.377E+07	5.690E+08	3.506E-08
TE-127M	1.480E+06	1.083E+05	5.932E+08	5.060E+09	3.769E+09
TE-127	5.624E+04	3.293E+03	1.191E+05	1.607E-08	3.903E+05
TE-129M	1.761E+06	2.305E+07	7.961E+08	5.245E+09	2.460E+09
TE-129	2.549E+04	3.078E+04	6.166E-08	0.000E+00	7.204E-02
TE-131M	3.078E+05	9.459E+06	2.244E+07	9.815E+03	2.163E+07
TE-131	2.054E+03	3.450E+07	8.489E-32	0.000E+00	1.349E-14
TE-132	3.774E+05	4.968E+06	4.551E+07	9.325E+06	3.111E+07
I-130	1.846E+06	6.692E+06	3.845E+08	6.758E-04	1.370E+08
I-131	1.624E+07	2.089E+07	4.333E+11	5.503E+09	4.754E+10
I-132	1.935E+05	1.452E+06	5.129E+01	2.429E-57	7.314E+03
I-133	3.848E+06	2.981E+06	3.945E+09	1.304E+02	8.113E+08
I-134	5.069E+04	5.305E+05	3.624E-10	0.000E+00	6.622E-03
I-135	7.918E+05	2.947E+06	8.607E+06	1.039E-14	9.973E+06
CS-134	1.104E+06	8.007E+09	3.715E+10	1.513E+09	2.631E+10
CS-136	1.709E+05	1.702E+08	2.773E+09	4.426E+07	2.247E+08
CS-137	9.065E+05	1.201E+10	3.224E+10	1.334E+09	2.392E+10
CS-138	8.399E+02	4.102E+05	5.528E-23	0.000E+00	9.133E-11
BA-139	5.772E+04	1.194E+05	1.231E-05	0.000E+00	2.950E+00
BA-140	1.743E+06	2.346E+07	1.171E+08	4.384E+07	2.767E+08
BA-141	2.919E+03	4.734E+04	1.210E-45	0.000E+00	1.605E-21
BA-142	1.643E+03	5.064E+04	0.000E+00	0.000E+00	4.105E-39
LA-140	2.257E+05	2.180E+07	1.894E+05	5.492E+02	3.166E+07
LA-142	7.585E+04	8.886E+05	2.904E-06	0.000E+00	1.582E+01
CE-141	5.439E+05	1.540E+07	1.361E+07	1.382E+07	4.082E+08
CE-143	1.273E+05	2.627E+06	1.488E+06	2.516E+02	1.364E+07
CE-144	1.195E+07	8.032E+07	1.326E+08	1.893E+08	1.039E+10
PR-143	4.329E+05	0.000E+00	7.754E+05	3.609E+07	1.575E+08
PR-144	1.565E+03	2.112E+03	2.040E-50	0.000E+00	3.829E-23
ND-147	3.282E+05	1.009E+07	5.712E+05	1.505E+07	9.197E+07
W-187	9.102E+04	2.740E+06	2.420E+06	2.790E+00	5.380E+06
NP-239	6.401E+04	1.976E+06	9.138E+04	2.232E+03	1.357E+07

Units: Inhalation - mrem/yr per uCi/m^3
Others - m^2 . mrem/yr per uCi/sec

Values based on standard NUREG-0133, Section 5.3.1 assumptions unless otherwise indicated.

TABLE 2.2-2d

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3

AGE GROUP	(TEENAGER)	(N.A.)	(TEENAGER)	(TEENAGER)	(TEENAGER)
ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
H-3	1.272E+03	0.000E+00	9.941E+02	1.938E+02	2.588E+03
C-14	2.600E+04	0.000E+00	4.859E+08	2.040E+08	3.690E+08
NA-24	1.376E+04	1.385E+07	4.255E+06	1.084E-03	2.389E+05
P-32	1.888E+06	0.000E+00	3.153E+10	3.931E+09	1.608E+09
CR-51	2.096E+04	5.506E+06	8.387E+06	9.471E+05	1.037E+07
MN-54	1.984E+06	1.625E+09	2.875E+07	1.436E+07	9.320E+08
MN-56	5.744E+04	1.068E+06	4.856E-01	8.302E-52	9.451E+02
FE-55	1.240E+05	0.000E+00	4.454E+07	2.382E+08	3.259E+08
FE-59	1.528E+06	3.204E+08	2.861E+08	1.171E+09	9.895E+08
CO-58	1.344E+06	4.464E+08	1.095E+08	1.942E+08	6.034E+08
CO-60	8.720E+06	2.532E+10	3.621E+08	7.600E+08	3.238E+09
NI-63	5.800E+05	0.000E+00	1.182E+10	1.519E+10	1.606E+10
NI-65	3.672E+04	3.451E+05	4.692E+00	1.305E-51	3.966E+02
CU-64	6.144E+04	6.876E+05	3.293E+06	1.713E-05	6.465E+05
ZN-65	1.240E+06	8.583E+08	7.315E+09	8.688E+08	1.471E+09
ZN-69	1.584E+03	0.000E+00	1.760E-11	0.000E+00	2.067E-05
BR-83	3.440E+02	7.079E+03	1.790E-01	5.066E-57	2.911E+00
BR-84	4.328E+02	2.363E+05	2.877E-22	0.000E+00	2.251E-11
BR-85	1.832E+01	0.000E+00	0.000E+00	0.000E+00	0.000E-00
RB-86	1.904E+05	1.035E+07	4.746E+09	4.101E+08	2.772E+08
RB-88	5.456E+02	3.779E+04	3.886E-45	0.000E+00	3.168E-22
RB-89	3.520E+02	1.452E+05	9.774E-54	0.000E+00	1.247E-26
SR-89	2.416E+06	2.509E+04	2.674E+09	2.545E+08	1.513E+10
SR-90	1.080E+08	0.000E+00	6.612E+10	8.049E+09	7.507E+11
SR-91	2.592E+05	2.511E+06	2.409E+05	5.794E-10	1.291E+06
SR-92	1.192E+05	8.631E+05	2.277E+01	2.516E-48	1.012E+04
Y-90	5.592E+05	5.308E+03	1.074E+06	7.470E+05	1.025E+08
Y-91M	3.200E+03	1.161E+05	5.129E-18	0.000E+00	2.285E-07
Y-91	2.936E+06	1.207E+06	6.475E+06	3.910E+08	3.212E+09
Y-92	1.648E+05	2.142E+05	2.828E+00	3.522E-35	2.360E+04
Y-93	5.792E+05	2.534E+05	1.312E+04	1.688E-07	4.983E+06
ZR-95	2.688E+06	2.837E+08	1.201E+06	1.092E+09	1.253E+09
ZR-97	6.304E+05	3.445E+06	4.225E+04	9.231E-01	1.673E+07
NB-95	7.512E+05	1.605E+08	3.338E+08	4.251E+09	4.551E+08
MO-99	2.688E+05	4.626E+06	1.023E+08	1.892E+05	1.293E+07
TC-99M	6.128E+03	2.109E+05	1.055E+04	6.471E-18	5.011E+03
TC-101	6.672E+02	2.277E+04	3.287E-58	0.000E+00	3.229E-29
RU-103	7.832E+05	1.265E+08	1.513E+05	7.162E+09	5.706E+08
RU-105	9.040E+04	7.212E+05	1.263E+00	3.900E-25	4.039E+04
RU-106	1.608E+07	5.049E+08	1.799E+06	1.130E+11	1.484E+10
AG-110M	6.752E+06	4.019E+09	2.559E+10	1.345E+09	4.031E+09

TABLE 2.2-2d (Continued)

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3

AGE GROUP	(TEENAGER)	(N.A.)	(TEENAGER)	(TEENAGER)	(TEENAGER)
ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
TE-125M	5.360E+05	2.128E+06	8.863E+07	8.941E+08	4.375E-08
TE-127M	1.656E+06	1.083E+05	3.420E+08	3.816E+09	2.236E-09
TE-127	8.080E+04	3.293E+03	9.572E+04	1.689E-08	4.180E+05
TE-129M	1.976E+06	2.305E+07	4.602E+08	3.966E+09	1.508E+09
TE-129	3.296E+03	3.076E+04	2.196E-09	0.000E+00	3.418E-03
TE-131M	6.208E+05	9.459E+06	2.529E+07	1.447E+04	3.248E-07
TE-131	2.336E+03	3.450E+07	2.879E-32	0.000E+00	6.099E-15
TE-132	4.632E+05	4.968E+06	8.581E+07	2.300E+07	7.818E+07
I-130	1.488E+06	6.692E+06	1.742E+08	4.005E-04	8.276E+07
I-131	1.464E+07	2.089E+07	2.195E+11	3.645E+09	3.140E+10
I-132	1.512E+05	1.452E+06	2.242E+01	1.389E-57	4.262E+03
I-133	2.920E+06	2.981E+06	1.674E+09	7.234E+01	4.587E+08
I-134	3.952E+04	5.305E+05	1.583E-10	0.000E+00	3.854E-03
I-135	6.208E+05	2.947E+06	3.777E+06	5.963E-15	5.832E+06
CS-134	1.128E+06	8.007E+09	2.310E+10	1.231E+09	1.671E+10
CS-136	1.936E+05	1.702E+08	1.759E+09	3.671E+07	1.708E+08
CS-137	8.480E+05	1.201E+10	1.781E+10	9.634E+08	1.348E+10
CS-138	8.560E+02	4.102E+05	3.149E-23	0.000E+00	6.935E-11
BA-139	6.464E+03	1.194E+05	7.741E-07	0.000E+00	2.472E-01
BA-140	2.032E+06	2.346E+07	7.483E+07	3.663E+07	2.130E+08
BA-141	3.288E+03	4.734E+04	4.922E-46	0.000E+00	8.699E-22
BA-142	1.912E+03	5.064E+04	0.000E+00	0.000E+00	2.269E-39
LA-140	4.872E+05	2.180E+07	2.291E+05	8.689E+02	5.104E+07
LA-142	1.200E+04	8.886E+05	2.574E-07	0.000E+00	1.868E+00
CE-141	6.136E+05	1.540E+07	1.696E+07	2.252E+07	5.404E+08
CE-143	2.552E+05	2.627E+06	1.671E+06	3.695E+02	2.040E+07
CE-144	1.336E+07	8.032E+07	1.655E+08	3.089E+08	1.326E+10
PR-143	4.832E+05	0.000E+00	9.553E+05	5.817E+07	2.310E+08
PR-144	1.752E+03	2.112E+03	1.238E-53	0.000E+00	3.097E-26
ND-147	3.720E+05	1.009E+07	7.116E+05	2.452E+07	1.424E+08
W-187	1.768E+05	2.740E+06	2.646E+06	3.989E+00	7.839E+06
NP-239	1.320E+05	1.976E+06	1.060E+05	3.387E+03	2.097E+07

Units: Inhalation - mrem/yr per uCi/m³
Others - m² . mrem/yr per uCi/sec

Values based on standard NUREG-0133, Section 5.3.1 assumptions unless otherwise indicated.

ONLY

TABLE 2.2-2e

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3

AGE GROUP	(ADULT)	(N. A.)	(ADULT)	(ADULT)	(ADULT)
ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
H-3	1.264E+03	0.000E+00	7.629E+02	3.248E+02	2.260E+03
C-14	1.816E+04	0.000E+00	2.634E+08	2.414E+08	2.276E+08
NA-24	1.024E+04	1.385E+07	2.438E+06	1.356E-03	2.690E+05
P-32	1.320E+06	0.000E+00	1.709E+10	4.651E+09	1.403E+09
CR-51	1.440E+04	5.506E+06	7.187E+06	1.772E+06	1.168E+07
MN-54	1.400E+06	1.625E+09	2.578E+07	2.812E+07	9.585E+08
MN-56	2.024E+04	1.068E+06	1.328E-01	4.958E-52	5.082E+02
FE-55	7.208E+04	0.000E+00	2.511E+07	2.933E+08	2.096E+08
FE-59	1.016E+06	3.204E+08	2.326E+08	2.080E+09	9.875E+08
CO-58	9.280E+05	4.464E+08	9.565E+07	3.703E+08	6.252E+08
CO-60	5.968E+06	2.532E+10	3.082E+08	1.413E+09	3.139E+09
NI-63	4.320E+05	0.000E+00	6.729E+09	1.888E+10	1.040E+10
NI-65	1.232E+04	3.451E+05	1.219E+00	7.405E-52	2.026E+02
CU-64	4.896E+04	6.876E+05	2.031E+06	2.307E-05	7.841E+05
ZN-65	8.640E+05	8.583E+08	4.365E+09	1.132E+09	1.009E+09
ZN-69	9.200E+02	0.000E+00	5.207E-12	0.000E+00	1.202E-05
BR-83	2.408E+02	7.079E+03	1.399E-01	8.648E-57	4.475E+00
BR-84	3.128E+02	2.363E+05	1.609E-23	0.000E+00	2.475E-11
BR-85	1.280E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
RB-86	1.352E+05	1.035E+07	2.604E+09	4.914E+08	2.217E+08
RB-88	3.872E+02	3.779E+04	2.139E-45	0.000E+00	3.428E-22
RB-89	2.560E+02	1.452E+05	5.523E-54	0.000E+00	1.385E-26
SR-89	1.400E+06	2.509E+04	1.451E+09	3.014E+08	9.961E+09
SR-90	9.920E+07	0.000E+00	4.680E+10	1.244E+10	6.046E+11
SR-91	1.912E+05	2.511E+06	1.377E+05	7.233E-10	1.451E+06
SR-92	4.304E+04	8.631E+05	9.675E+00	2.334E-48	8.452E+03
Y-90	5.056E+05	5.308E+03	7.511E+05	1.141E+06	1.410E+08
Y-91M	1.920E+03	1.161E+05	1.743E-19	0.000E+00	1.527E-08
Y-91	1.704E+06	1.207E+06	4.726E+06	6.231E+08	2.814E+09
Y-92	7.352E+04	2.142E+05	9.772E-01	2.657E-35	1.603E+04
Y-93	4.216E+05	2.534E+05	7.388E+03	2.075E-07	5.517E+06
ZR-95	1.768E+06	2.837E+08	9.587E+05	1.903E+09	1.194E+09
ZR-97	5.232E+05	3.445E+06	2.707E+04	1.292E+00	2.108E+07
NB-95	5.048E+05	1.605E+08	2.786E+08	7.748E+09	4.798E+08
MO-99	2.480E+05	4.626E+06	5.741E+07	2.318E+05	1.426E+07
TC-99M	4.160E+03	2.109E+05	5.553E+03	7.439E-18	5.187E+03
TC-101	3.992E+02	2.277E+04	1.813E-58	0.000E+00	3.502E-29
RU-103	5.048E+05	1.265E+08	1.189E+05	1.299E+10	5.577E+08
RU-105	4.816E+04	7.212E+05	5.240E-01	3.533E-25	3.294E+04
RU-106	9.360E+06	5.049E+08	1.320E+06	1.811E+11	1.247E+10
AG-110M	4.632E+06	4.019E+09	2.198E+10	2.523E+09	3.979E+09

TABLE 2.2-2e (Continued)

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3

AGE GROUP	(ADULT)	(N. A.)	(ADULT)	(ADULT)	(ADULT)
ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
TE-125M	3.136E+05	2.128E+06	6.626E+07	1.460E+09	3.927E+08
TE-127M	9.600E+05	1.083E+05	1.860E+08	4.531E+09	1.418E+09
TE-127	5.736E+04	3.293E+03	5.278E+04	2.034E-08	4.532E+05
TE-129M	1.160E+06	2.305E+07	3.028E+08	5.698E+09	1.261E+09
TE-129	1.936E+03	3.076E+04	9.167E-10	0.000E+00	2.806E-03
TE-131M	5.560E+05	9.459E+06	1.753E+07	2.190E+04	4.428E+07
TE-131	1.392E+03	3.450E+07	1.578E-32	0.000E+00	6.575E-15
TE-132	5.096E+05	4.968E+06	7.324E+07	4.287E+07	1.312E+08
I-130	1.136E+06	6.692E+06	1.050E+08	5.272E-04	9.809E+07
I-131	1.192E+07	2.089E+07	1.388E+11	5.034E+09	3.785E+10
I-132	1.144E+05	1.452E+06	1.342E+01	1.816E-57	5.016E+03
I-133	2.152E+06	2.981E+06	9.891E+08	9.336E+01	5.331E+08
I-134	2.984E+04	5.305E+05	9.491E-11	0.000E+00	4.544E-03
I-135	4.480E+05	2.947E+06	2.217E+06	7.644E-15	6.731E+06
CS-134	8.480E+05	8.007E+09	1.345E+10	1.565E+09	1.110E+10
CS-136	1.464E+05	1.702E+08	1.036E+09	4.724E+07	1.675E+08
CS-137	6.208E+05	1.201E+10	1.010E+10	1.193E+09	8.696E+09
CS-138	6.208E+02	4.102E+05	1.786E-23	0.000E+00	7.730E-11
BA-139	3.760E+03	1.194E+05	8.322E-08	0.000E+00	5.225E-02
BA-140	1.272E+06	2.346E+07	5.535E+07	5.917E+07	2.646E+08
BA-141	1.936E+03	4.734E+04	2.677E-46	0.000E+00	9.305E-22
BA-142	1.192E+03	5.064E+04	0.000E+00	0.000E+00	2.463E-39
LA-140	4.584E+05	2.180E+07	1.672E+05	1.385E+03	7.327E+07
LA-142	6.328E+03	8.886E+05	3.503E-08	0.000E+00	4.999E-01
CE-141	3.616E+05	1.540E+07	1.253E+07	3.632E+07	5.097E+08
CE-143	2.264E+05	2.627E+06	1.149E+06	5.547E+02	2.758E+07
CE-144	7.776E+06	8.032E+07	1.209E+08	4.928E+08	1.112E+10
PR-143	2.808E+05	0.000E+00	6.923E+05	9.204E+07	2.748E+08
PR-144	1.016E+03	2.112E+03	6.716E-54	0.000E+00	3.303E-26
ND-147	2.208E+05	1.009E+07	5.231E+05	3.935E+07	1.853E+08
W-187	1.552E+05	2.740E+06	1.796E+06	5.912E+00	1.046E+07
NP-239	1.192E+05	1.976E+06	7.385E+04	5.152E+03	2.872E+07

Units: Inhalation - mrem/yr per uCi/m³
Others - m³ . mrem/yr per uCi/sec

Values based on standard NUREG-0133, Section 5.3.1 assumptions unless otherwise indicated.

INFO ONLY

TABLE 2.2-3

CONTROLLING RECEPTORS, LOCATIONS, AND PATHWAYS

Sector	Distance (Meters)	Pathway	Age Group	Origin (for info only)
N	2816	Vegetation	Child	- garden
NNE	2414	Vegetation	Child	- garden
NE	1062	Inhal/Grd Plane	Infant	- residence
ENE	4828	Vegetation	Child	- garden
E	2414	Vegetation	Child	- garden
ESE	4426	Vegetation	Child	- garden
SE	3299	Inhal/Grd Plane	Infant	- residence
SSE	1690	Inhal/Grd Plane	Infant	- residence
S	1770	Inhal/Grd Plane	Infant	- residence
SSW	3734	Inhal/Grd Plane	Infant	- residence
SW	1432	Inhal/Grd Plane	Infant	- residence
WSW	8047	Cow/Milk	Infant	- hypothetical
W	8047	Cow/Milk	Infant	- hypothetical
WNW	6437	Inhal/Grd Plane	Infant	- residence
NW	8047	Cow/Milk	Infant	- hypothetical
NNW	1738	Inhal/Grd Plane	Infant	- residence

Table based on Reference 4, Tables 5.2.8 and 6.1.26.

2.3 Meteorological Model

2.3.1 The atmospheric dispersion for all gaseous releases is calculated using a ground-level, wake-split form of the straight line flow model.

X/Q = atmospheric dispersion (sec/m^3)

$$= \frac{2.03\ \delta\ k}{ru\ \sum}$$

Where,

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

δ = plume depletion factor at distance r from Figure 2.3-1.

u = wind speed at ground level (m/sec)

k = open terrain recirculation factor at distance r, from Figure 2.3.4

$\sum$ = the lesser of $(\sigma^2 + \frac{b^2}{\pi})^{\frac{1}{2}}$ or $\sqrt{3}\,\sigma$

Where,

σ = vertical standard deviation (m) of the plume at distance r for ground-level releases under the stability category indicated by $\dot{T}$, from Figure 2.3-2.

$\dot{T}$ = temperature differential with vertical separation (°K/100m)

b = height of the reactor building = 53.3m.

2.3.2 Relative deposition per unit area for all releases is calculated for a ground level release as follows:

D/Q = relative deposition per unit area (m^{-2})

$$= \frac{2.55}{r} (D_g)$$

Where,

D_g = relative deposition rate at distance r for ground level releases from Figure 2.3-3.

TABLE 2.3-1

ATMOSPHERIC DISPERSION PARAMETERS*

FOR TECHNICAL SPECIFICATION 4.11.2.4.1

SECTOR	X/Q	D/Q
N	5.468×10^{-7}	1.840×10^{-9}
NNE	4.079×10^{-7}	1.600×10^{-9}
NE	1.121×10^{-6}	5.759×10^{-9}
ENE	7.044×10^{-8}	3.207×10^{-10}
E	2.283×10^{-7}	1.093×10^{-9}
ESE	7.183×10^{-8}	3.520×10^{-10}
SE	1.817×10^{-7}	8.420×10^{-10}
SSE	7.600×10^{-7}	3.300×10^{-9}
S	1.219×10^{-6}	3.809×10^{-9}
SSW	4.113×10^{-7}	8.261×10^{-10}
SW	3.001×10^{-6}	4.440×10^{-9}
WSW	3.931×10^{-7}	3.177×10^{-10}
W	4.259×10^{-7}	3.476×10^{-10}
WNW	4.359×10^{-7}	4.662×10^{-10}
NW	1.548×10^{-7}	2.733×10^{-10}
NNW	1.373×10^{-6}	4.174×10^{-9}

* Reference: Grand Gulf Nuclear Station, Environmental Report, Table 6.1.26.

2.4 Definitions of Gaseous Effluents Parameters

h = height of reactor building (m) (2.3.1)

C = count rate of the station vent monitor corresponding to grab sample radionuclide concentrations (2.1.1)

C' = count rate of station vent monitor corresponding to a 1.0 uCi/ml concentration of Xe-133 (2.1.2)

c = count rate of the containment purge monitor for radionuclide concentrations to be discharged (2.1.2)

c' = count rate of the containment purge monitor corresponding to a 1.0 uCi/ml concentration of Xe-133 (2.1.2)

D_g = relative deposition rate for ground level releases from Figure 2.3-3 (m^{-1}) (2.3.2)

D_o = average organ dose rate in current year (mrem) (2.2.1.b)

D_p = dose to an individual from radioiodines and radionuclides in particulate form, with half-life greater than eight days (mrem) (2.2.2.b)

D_s = average skin dose rate in current year (mrem) (2.2.1.a)

D_{tb} = average total body dose rate in current year (mrem) (2.2.1.a)

D_β = air dose due to beta emissions from noble gas radionuclide i (mrad) (2.2.2.a)

D_γ = air dose due to gamma emissions from noble gas radionuclide i (mrad) (2.2.2.a)

D/Q = relative deposition per unit area (m^{-2}) (2.3.2)

δ = plume depletion factor at distance r for appropriate stability class and effective height from Figures 2.3-2 and 2.3-3. (2.3.1)

F = fraction of current year elapsed at time of calculation (2.1.1)

k = open terrain recirculation factor at distance r from Figure 2.3-1 (2.3.1)

2.4 Definitions of Gaseous Effluents Parameters (Continued)

K = total body dose factor for Kr-89, the most restrictive isotope (mrem/yr per uCi/m³), from Table 2.1-1 (2.1.2)

K_i = total body dose factor due to gamma emissions from isotope i (mrem/yr per uCi/m³) from Table 2.1-1 (2.1.1)

D_{TB} = limiting dose rate to the total body based on the limit of 500 mrem in one year. (2.1.1)

D_{ss} = limiting dose rate to the skin based on the limit of 3000 mrem in one year. (2.1.1)

D'_{TB} = limiting dose rate to the total body based on the limit of 500 mrem in one year (containment purge) (2.1.2)

D'_{ss} = limiting dose rate to the skin based on the limit of 3000 mrem in one year (containment purge) (2.1.2)

D''_{TB} = limiting dose rate to the total body based on the conservative dose rate of 500 mrem/year. (Note 2)

D''_{ss} = limiting dose rate to the skin based on the conservative dose rate of 3000 mrem/year. (Note 2)

L = skin dose factor for Kr-89, the most restrictive isotope (mrem/yr per uCi/m³) from Table 2.1-1 (2.1.2)

L_i = skin dose factor due to beta emissions from isotope i (mrem/yr per uCi/m³) from Table 2.1-1 (2.1.1)

M = air dose factor for Kr-89, the most restrictive isotope (mrad/yr per uCi/m³), from Table 2.1-1 (2.1.2)

M_i = air dose factor due to gamma emissions from isotope i (mrad/yr per uCi/m³) 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 uCi/m³) from Table 2.1-1 (2.2.2.a)

P_i = dose parameter for radionuclide i, (mrem/yr per uCi/m³) for inhalation from (m³ · mrem/yr per uCi/sec) for other pathways, from Table 2.2-1 (2.2.1.b)

$\dot{Q}_i$ = rate of release of noble gas radionuclide i (uCi/sec) (2.1.1)

$\overline{Q}_i$ = average rate of release of noble gas radionuclide i for the elapsed fraction of the year F (uCi/sec) (2.1.1)

2.4 Definitions of Gaseous Effluents Parameters (Continued)

$\overline{\overline{Q'}}_i$ = average release rate of isotope i of radioiodine or other radionuclide in particulate form, with half-life greater than eight (8) days in the current year (uCi/sec) (2.2.1.b)

$\tilde{Q}_i$ = cumulative release of noble gas radionulide i over the period of interest (uCi) (2.2.2.a)

$\tilde{Q'}_i$ = cumulative release of radionuclide i of iodine or material in particulate form over the period of interest (uCi) (2.2.2.b)

$\dot{q}_i$ = rate of release of noble gas radionuclide i (uCi/sec) (2.1.2)

$\overline{q}_i$ = average rate of release of noble gas radionuclide i from the elapsed fraction of the year F (uCi/sec) (2.1.2)

$\dot{Q}''$ = assigned release rate value of, for example, 1.0 uCi/sec, Xe-133; related to definition of C' for the vent. (Note 3)

$\dot{q}''$ = release rate from containment purge associated with maximum flow from system and concentration specified for c'. (Note 3)

R_i = dose factor for radionuclide i, (mrem/yr per uCi/m^3) or (m^3 • mrem/yr per uCi/sec)

R_s = count rate per mrem/yr to the skin. (2.1.1)

R_t = count rate per mrem/yr to the total body. (2.1.1)

R''_s = conservative count rate per mrem/yr to the skin. (2.1.2)

R''_t = conservative count rate per mrem/yr to the total body (Xe-133 detection, Kr-89 dose). (2.1.2)

r = distance (m) from release point to location of interest for dispersion calculation. (2.3.1)

r_s = count rate per mrem/yr to the skin for containment purge monitor only. (2.1.2)

r_t = count rate per mrem/yr to the total body for containment purge monitor only. (2.1.2)

r''_s = conservative count rate per mrem/yr to the skin for containment purge only. (2.1.2)

2.4 Definitions of Gaseous Effluents Parameters (Continued)

r''_t = conservative count rate per mrem/yr to the total body for containment purge only. (2.1.2)

S_d = count rate of containment purge noble gas monitor at alarm setpoint level. (2.1.2)

S_v = count rate of station vent noble gas monitor at alarm setpoint level. (2.1.1)

$\sum$ = vertical standard deviation of the plume with building wake correction (m). (2.3.1)

σ = vertical standard deviation (m) of the plume at distance r for effective height under stability category indicated by T(m) from Figure 2.3-2. (2.3.1)

$\dot{T}$ = temperature differential with vertical separation (°K/100m). (2.3.1)

u = wind speed at ground level (m/sec). (2.3.1)

W = controlling sector annual average atmospheric dispersion at the site boundary for the appropriate pathway (sec/m^3). (2.2.1.b)

W' = relative concentration for unrestricted areas (sec/m^3). (2.2.2.b)

X/Q = atmospheric dispersion (sec/m^3) (2.3.1)

$\overline{X/Q}$ = highest sector annual average atmospheric dispersion at the unrestricted area boundary (sec/m^3) (2.1.1)

$\overline{X/Q}'$ = relative concentration for unrestricted areas (sec/m^3) (2.2.2.a)

Figure 2.3-1 Plume Depletion Effect for Ground Level Releases
(All Atmospheric Stability Classes)

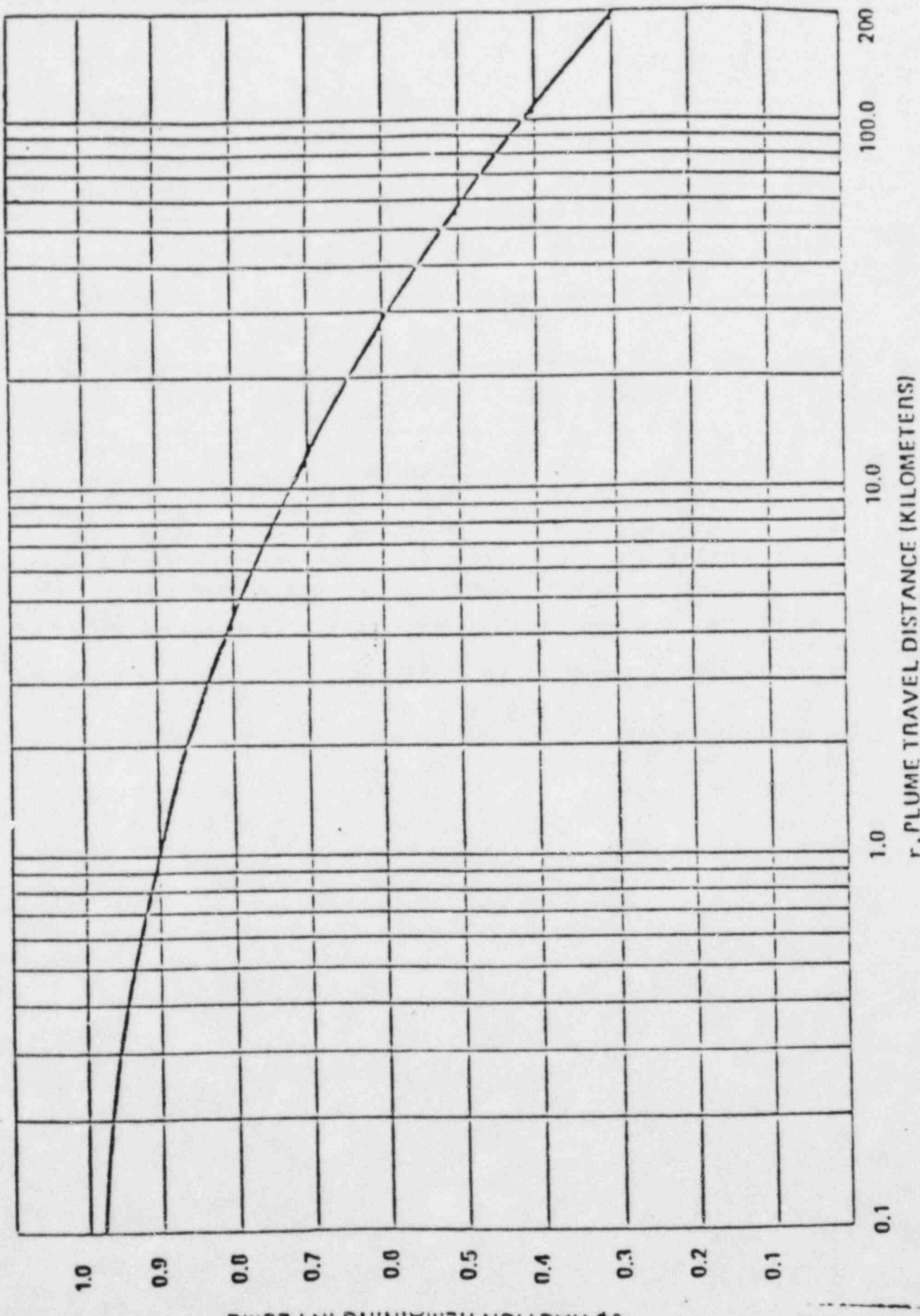


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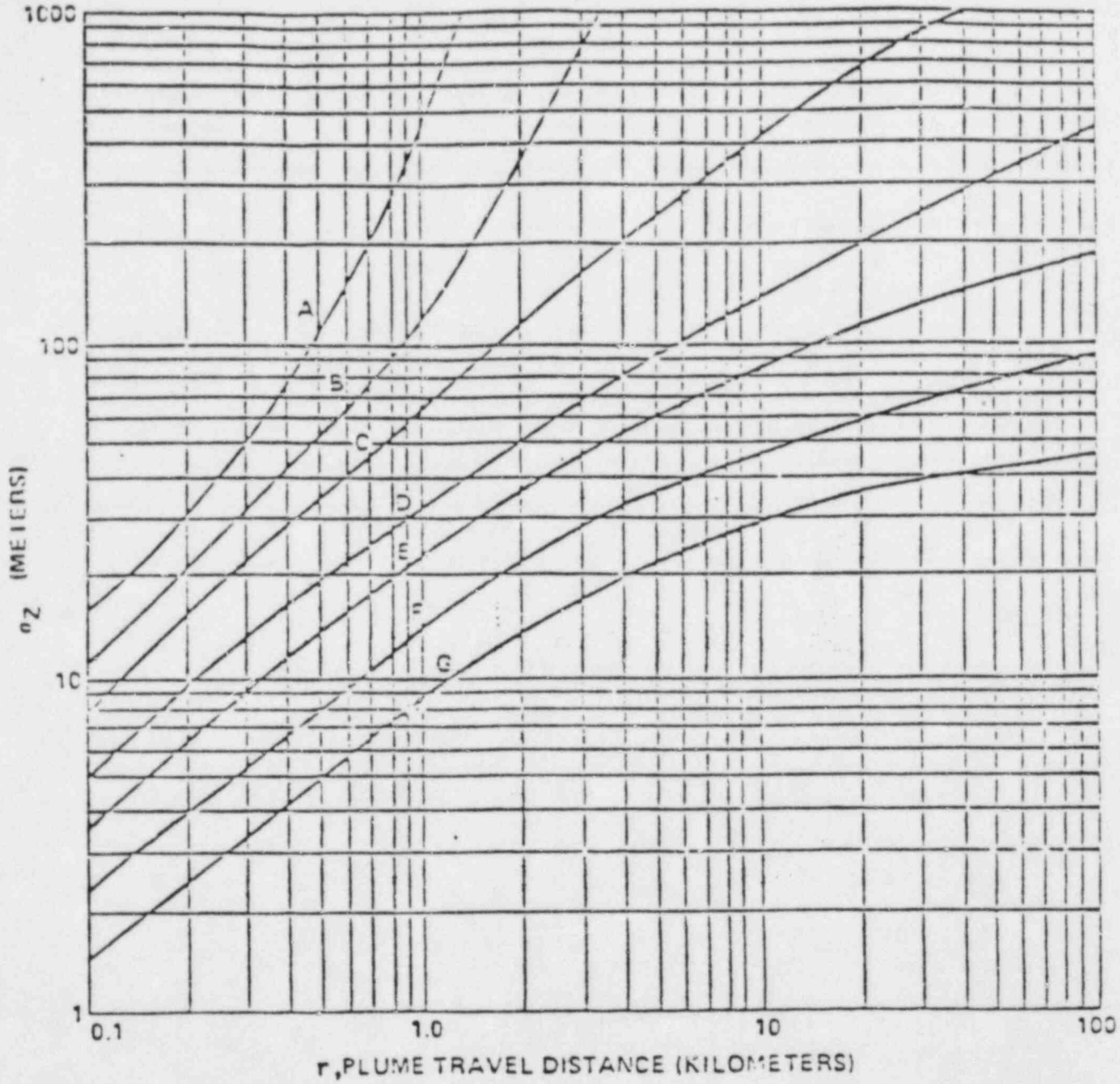
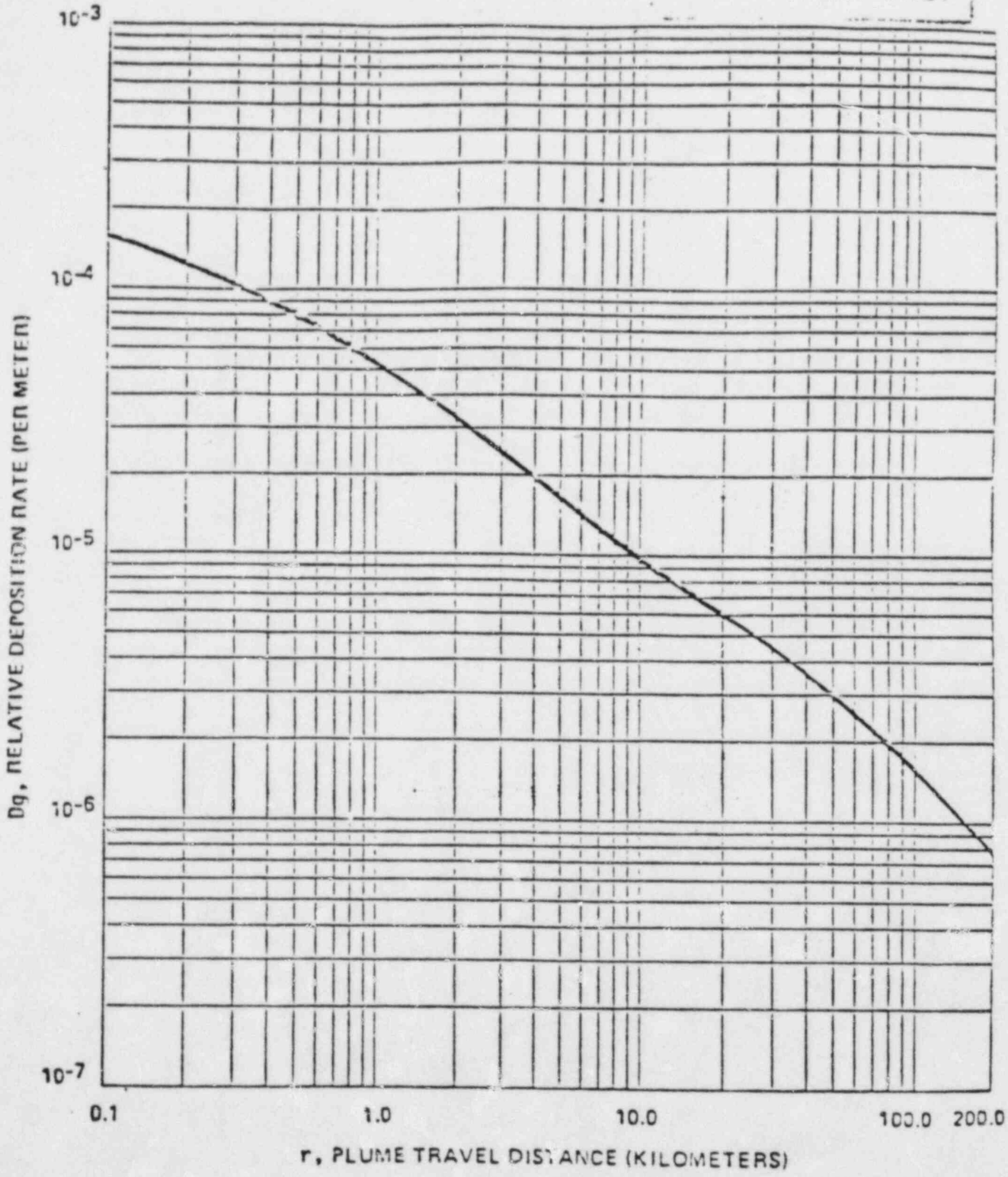
Figure 2.3-2 Vertical Standard Deviation of Material in a Plume (Letters denote Pasquill Stability Class)



Taken from Reference 7, Figure 1

Temperature Change with Height (Δt)(°K/100 m)	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

Figure 2.3-3 Relative Deposition for Ground-Level Releases (All Atmospheric Stability Classes)



Graph taken from Reference 7, Figure 6

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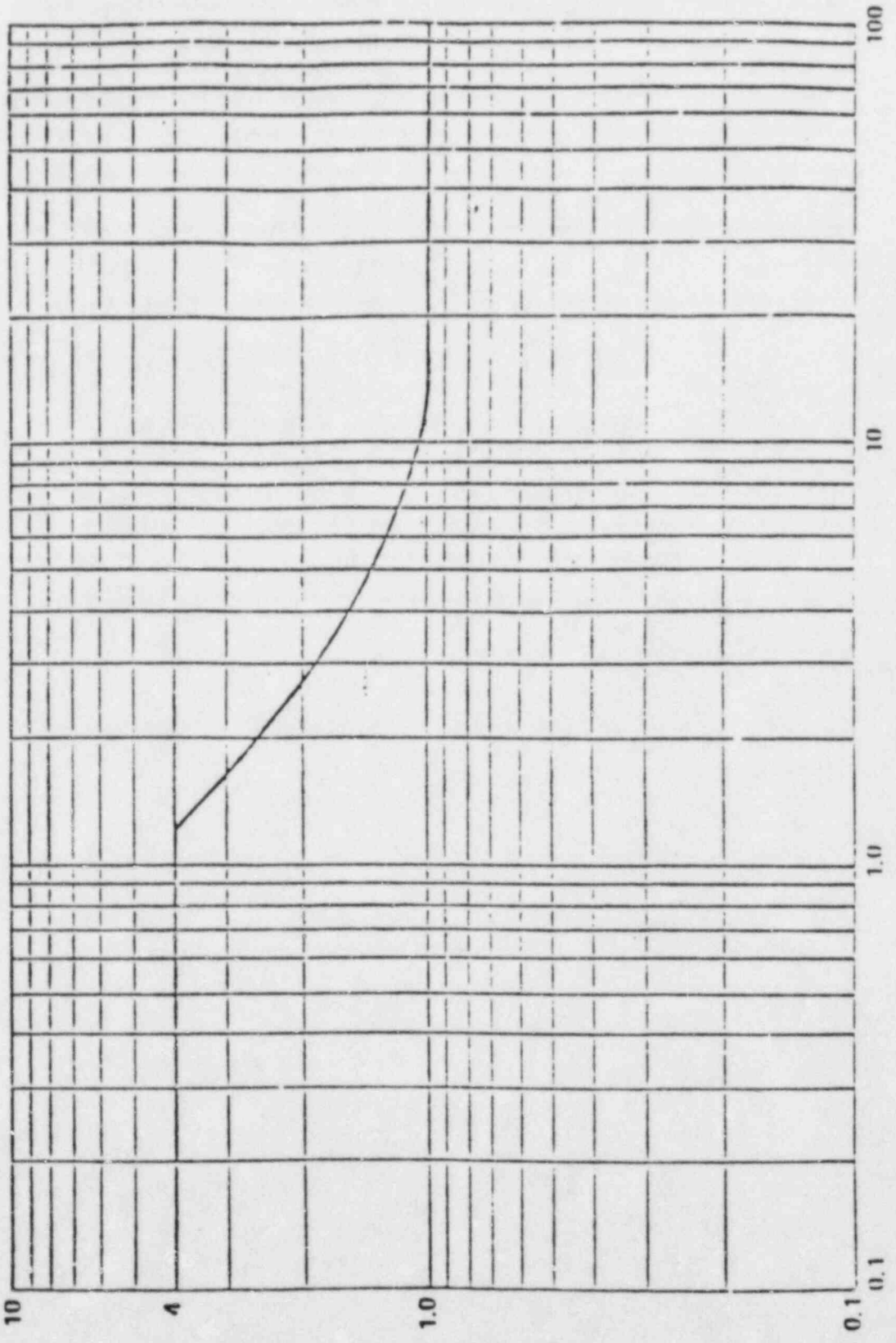
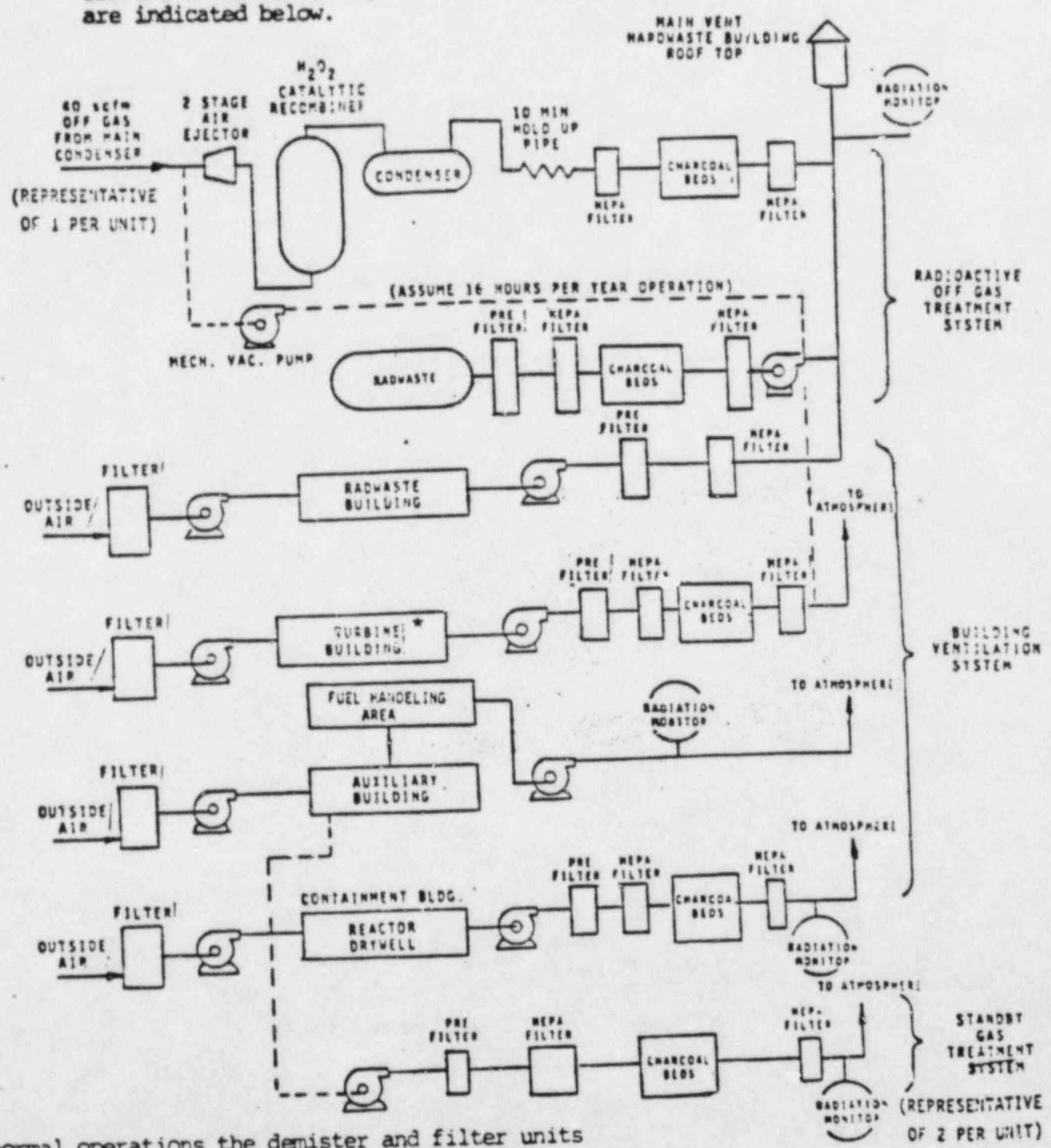
Figure 2.3-4 Open Terrain Recirculation Factor



Graph taken from Reference 6, Figure 2

2.5 GASEOUS RADWASTE TREATMENT SYSTEM

The essential components of the gaseous radwaste treatment system for the OPERABILITY requirement of RETS Specification 3/4.11.2.5 are indicated below.



*During normal operations the demister and filter units (prefilters, charcoal filters and HEPA filters) are not installed in the filter train. However, the filter train is available to be operable at a later date when the filter and demister are installed.

Taken from Reference 4, Figure 3-8.

3.0 RADIOLOGICAL ENVIRONMENTAL MONITORING

Sampling locations as required in section 3/4.12.1 of the Radiological Effluent Technical Specification are described in Table 3.0-1 through 3.0-3 and shown on maps in Figures 3.0-1 through 3.0-3.