Revision No. 3

Date 5/84

GRAND GULF NUCLEAR STATION

OFFSITE DOSE CALCULATION MANUAL

SAFETY RELATED

EVALUATION APPLICABILITY	
SAFETY EVALUATION	ENVIRONMENTAL EVALUATION
☐ APPLICABLE	☐ APPLICABLE
☒ NOT APPLICABLE	☒ NOT APPLICABLE

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INTRODUCTION

The OFFSITE DOSE CALCULATION MANUAL is a supporting document of Grand Gulf Nuclear Station Radiological Effluent Technical Specifications (RETS). 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. Diagrams of the liquid and gaseous radwaste treatment systems are also included. 2

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-0133 (October 1978). | 2

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).

ODCM

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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) should be 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 4.11.1.1.1-1:

$$\sum_i C_i = \sum_g C_g + (\sum C_a + \sum C_s + C_t) \qquad (2)$$

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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.

$\sum C_s$ = 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.

$$D.F. = \left[\sum_i \frac{C_i}{MPC_i}\right] \times S.F. \qquad \Big|_2 \qquad (3)$$

$$= \left[\sum_g \frac{C_g}{MPC_g} + \left(\sum_a \frac{C_a}{MPC_a} + \sum_s \frac{C_s}{MPC_s} + \frac{C_t}{MPC_t}\right)\right] \times S.F. \qquad \Big|_2$$

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:

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

where:

F_d = 0.9 x minimum expected dilution flow rate | 1

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 minimum expected dilution flow rate (5) | 1

$f = 0.9 \times f_d$ = 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.

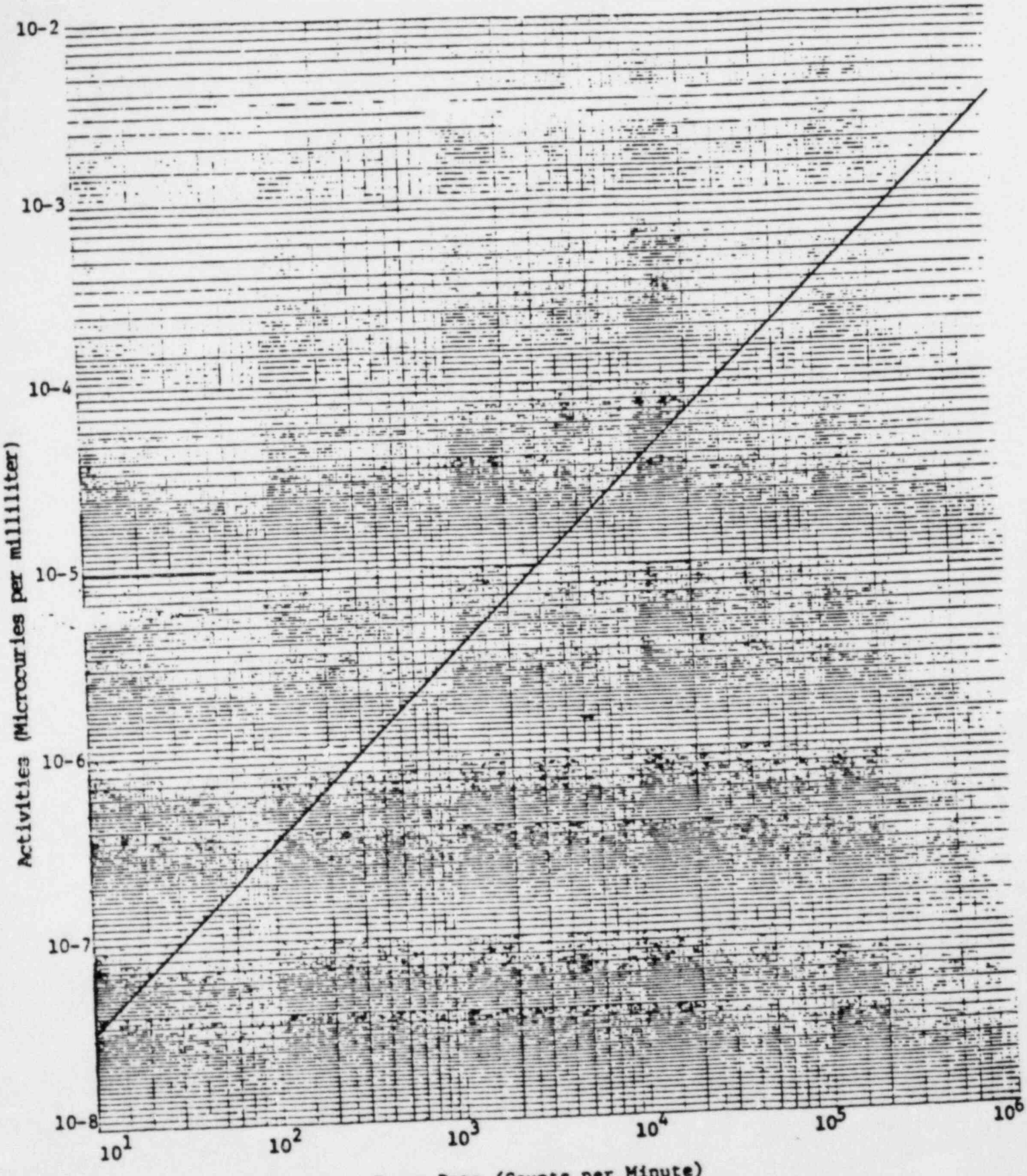
Step 5) The radioactivity monitor setpoint may now be specified based on the values of $\sum C_i$, F, and f which were specified to provide compliance with the limits of 10CFR20, Appendix B, Table II, Column 2. The monitor response is primarily to gamma radiation; therefore, the actual setpoint is based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

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

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 Specifications 3.11.1.2, 4.11.1.2 and 4.11.1.3.1 using the following expression: | 1

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

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)*

ELEMENT	FRESHWATER FISH	FRESHWATER 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

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*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	1.46E-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	9.33E-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)

INGESTION DOSE CONVERSION FACTORS FOR ADULTS (DFi)

(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	2.68E-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	1.90E-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

* 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	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

* 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
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+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

2

* Calculated from Equation 8.

TABLE 1.2-3 (Continued)

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

(mrem/hr per uCi/ml) *

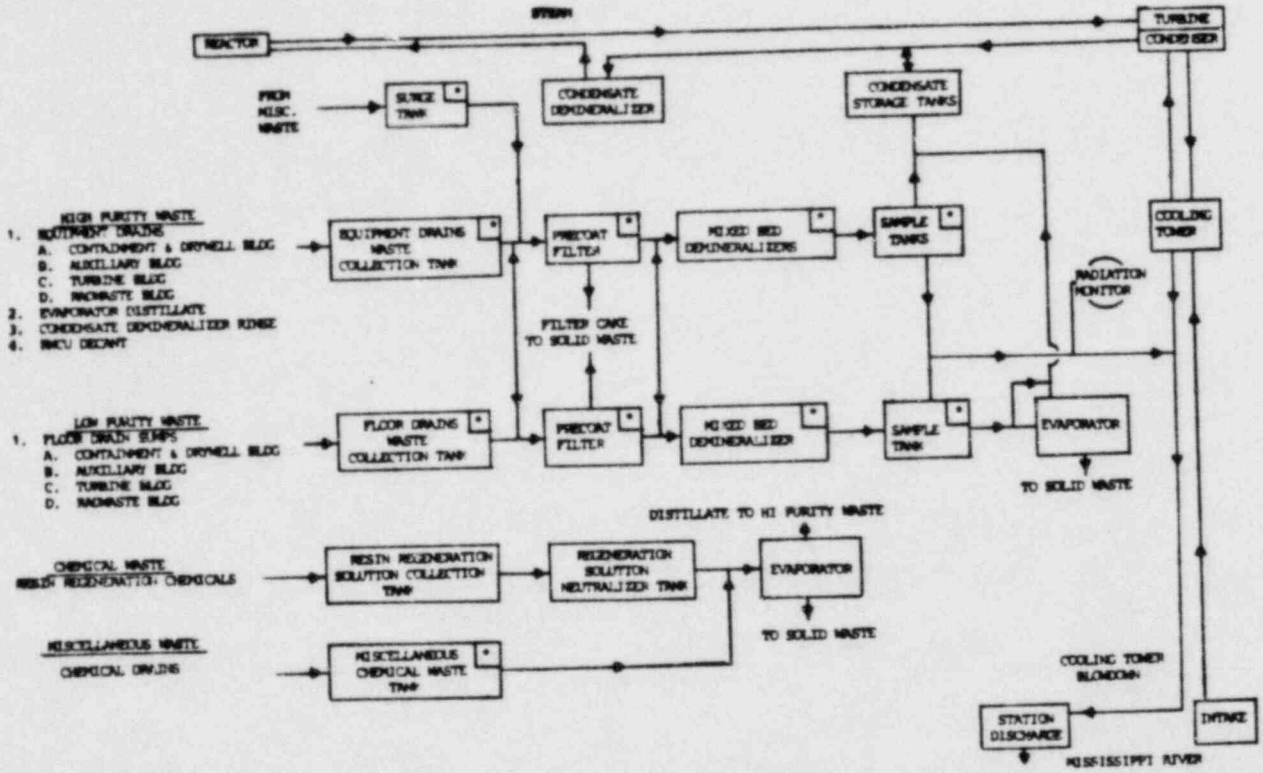
NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Ru-106	6.58E+01	0.00E+00	8.33E+00	0.00E+00	1.27E+02	0.00E+00	4.26E+03
Ag-110m	8.81E-01	8.15E-01	4.84E-01	0.00E+00	1.60E+00	0.00E+00	3.30E+02
Te-125m	2.57E+03	9.30E+02	3.44E+02	7.72E+02	1.04E+04	0.00E+00	1.02E+04
Te-127m	6.48E+03	2.32E+03	7.90E-02	1.66E+03	2.63E+04	0.00E+00	2.17E+04
Te-127	1.05E+02	3.70E+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

1

* 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 by an asterisk (*).



NOTES

1. The essential components outlined above are those necessary to collect, process and sample liquid radwaste prior to discharge to the environment.
2. Only one of the following is required in order to process liquid waste.
   a. Equipment drain filter
   b. Floor drain filter
   c. Equipment drain demineralizer
   d. Floor drain demineralizer
3. One of the Waste Surge Tanks may be used to replace the Floor Drain Waste Collection Tank.

(A COMMON SYSTEM SCALED TO A PER UNIT BASIS)

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 at the Site Boundary required to limit dose to 500 mrem in one year.

$$= \overline{(X/Q)} \sum_i K_i \overline{Q}_i \quad (\leq 500 \text{ mrem})$$

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

$$= \overline{(X/Q)} \sum_i (L_i + 1.1 M_i) \overline{Q}_i \quad (\leq 3000 \text{ mrem})$$

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

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

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 Site 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.

$\overline{Q_i}$ = rate of release of noble gas radionuclide i (uCi/sec) from the release point | 3

R_s = count rate per mrem/yr to the skin

$$= C \div \overline{X/Q} \left[\sum_i (L_i + 1.1\, M_i)\, \overline{Q_i} \right] \quad | 3$$

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

TEXT DELETED

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

D_{TB} = 500 mrem/yr | 3

D_{ss} = 3000 mrem/yr

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

= $C' \div (\overline{X/Q} \times K \times \overline{Q''_i})$ | 3

Where,

$\overline{Q''_i}$ = Assigned release rate value of, for example, 1.0 uCi/sec, Xe-133. (See definition of C' below.) | 3

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

= $C' \div \left[\overline{X/Q} \times (L + 1.1M) \times \overline{Q''_i} \right]$ | 3

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.

3

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 Site Boundary due to noble gases shall be calculated as follows: | 2

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

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

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

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

2.2.1.b Organ doses due to tritium, I-131, I-133 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)

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

W = controlling sector annual average atmospheric dispersion at the Site Boundary for the appropriate pathway. | 2

$$= \begin{cases} \overline{X/Q} = 5.176 \times 10^{-6*} \text{ sec/m}^3 \text{ for inhalation in the WSW sector.} \\ \overline{D/Q} = 1.301 \times 10^{-8*} \text{ m}^{-2} \text{ for other pathways in the SSE* sector} \end{cases}$$ | 2

* 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.a-b.

$\overline{Q'}_i$ = 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 at the Site Boundary 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 the Site Boundary

$= 5.176 \times 10^{-6*}$ 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)

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

* Value taken from Reference 4, Table 6.1.26.

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 the Site Boundary 2

= $5.176 \times 10^{-6*}$ 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, I-131, I-133 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 at a controlling location for an individual

$$= \begin{cases} \overline{X/Q'} = \underline{3.001 \times 10^{-6**}} \text{ sec/m}^3 \text{ for inhalation in the SW sector} \\ \overline{D/Q'} = \underline{4.440 \times 10^{-9**}} \text{ m}^{-2} \text{ for other pathways in the SW Sector} \end{cases}$$

* Value taken from reference 4 Table 6.1.26

** Values taken from Tables 2.2-3 and 2.3-1

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

$\tilde{Q}'_i$ = 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, of the | 2 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.

| 2

TABLE 2.2-1a

PATHWAY DOSE FACTORS (Pi) FOR TECHNICAL SPECIFICATION 3.11.2.1 and 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	3.493E+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 2.2-1a (Continued)

PATHWAY DOSE FACTORS (Pi) FOR TECHNICAL SPECIFICATION 3.11.2.1 and 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+02	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 and all tritium pathways - mrem/yr per uCi/m³
Others - m³ . mrem/yr per uCi/sec

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

TABLE 2.2-1b

PATHWAY DOSE FACTORS (Pi) FOR TECHNICAL SPECIFICATIONS 3.11.2.1 and SECTION 2.2.1.b

AGE GROUP	(CHILD)	(N. A.)	(CHILD)
ISOTOPE	INHALATION	GROUND PLANE	GRS/ANL/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-95	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

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TABLE 2.2-1b (Continued)

PATHWAY DOSE FACTORS (Pi) FOR TECHNICAL SPECIFICATIONS 3.11.2.1 and SECTION 2.2.1.b

AGE GROUP	(CHILD)	(N. A.)	(CHILD)*
ISOTOPE	INHALATION	GROUND PLANE	GRS/ANL/MEAT
TE-125M	4.773E+05	2.128E+06	4.438E+08
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 and all tritium pathways - 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.

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

TABLE 2.2-2a

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

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	1.055E+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

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TABLE 2.2-2a (Continued)

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

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	3.402E+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

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Units: Inhalation and all tritium pathways - 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.

TABLE 2.2-2b

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

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+08	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 2.2-2b (Continued)

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

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	3.076E+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	1.014E+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

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Units: Inhalation and all tritium pathways - 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.

TABLE 2.2-2c

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

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-23	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 2.2-2c (Continued)

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

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 and all tritium pathways - 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.

TABLE 2.2-2d

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

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+05	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	1.229E+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

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TABLE 2.2-2d (Continued)

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

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 and all tritium pathways - 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.

TABLE 2.2-3

CONTROLLING RECEPTORS, LOCATIONS, AND PATHWAYS

Sector	Distance (Meters)	Miles	Pathway	Age Group	Origin (for info only)
N	1207	0.75	Vegetation	Infant	- garden
NNE	1207	0.75	Inhal/Gnd Plane	Infant	- residence
NE	2414	1.50	Inhal/Gnd Plane	Infant	- residence
ENE	4023	2.50	Vegetation	Child	- garden
E	4023	2.50	Vegetation	Infant	- garden
ESE	1207	0.75	Inhal/Gnd Plane	Teenager	- residence
SE	2414	1.50	Vegetation	Child	- garden
SSE	2414	1.50	Vegetation	Adult	- garden 2
S	4023	2.50	Inhal/Gnd Plane	Child	- residence
SSW	3218	2.00	Inhal/Gnd Plane	Infant	- hypothetical
SW	1432	0.90	Vegetation	Child	- garden
WSW	8047	5.00	Cow/Milk	Infant	- hypothetical
W	8047	5.00	Cow/Milk	Infant	- hypothetical
WNW	7242	4.50	Inhal/Gnd Plane	Infant	- residence
NW	8047	5.00	Cow/Milk	Infant	- hypothetical
NNW	2414	1.50	Inhal/Gnd Plane	Child	- residence

Table based on 1983 Land Use Census

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 page 2.0-34

$\sum$ = 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

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 SPECIFICATIONS 4.11.2.2, 4.11.2.3, 4.11.2.5.1

SECTOR	MILES	X/Q	D/Q
N	0.75	1.868×10^{-6}	7.751×10^{-9}
NNE	0.75	1.129×10^{-6}	5.298×10^{-9}
NE	1.50	2.391×10^{-7}	1.437×10^{-9}
ENE	2.50	7.358×10^{-8}	4.341×10^{-10}
E	2.50	8.434×10^{-8}	4.581×10^{-10}
ESE	0.75	5.134×10^{-7}	3.348×10^{-9}
SE	1.50	2.628×10^{-7}	1.474×10^{-9}
SSE	1.50	3.760×10^{-7}	1.288×10^{-9}
S	2.50	3.038×10^{-7}	9.074×10^{-10}
SSW	2.00	5.063×10^{-7}	1.068×10^{-9}
SW	0.90	3.001×10^{-6}	4.440×10^{-9}
WSW	5.00	3.931×10^{-7}	3.177×10^{-10}
W	5.00	4.259×10^{-7}	3.746×10^{-10}
WNW	4.50	3.164×10^{-7}	3.739×10^{-10}
NW	5.00	1.584×10^{-7}	2.733×10^{-10}
NNW	1.50	7.237×10^{-7}	2.342×10^{-9}

3

* Reference: Grand Gulf Nuclear Station, Environmental Report, Table 6.1.28, 6.1.29 and ODCM Table 2.2-3.

2.4 Definitions of Gaseous Effluents Parameters

b = 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) | 3

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)

σ = 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)

K = total body dose factor for Kr-89, the most restrictive isotope (mrem/yr per uCi/m^3), 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/m^3) from Table 2.1-1 (2.1.1)

2.4 Definitions of Gaseous Effluents Parameters (Continued)

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) |3

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 (m² mrem/yr per uCi/sec) for other pathways, from Table 2.2-1 (2.2.1.b) |3

$\overline{Q_i}$ = rate of release of noble gas radionuclide i (uCi/sec) (2.1.1) |3

$\overline{Q'_i}$ = 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)

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

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

2.4 Definitions of Gaseous Effluents Parameters (Continued)

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

R_i = dose factor for radionuclide i, (mrem/yr per uCi/m^3) or (m^2 mrem/yr per uCi/sec) | 3

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) | 3

2.4 Definitions of Gaseous Effluents Parameters (Continued)

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/m³). (2.2.1.b)

W' = relative concentration for unrestricted areas (sec/m³). (2.2.2.b)

X/Q = atmospheric dispersion (sec/m³) (2.3.1)

$\overline{X/Q}$ = highest sector annual average atmospheric dispersion at the unrestricted area boundary (sec/m³) (2.1.1)

$\overline{X/Q'}$ = relative concentration for unrestricted areas (sec/m³) (2.2.2.a)

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

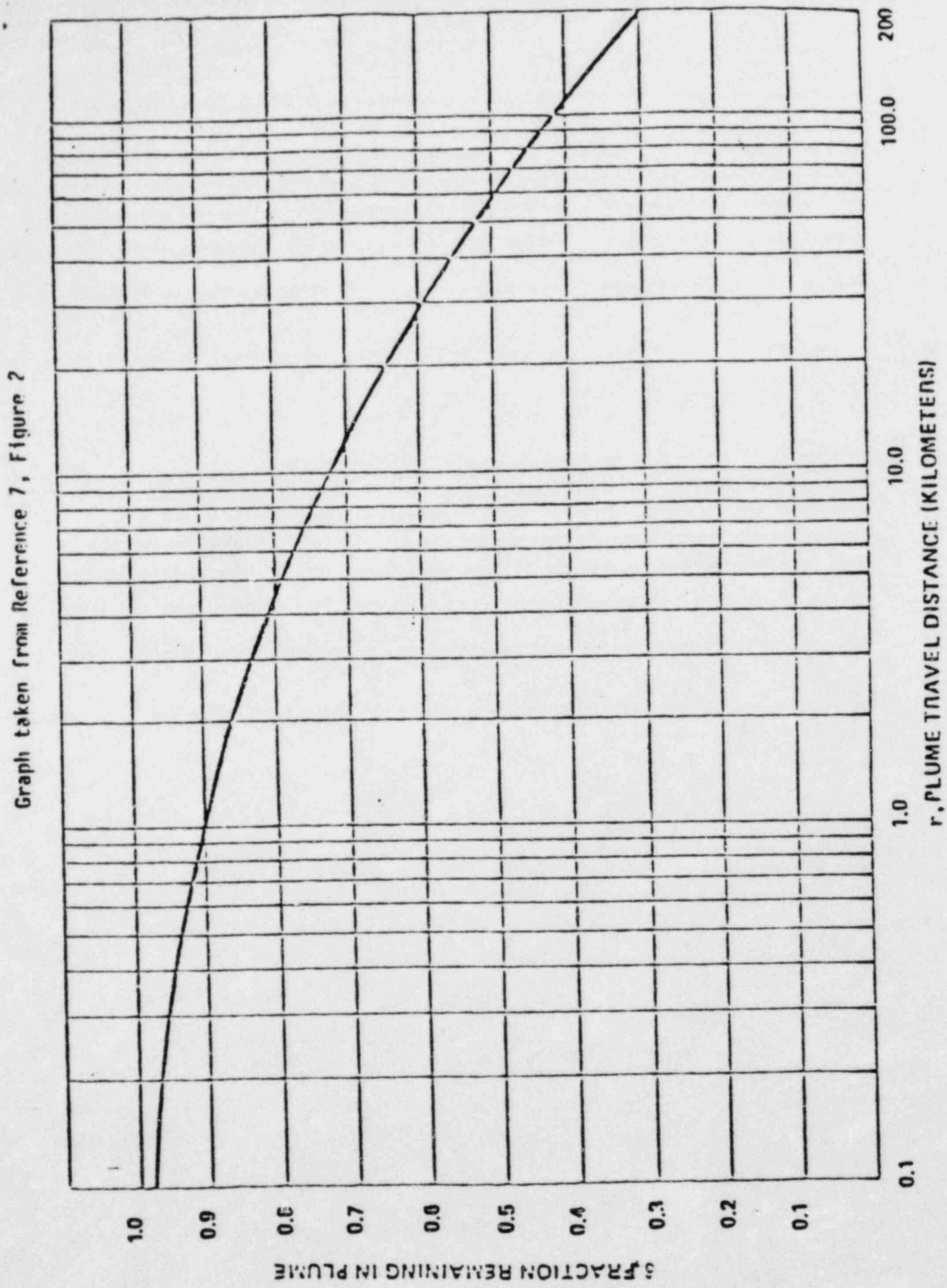
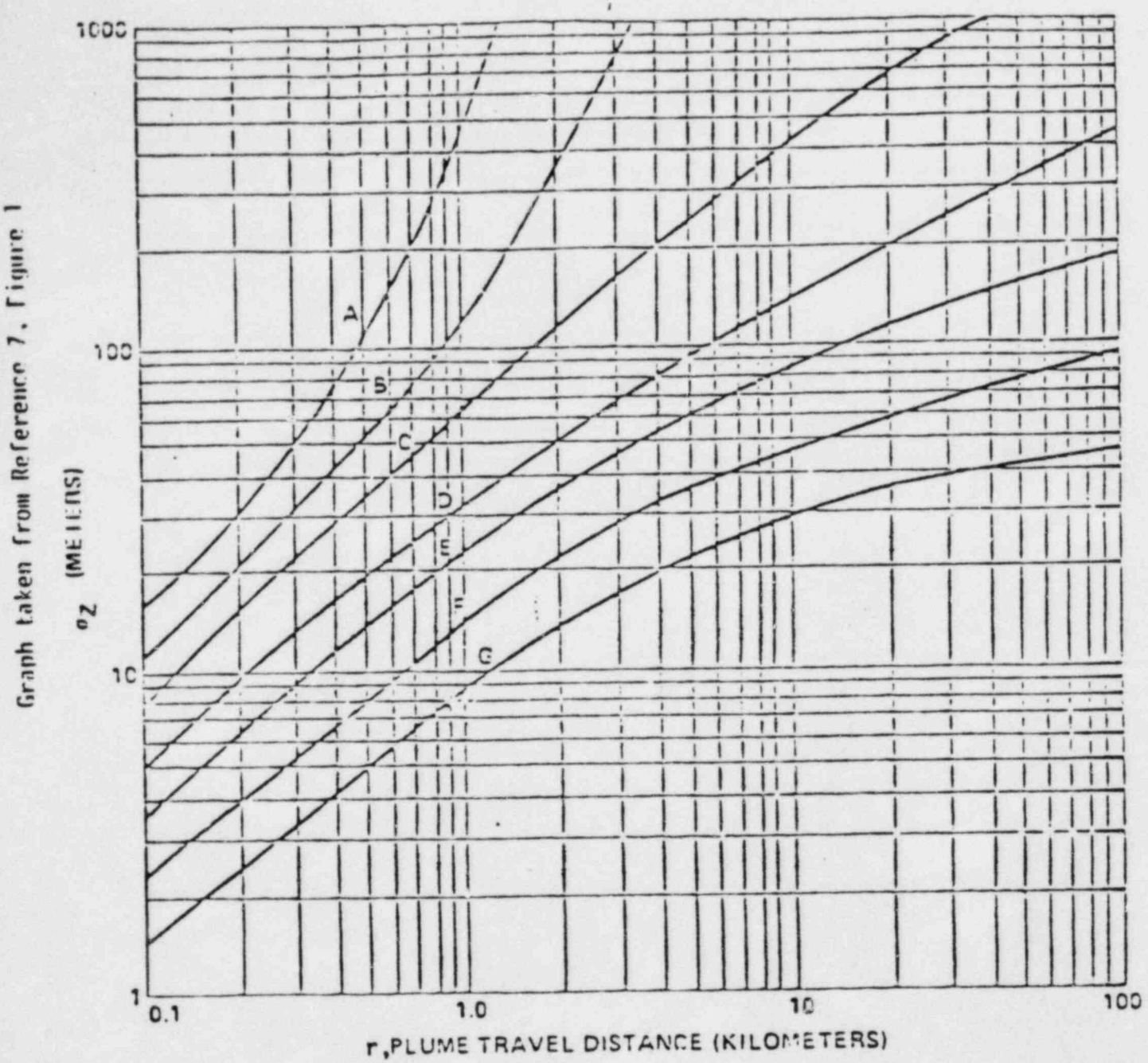


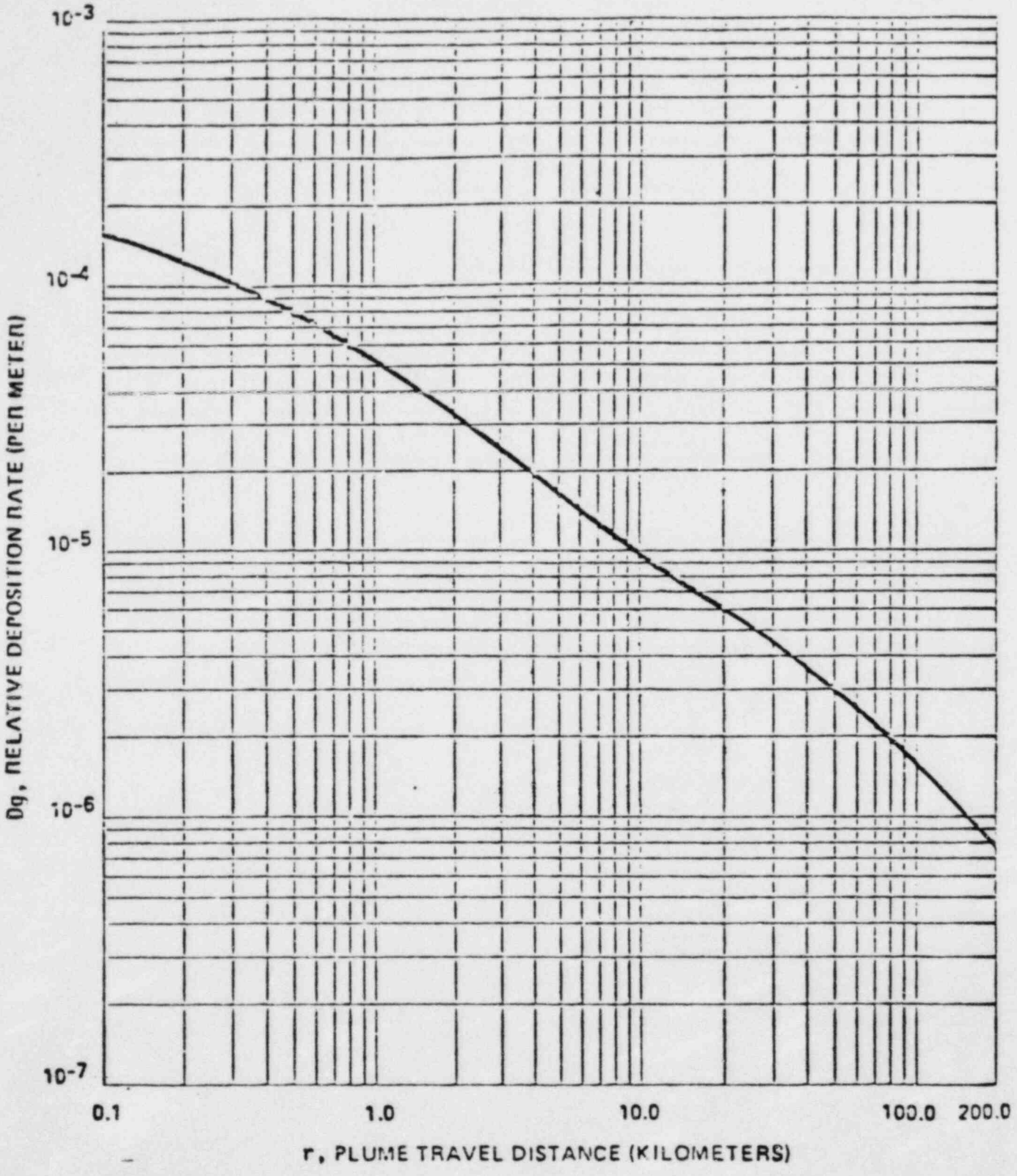
Figure 2.3-2 Vertical Standard Deviation of Material in a Plume (Letters denote Pasquill Stability Class)



Graph taken from Reference 7, Figure 1

Temperature Change with Height (Δ°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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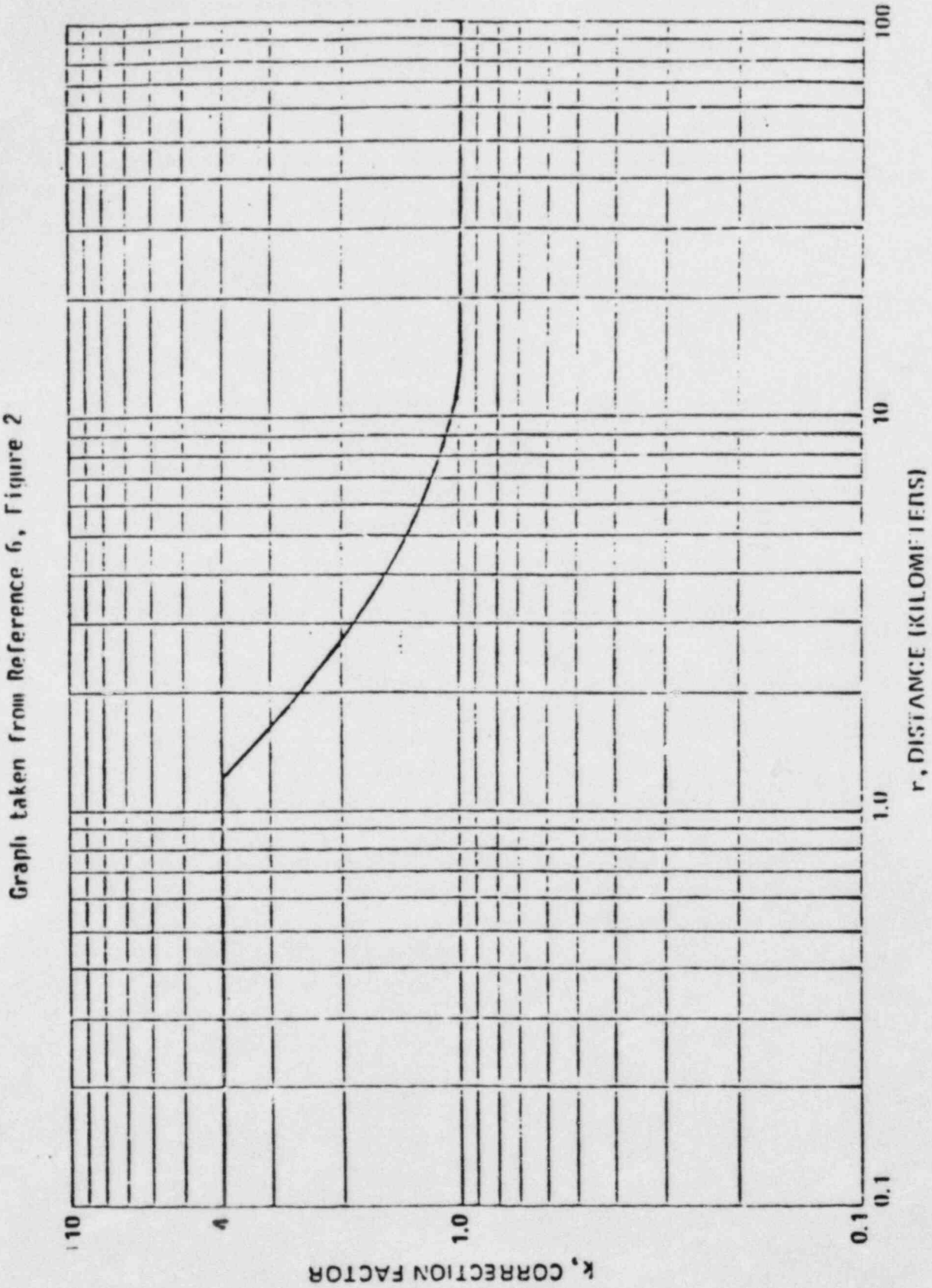
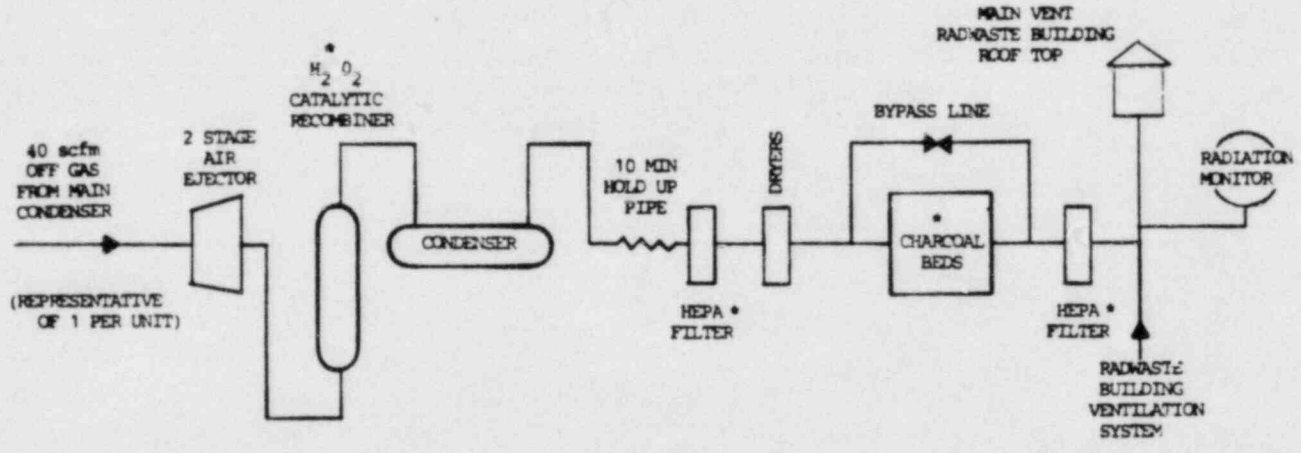
Figure 2.3-4 Open Terrain Recirculation Factor



2.5 GASEOUS RADWASTE TREATMENT SYSTEM

The essential components of the GASEOUS RADWASTE TREATMENT (OFFGAS) SYSTEM for the OPERABILITY requirement of RETS Specification 3/4.11.2.4 are indicated below by an asterisk (*).



3

NOTES

1. The essential components included above are those necessary to process gaseous radwaste prior to discharge to the environment.
2. The charcoal beds may be bypassed provided the limits of Technical Specification 3.11.2.1 are not exceeded. The charcoal beds will be used as much as possible to ensure releases are as low as reasonably achievable.

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 3.0-4. | 1

ODCM

TABLE 3.0-1

AIR SAMPLER COLLECTION SITES

AIR SAMPLERS

NUMBER	FIGURE	LOCATION	
* AS-1 PG	3.0-3	Southeast of GGNS at the Port Gibson City Barn. (Sector G Radius 5.5 miles)	3
AS-2 61N	3.0-2	North Northeast of GGNS, on Hwy 61 South across from the Yokena Church. (Sector B Radius 13 miles)	3
* AS-3 61 VA	3.0-2	North Northeast of GGNS on Hwy 61 south at the Vicksburg Airport. (Sector B Radius 18 miles)	
* AS-4 GJOE	3.0-1	Southwest of GGNS. Glodjo property on Waterloo Road. (Sector L Radius .9 miles)	
AS-5 TC	3.0-1	South of GGNS behind MP&L training center building. (Sector J Radius .4 miles)	3
AS-6 RS	3.0-1	Northeast of GGNS, South of Grand Gulf Road. (Sector C Radius .8 miles)	
* AS-7 MT	3.0-1	North of GGNS, located next to the Meteorological Tower. (Sector A Radius .8 miles)	3
AS-8 WR	3.0-1	East of GGNS, located at Maggie Jackson's trailer on Waterloo Road near the Eastern Site Boundary. (Sector E Radius .5 miles)	
* AS-9 GGMP	3.0-1	North of GGNS, located in Grand Gulf Military Park. (Sector A Radius 1.5 miles)	3
AS-10 NLT	3.0-3	West Northwest of GGNS, located at Newellton, Louisiana. (Sector P Radius 12.5 miles)	
AS-11 STJ	3.0-3	West Southwest of GGNS, located at St. Joseph, Louisiana. (Sector M Radius 13.0 miles)	

* Technical Specification requirements

From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. 3

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TABLE 3.0-2

MISCELLANEOUS COLLECTION SITES

	Figure	
MILK SAMPLES (CONTROL LOCATION)		
Alcorn State University*	3.0-3	Located Southwest of GGNS. (Sector K Radius 10.5 miles)
Rosco Johnson farm	3.0-3	Located Southeast of GGNS. (Sector G Radius 9 miles)
Hazetta Warren farm	3.0-3	Located in Louisiana West Northwest of GGNS. (Sector N Radius 8.5 miles)
CISTERN WATER		
1. Trimble Cistern*	3.0-4	Located east of GGNS at the Trimble Tenant House. (Sector E Padius .5 miles)
2. Willis Cistern*	3.0-3	Located at the C.E. Willis house East Northeast of GGNS across from the Shiloh Baptist Church. (Sector D Radius 6 miles)
GROUND WATER		
1. PGWELL*	3.0-4	PORT GIBSON WELL - Taken at Port Gibson City Water lift Station. (Sector G Radius 5.0 miles)
2. GGMPWELL*	3.0-4	GRAND GULF MILITARY PARK - Taken from faucet at the Grand Gulf Military Park. (Sector A Radius 1.5 miles) | 3
3. TRIMWELL	3.0-4	TRIMBLE house faucet. (Sector E Radius 0.7 miles) | 3
4. LAKE BRUIN	3.0-3	Taken from faucet at the bath house in Lake Bruin State Park, Louisiana. (Sector M Radius 9.5 miles) | 3

* Technical Specification requirements

From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. \| 3

	Figure		
SURFACE WATER			
Upstream *	3.0-4	4500 ft. upstream of the GGNS outfall to allow adequate mixing of the Mississippi and Big Black Rivers. (Sector Q)	3
Downstream *	3.0-4	5000 ft. downstream of GGNS outfall, near the most southern radial well. (Sector N)	3
Discharge Basin *	3.0-4	West of GGNS, 0.5 miles, Sector P	
VEGETATION			
Broad Leaf Vegetation*	3.0-4	South of GGNS in the MP&L garden near the training center, or South Southwest in Glodjo garden, or areas adjacent to these gardens. (Sector J, 0.4 miles)	
		Lake Claiborne Willis garden (Sector E, 3.0 miles)	
		Nelson Truck Farm (Sector E, 4.5 miles)	
		Alcorn State University Southwest of GGNS (Sector K, 10.5 miles)	3
FISH SAMPLES			
Catfish *	3.0-4	Downstream of the discharge point in the Mississippi River	
	3.0-4	Upstream of Discharge Point uninfluenced by Plant Operations.	

* Technical Specification requirements
From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. 3

ODCM
TABLE 3.0-2 (CONTINUED)

SEDIMENT SAMPLES *	Figure 3.0-4	Collected semiannually during the low water periods of the Tidal Basin - samples taken downstream of the outfall in the vicinity of the boat landing near Hamilitaon Lake outlet and in the Barge Slip. (Sector N and Q, 2 miles)
SEDCONT		Collected upstream from barge slip at Upper Grand Gulf Landing (Sector R, 2.2 miles) 3

* Technical Specification requirements
From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. 3

ODCM
TABLE 3.0-3
TLD LOCATIONS

TLD NO.	LOCATION	FIGURE	SECTOR	MILE	
* M-00	Maintained in lead shield during the exposure period	-	-	-	3
* M-01	REA Pole-East of Entry Gate at Lake Claiborne	3.0-3	E	3.5	
M-02	REA Pole Left of Entry Gate Windsor Ruins	3.0-3	L	7.0	
M-03	REA Pole-East Side Hwy 61 P.G. Country Club entrance	3.0-3	H	7.0	
M-04	MP&L Pole-Hwy 547 North Side Between Twin Power Poles		G	6.5	3
M-05	50 yards North of Hwy 18 Approximately 5 miles East of U.S. 61	3.0-3	F	9.0	
M-06	REA Pole-East of Willows Beyond MMB Church MS Hwy 462		E	8.0	
* M-07	Port Gibson City Barn AS-1	3.0-3	G	5.5	
M-08	West Side Big Black River South Entrance	3.0-3	C	8.5	
* M-09	Oak Tree Hanger-South Warner Tully Camp	3.0-3	D	3.5	
* M-10	Entrance Gate Grand Gulf Military Park	3.0-1	R	1.5	
M-11	Hwy 61 3 miles North of Big Black River at Twin Tower	3.0-3	C	10.5	
M-12	Hwy 61 at AS-2-61 North Yokena	3.0-2	B	13.0	
M-13	Hwy 61 LeTourneau Hill West Side of Road	3.0-2	B	15.0	

* Technical Specification requirements
From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. 3

TABLE 3.0-3 (CONTINUED)
TLD LOCATIONS

TLD NO.	LOCATION	FIGURE	SECTOR	MILE	
* M-14 (CONTROL)	Hwy 61 AS-3-61VA at Casket Company	3.0-2	B	18.0	
M-15	Barge Slip (South edge)	3.0-1	P	1.5	
* M-16	AS-7 MET Tower	3.0-1	A	0.8	3
M-17	AS-6-RS Grand Gulf Road	3.0-1	C	0.5	
* M-18	Railroad Crossing Eastern Site Boundary	3.0-1	F	0.5	
M-19	Behind Burn Pit on Fence at Eastern Site Boundary	3.0-1	E	0.5	
M-20	Eastern site boundary behind hazardous waste storage area	3.0-1	F	0.5	3
M-21	AS-5-TC Training Center	3.0-1	J	0.4	3
M-22	100 yards south of RR Entrance Crossing on West Side	3.0-1	G	0.5	3
M-23	County Road/Heavy Haul Road 50 Yards North on Power Pole	3.0-1	Q	0.5	
M-24	Upper Grand Gulf Landing	3.0-1	R	2.2	3
* M-25	Hamilton Lake Boat Launch	3.0-1	N	1.0	
M-26	Hamilton Lake Outfall	3.0-1	N	1.5	3
* M-27	South Point Site Boundary 200 Yards along Property Line	3.0-1	M	1.5	
* M-28	AS-4-Glodjo Residence Glodjo	3.0-1	L	0.9	
M-29	In sharp curve of Waterloo Road to Waterloo Plantation	3.0-1	K	1.5	
* M-30	Arnold Acres Trailer Park Entrance	3.0-1	J	1.1	3

* Technical Specification requirements
From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. | 3

ODCM

TABLE 3.0-3 (CONTINUED)

TLD LOCATIONS

TLD NO.	LOCATION	FIGURE	SECTOR	MILE	
M-31	Duplicate TLD Installed at designated Site Number	-	-	-	
M-32	Duplicate TLD Installed at designated Site Number	-	-	-	
* M-33	Newellton, Louisiana Water Tower	3.0-3	P	12.5	3
* M-34	Primary Levee at End of County Road at Point Pleasant, Louisiana	3.0-3	R	8.0	3
* M-35	Mor Landing - Lake Yucatan	3.0-3	Q	8.0	
* M-36	Curve on 608 Point Nearest GGNS, at Power Pole	3.0-3	P	5.0	
M-37	Winter Quarters Home	3.0-3	N	8.0	
* M-38	Lake Bruin State Park Second Pole	3.0-3	M	9.5	3
* M-39	St. Joseph, Louisiana, Aux. Water Tank	3.0-3	M	13.0	3
* M-40	International Paper Road, Approximately 5 miles from Site	3.0-3	M	5.0	
* M-41	Heavy Haul Road - J Pipe on Concrete Block	3.0-1	P	1.0	
* M-42	Heavy Haul Road North Iron Gate	3.0-1	Q	1.0	
* M-43	Gin Lake Entrance	3.0-1	R	1.2	
* M-44	Truck Bypass on Grand Gulf Road	3.0-1	C	0.5	
* M-45	Visitor Center Gate East Side	3.0-1	D	0.5	

* Technical Specification requirements
From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. 3

TABLE 3.0-3 (CONTINUED)

TLD LOCATIONS

TLD NO.	LOCATION	FIGURE	SECTOR	MILE	
* M-46	Power Pole Across from Grand Gulf/Waterloo roads intersection	3.0-1	E	1.0	
* M-47	Bridge 0.6 miles past Rodney Road/Greenwood Road intersection North Side	3.0-3	L	5.2	3
* M-48	Property Line Fence 0.4 miles on Greenwood Road on West Side	3.0-3	K	4.8	3
* M-49	Fork in Weathers Road	3.0-3	H	4.5	
* M-50	Panola Hunting Club Entrance		B	5.5	3
* M-51	Power Pole 0.5 miles on Gravel Road to Big Black on West Side	3.0-3	C	4.8	3
* M-52	Power Pole-Waterloo Road Marked with White Paint	3.0-1	K	1.0	
* M-53	Arnold Acres Property Fence Past Trailer Park	3.0-1	H	1.1	3
* M-54	Bottom of curve past Arnold's house	3.0-1	G	1.0	3
* M-55	Behind Bonner's Beauty Shop at MSBH Air Sample	3.0-3	D	5.0	
* M-56	Hwy 61 South at "All Creatures Veterinary Hospital"	3.0-3	G	5.0	
* M-57	Hwy 61 North Behind the Welcome to Port Gibson sign	3.0-3	F	4.5	
* M-58	Big Bayou Pierre Bridge Southwest End	3.0-3	E	5.0	
* M-59	Off Levee at Winter Quarters Hunting Camp	3.0-3	N	5.1	

* Technical Specification requirements From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. | 3

TABLE 3.0-3 (CONTINUED)
TLD LOCATIONS

TLD NO.	LOCATION	FIGURE	SECTOR	MILE	
M-60	Duplicate TLD	-	-	-	
M-61	Protected area fence by the vehicle entrance gate	Not Shown	P	Onsite	
M-62	Protected area fence Northeast corner MP&L parking lot	"	N parking lot	"	
M-63	Protected area fence middle MP&L parking lot	"	N	"	
M-64	Protected area fence Southeast corner MP&L parking lot	"	M	"	3
M-65	South protected area fence behind MP&L warehouse	"	L	"	
M-66	South protected area fence across from cooling tower	"	K	"	
M-67	South protected area fence east end	"	J	"	3
M-68	East protected area fence across from chlorination tank	"	H	"	
M-69	East protected area fence near electric bus	"	G	"	
M-70	North fence behind turbine bldg.	"	F	"	
M-71	133' railway bay	"	C	"	3
M-72	133' railway bay	"	B	"	
M-73	Corner of fence outside control bldg.	"	P	"	

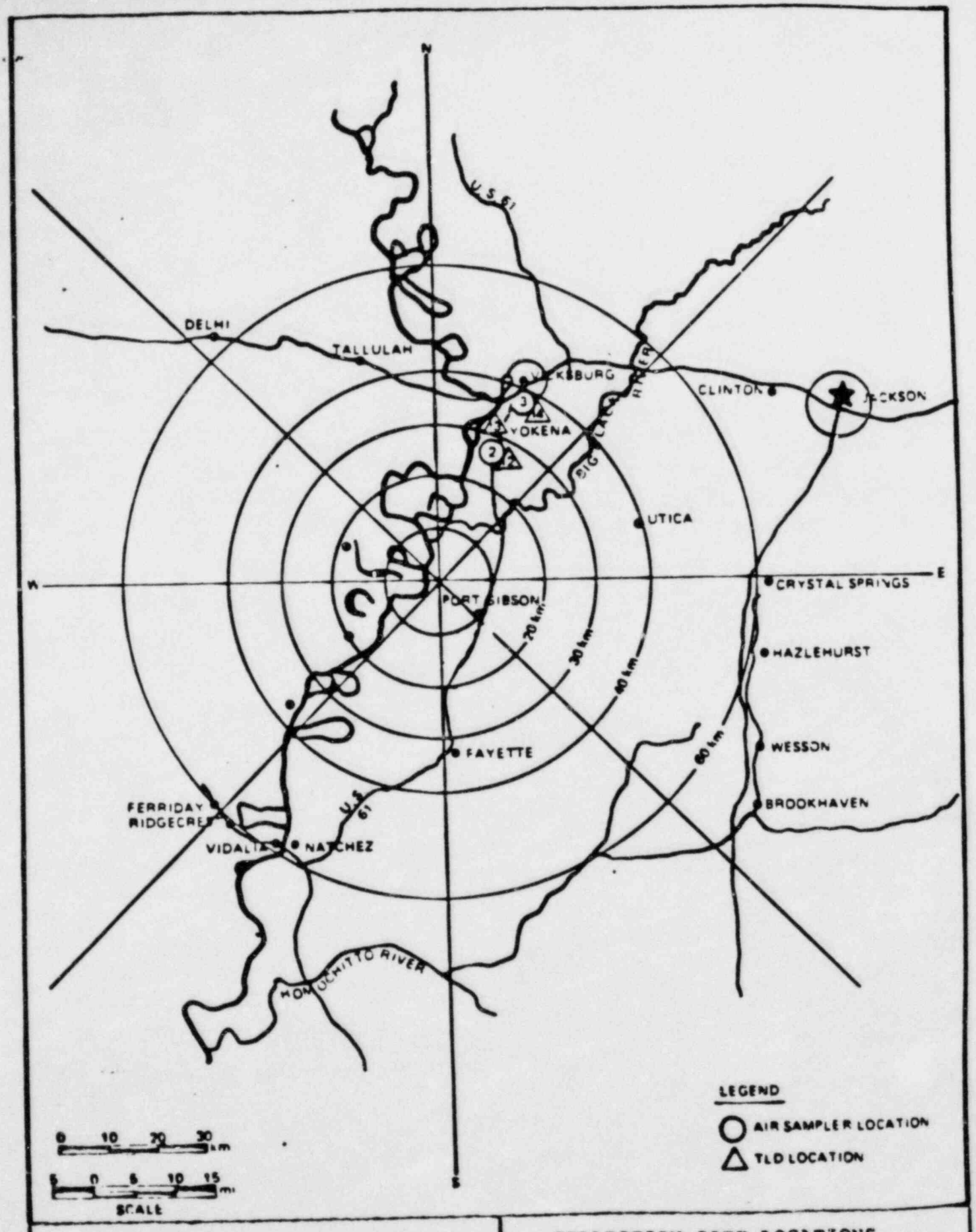
* Technical Specification requirements
From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. | 3

TABLE 3.0-3 (CONTINUED)
TLD LOCATIONS

TLD NO.	LOCATION	FIGURE	SECTOR	MILE	
M-74	Midway of North fence	Not Shown	P	Onsite	
M-75	Corner in fence in front of Maintenance Shop	"	A	"	
M-76	Southeast corner SSW Basins	"	A	"	
M-77	Protected area fence beside maintenance shop	"	R	"	
M-78	Outside vault in Admin. Bldg.	"	Q	"	
M-79	Wall in Central Records (middle)	"	Q	"	3
M-80	Wall in Central Records old library location	"	Q	"	
M-81	Inside Admin. Bldg., 2nd floor, northeast wall	"	Q	"	
M-82	Tech Support Area	"	Q	"	
M-83	Tech Support Secretary's office	"	Q	"	3
M-84	Security Island	"	P	"	
M-85	Rotating duplicate	-	-	-	
* M-86	Bechtel Gate North Site Boundary	3.0-1	B	0.5	
* M-87	Intersection of Rodney Road & transmission line	3.0-3	J	3.5	
* M-88	River mile marker 409.5	3.0-1	A	4.2	3
M-89	Middle Ground Island	3.0-1	R	4.4	
M-90	Across from Middle Ground Island	3.0-1	Q	3.5	
M-91	Transmission line by pond	3.0-1	J	4.5	

* Technical Specification requirements
From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. | 3

MISSISSIPPI POWER & LIGHT COMPANY GRAND GULF NUCLEAR STATION UNIT 1 & 2 ODCM	COLLECTION SITE LOCATIONS 0.5 MILE AREA MAP FIGURE 3.0-1

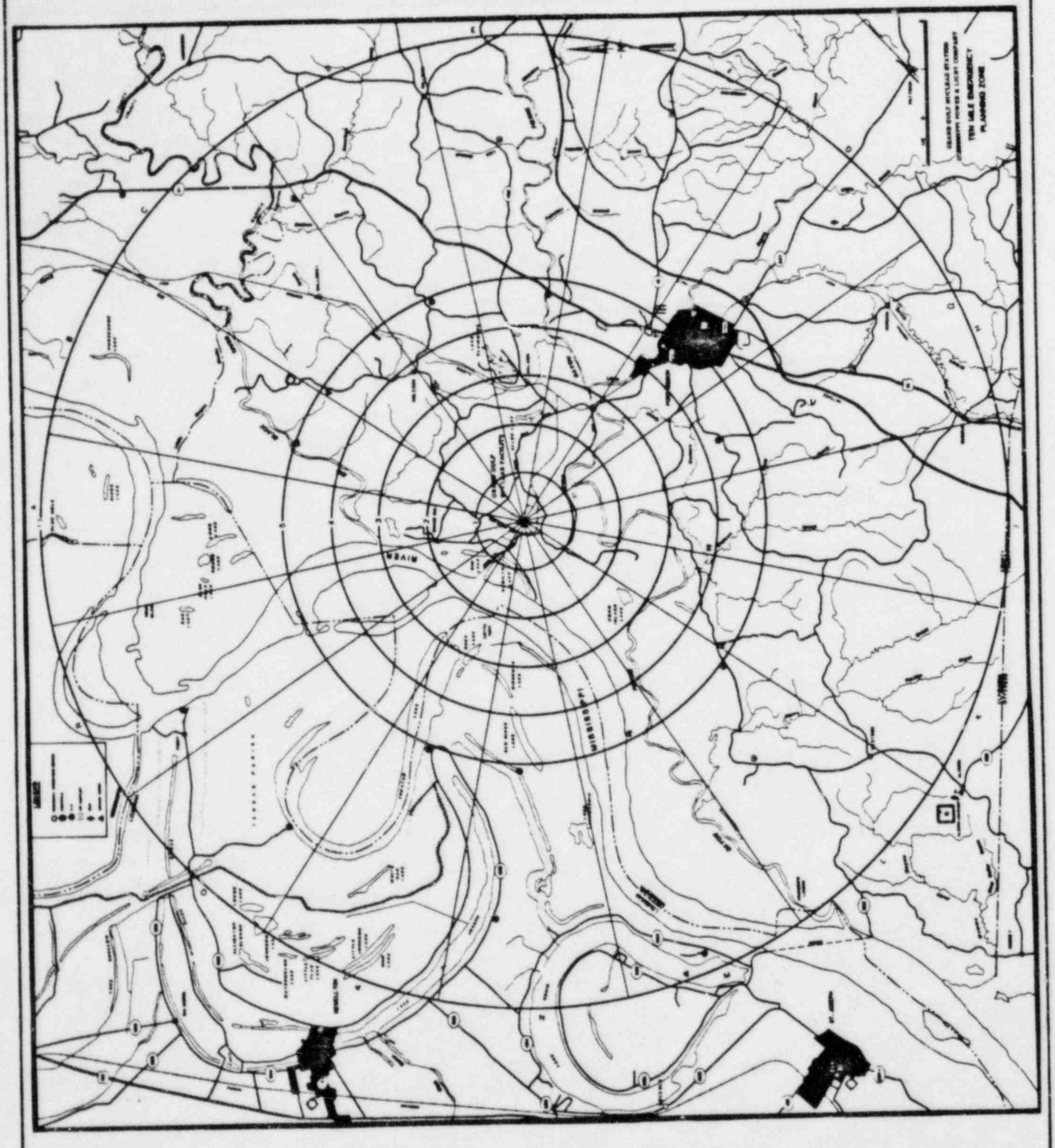


MISSISSIPPI POWER & LIGHT COMPANY
GRAND GULF NUCLEAR STATION
UNITS 1 & 2
ODCM

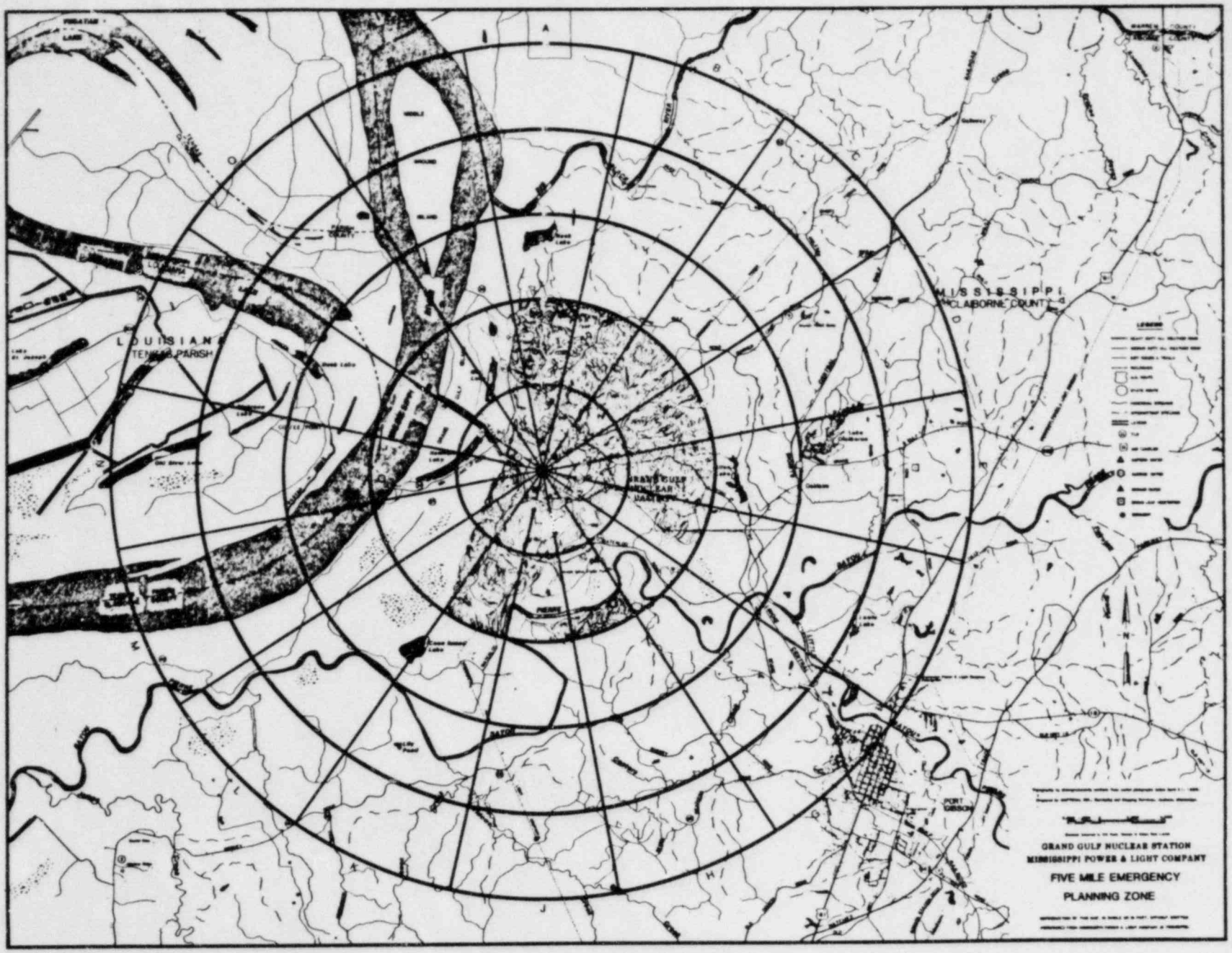
COLLECTION SITE LOCATIONS
GENERAL AREA MAP

FIGURE 3.0-2

Rev. 1 - 7/83



MISSISSIPPI POWER & LIGHT COMPANY GRAND GULF NUCLEAR STATION UNIT 1 & 2 ODCM	COLLECTION SITE LOCATIONS 0-10 MILE AREA MAP FIGURE 3.0-3


MISSISSIPPI
CLAIBORNE COUNTY
LOUISIANA
TENSAS PARISH
GRAND GULF NUCLEAR STATION
MISSISSIPPI POWER & LIGHT COMPANY
FIVE MILE EMERGENCY
PLANNING ZONE

TEXT DELETED

2

MARKUP OF REVISION 1 INCORPORATING THE
CHANGES IDENTIFIED IN REVISIONS 2 AND 3
TO THE GGNS ODCM

Mark up

Revision No. 1

Date 7/83

GRAND GULF NUCLEAR STATION

OFFSITE DOSE CALCULATION MANUAL

SAFETY RELATED

Reviewed/Approved: [signature] 6/24/83
Supervisor of Environmental Services/Date

Reviewed/Approved: [signature] 6/28/83
Manager of Radiological & Environmental Services/Date

Reviewed/Approved: [signature] 6/28/83
Manager of Nuclear Services/Date

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~~ Diagrams of the liquid and gaseous radwaste treatment systems ~~is~~ are 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.

ODCM

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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~~ NUREG-0133 (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).

ODCM

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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) should be 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: | 1

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 4.11.1.1.1-1: | 1

$$\sum_i Ci = \sum_g Cg + (\sum C_a + \sum C_s + C_t) \qquad (2)$$ | 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.

$\sum C_s$ = 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.

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

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

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:

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

where:

F_d = 0.9 x minimum expected dilution flow rate | 1

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 minimum expected dilution flow rate (5) | 1

$f = 0.9 \times f_d$ = 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.

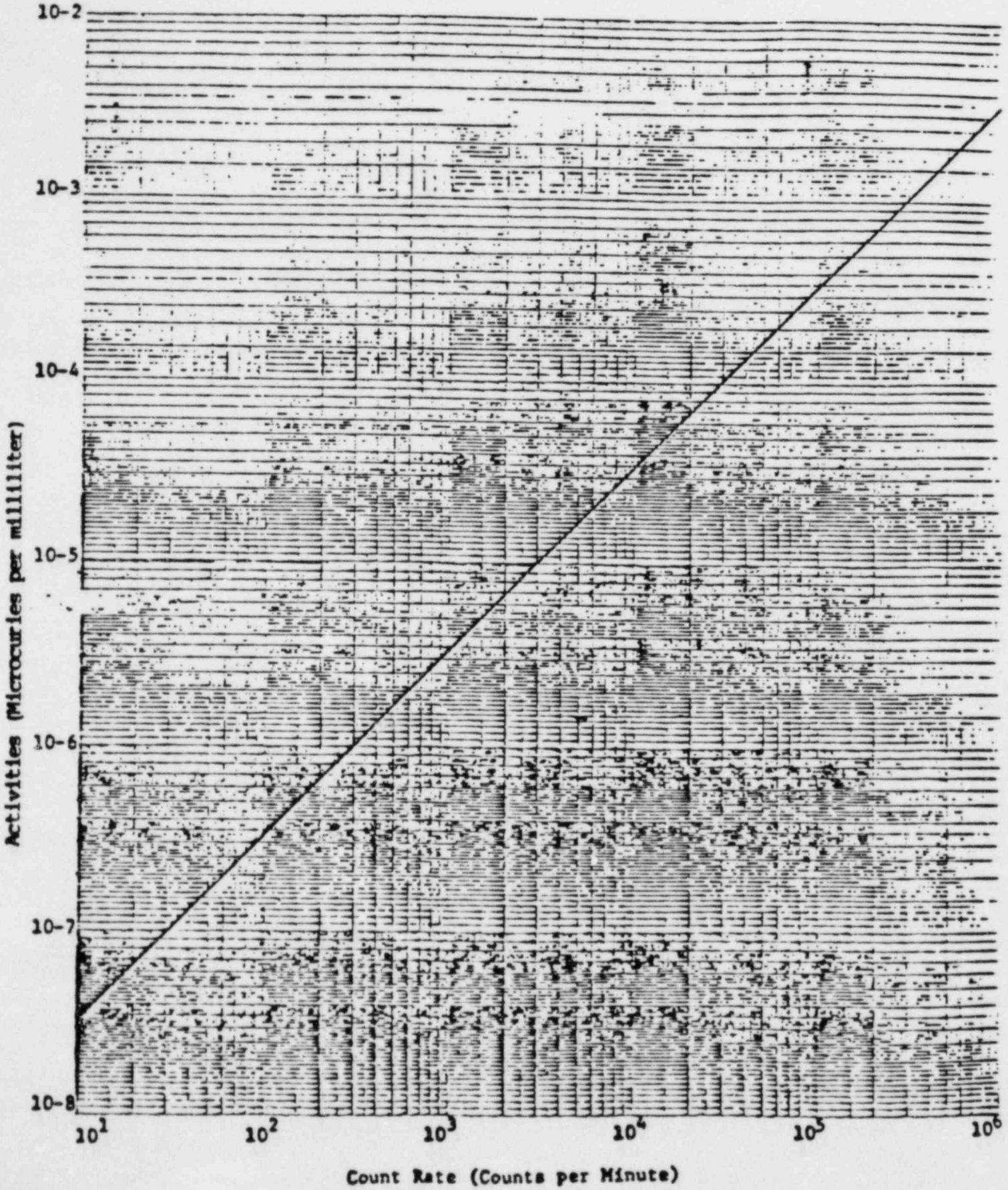
Step 5) The radioactivity monitor setpoint may now be specified based on the values of $\sum C_i$, F, and f which were specified to provide compliance with the limits of 10CFR20, Appendix B, Table II, Column 2. The monitor response is primarily to gamma radiation; therefore, the actual setpoint is based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

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

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



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

all (-) changed to (+)

2

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

TABLE 1.2-2
Page 1 of 3

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	1.46E-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

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

TABLE 1.2-2 (Continued)

Page 2 of 3

INGESTION DOSE CONVERSION FACTORS FOR ADULTS (DFi)

(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	2.68E-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	1.90E-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

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

TABLE 1.2-2 (Continued)
Page 3 of 3
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	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	4.89E-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
Page 1 of 2

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
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+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	1.40E+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	1.95E+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+03
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)

Page 2 of 2

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

(mrem/hr per uCi/ml) *

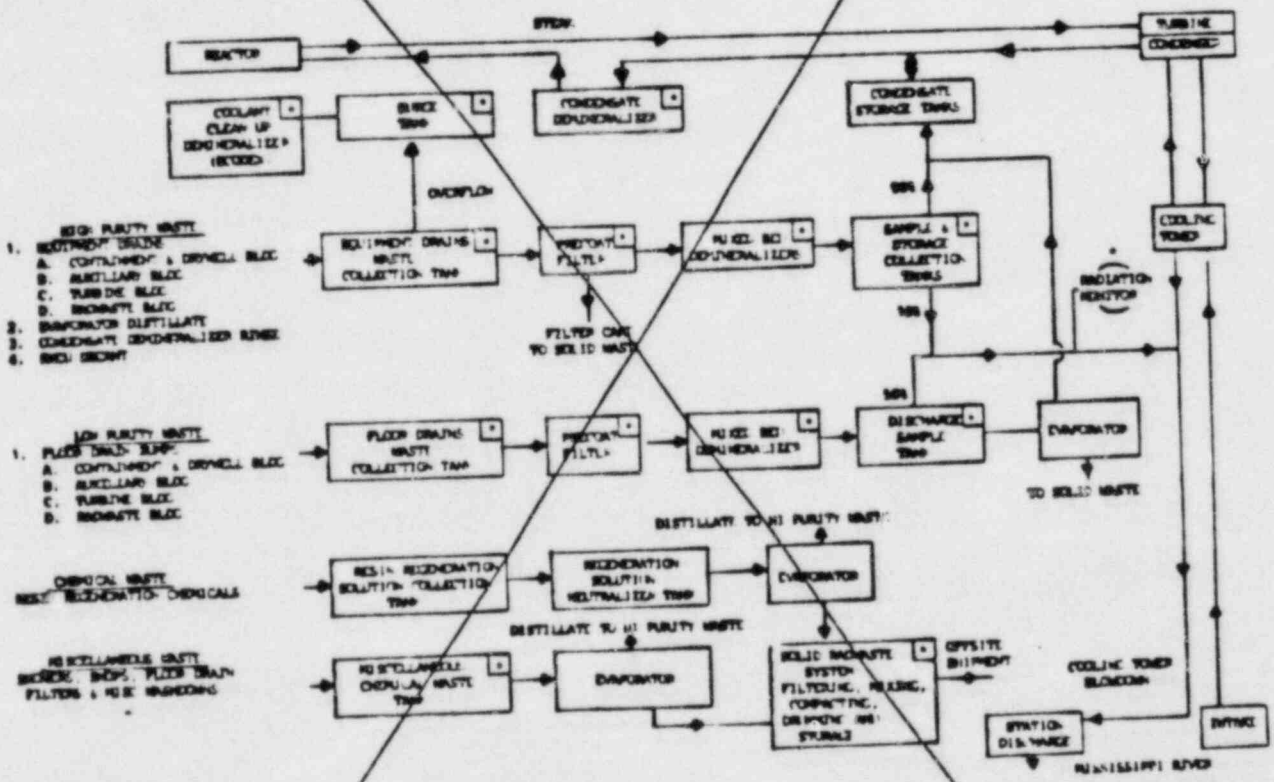
NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Ru-106	6.58E+01	0.00E+00	8.33E+00	0.00E+00	1.27E+02	0.00E+00	4.26E+03
Ag-110m	8.81E-01	8.15E-01	4.84E-01	0.00E+00	1.60E+00	0.00E+00	3.30E+02
Te-125m	2.57E+03	9.30E+02	3.44E+02	7.72E+02	1.04E+04	0.00E+00	1.02E+04
Te-127m	6.40E+03	2.32E+03	7.90E-02	1.66E+03	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

* Calculated from Equation 8.

See New Page

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 by an asterisk (*).

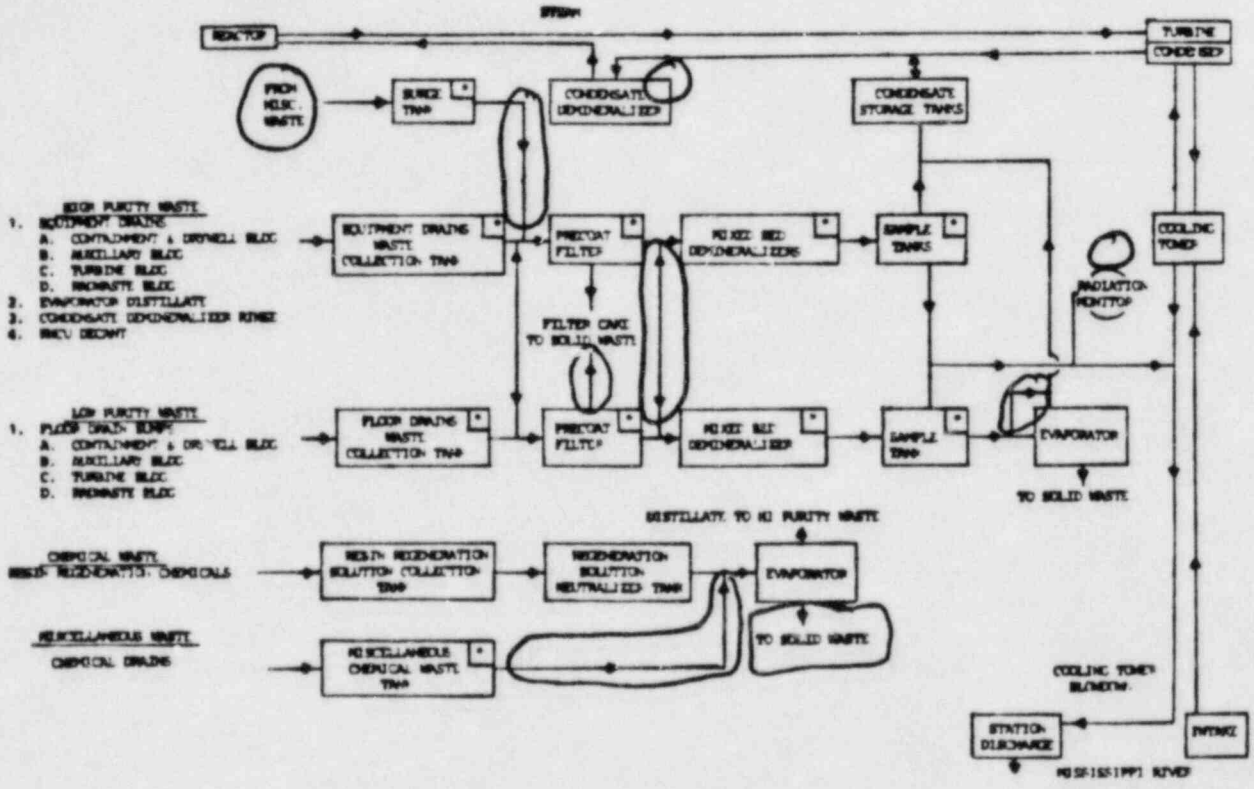


(A COMMON SYSTEM SCALED TO A PER UNIT BASIS)

Taken from Reference 4, Figure 3-7.

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 by an asterisk (*).



2

NOTES

1. The essential components outlined above are those necessary to collect, process and sample liquid radwaste prior to discharge to the environment.
2. Only one of the following is required in order to process liquid waste.
   a. Equipment drain filter
   b. Floor drain filter
   c. Equipment drain demineralizer
   d. Floor drain demineralizer
3. One of the Waste Surge Tanks may be used to replace the Floor Drain Waste Collection Tank.

(A COMMON SYSTEM SCALED TO A PER UNIT BASIS)

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~~ at the Site Boundary required to limit dose to 500 mrem in one year. | 2

$$= \frac{\cancel{500 \; P_i [(\overline{X/Q}) \; \sum_i K_i \overline{Q}_i]}}{\cancel{(1 \; P_i)}} \quad (\leq 500 \text{mrem}) \quad | 2$$

D_{ss} = Dose rate limit to the skin of the body of an individual ~~in an unrestricted area~~ At the Site Boundary required to limit dose to 3000 mrem in one year. | 2

$$= \frac{\cancel{3000 \; P_i (\overline{X/Q}) \; \sum_i (L_i + 1.1 \; M_i) \; \overline{Q}_i]}}{\cancel{(1 \; P_i)}} \quad | 2$$

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

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

See Note 2 | 3

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~~ Site boundary 12

= 5.176 x 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.

~~$\overline{Q}_i$ = rate of release of noble gas radionuclide, i (uCi/sec), from release point~~ 13

~~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 the release point 2

R_s = count rate per mrem/yr to the skin

$$= C \div \left[X/Q \sum_i (L_i + 1.1\, M_i)\, \overline{Q}_i \right]$$ See note 2 3

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.

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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

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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:

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

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

2

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

D^{χ}_{TB} = 500 mrem/yr

D^{χ}_{ss} = 3000 mrem/yr

3

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

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

3

Where,

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

3

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

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

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	3.05E+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

* $\frac{\text{mrad} \cdot \text{m}^3}{\text{pCi} \cdot \text{yr}}$

** $\frac{\text{mrem} \cdot \text{m}^3}{\text{pCi} \cdot \text{yr}}$

*** 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~~ Site boundary due to noble gases shall be calculated as follows: |2

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)

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

2.2.1.b Organ doses due to tritium, I-131, I-133 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: |1

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

$$= \sum_i W \; P_i \, \overline{Q'}_i$$ where |1

W = controlling sector annual average atmospheric dispersion at the ~~unrestricted area~~ Site boundary for the appropriate pathway. |2

$$= \begin{cases} \overline{X/Q} = 5.176 \times 10^{-6*} \text{ sec/m}^3 \text{ for inhalation in the WSW sector (~~Section 2.1.1~~)} \\ \overline{D/Q} = 1.301 \times 10^{-8*} \text{ m}^{-2} \text{ for other pathways in the SSE* sector} \end{cases}$$ |2

* 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 ~~(R)~~ mrem/yr per uCi/sec) for other pathways, from Table 2.2-1.a-b. | 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~~ at the Site Boundary shall be determined as follows: | 2

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~~ the Site Boundary | 2

= $5.176 \times 10^{-6*}$ 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~~ to the Site Boundary | 2

= $5.176 \times 10^{-6*}$ 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, I-131, I-133 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: | 1

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 at a controlling location for an individual ~~for unrestricted areas~~

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

* Values taken from Reference 4, Table 6.1.26

** Values taken from Tables 2.2-3 and 2.3-1 | 2

R_i = dose factor for radionuclide i, (mrem/yr per uCi/m^3) or (m^2 , mrem/yr per uCi/sec) from Tables 2.2-2a - d | 1

$\tilde{Q}'_i$ = 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.~~3~~, of the REMS dose calculations will be performed using the above equations with the substitution of average meteorological parameters which prevailed for the period of the report. | 2

~~* Values taken from Reference 4, Table 6.1.26.~~ | 2

TABLE 2.2-1a

PATHWAY DOSE FACTORS (Pi) FOR TECHNICAL SPECIFICATION 3.11.2.6 and 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	3.493E+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	3.537E+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 2.2-1a (Continued)

PATHWAY DOSE FACTORS (Pi) FOR TECHNICAL SPECIFICATION 3.11.2.1 and 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 and all tritium pathways - 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 2.2-1b

PATHWAY DOSE FACTORS (Pi) FOR TECHNICAL SPECIFICATIONS 3.11.2.1 and SECTION 2.2.1.b

1

AGE GROUP	(CHILD)	(N. A.)	(CHILD)
ISOTOPE	INHALATION	GROUND PLANE	GRS/ANL/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-95	6.142E+05	1.605E+08	1.738E+09
MO-99	1.354E+05	4.626E+06	1.315E+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

2

TABLE 2.2-1b (Continued)

PATHWAY DOSE FACTORS (Pi) FOR TECHNICAL SPECIFICATIONS 3.11.2.1 and SECTION 2.2.1.b

AGE GROUP	(CHILD)	(N. A.)	(CHILD)*
ISOTOPE	INHALATION	GROUND PLANE	GRS/ANL/MEAT
TE-125M	4.773E+05	2.128E+06	4.438E+08
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 and all tritium pathways - 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 2.2-2a

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

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	3.206E+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 2.2-2a (Continued)

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

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	3.407E+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	3.536E+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 and all tritium pathways - 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.

TABLE 2.2-2b

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 3.11.2.3 AND SECTION 2.2.2.b

1

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	1.57[illegible]+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+09	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	4.628E+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 2.2-2b (Continued)

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

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	3.076E+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	1.204E+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 and all tritium pathways - 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.

TABLE 2.2-2c

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

1

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-23	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	1.29 E+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 2.2-2c (Continued)

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

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 and all tritium pathways - 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.

TABLE 2.2-2d

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

1

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	1
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	1
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	1
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 2.	3.502E-29	
RU-103	5.048E+05	1.265E+08	1.189E+05	1.299E+10	5.577E+08	2.
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 2.2-2d (Continued)

PATHWAY DOSE FACTORS (Ri) FOR TECHNICAL SPECIFICATIONS 4.11.2.3 AND SECTION 2.2.2.b

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 and all tritium pathways - 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.

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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

TABLE 2.2-3

CONTROLLING RECEPTORS, LOCATIONS, AND PATHWAYS

Sector	Distance (Meters)	Miles	Pathway	Age Group	Origin (for info only)
N	1207	0.75	Vegetation	Infant	- garden
NNE	1207	0.75	Inhal/Gnd Plane	Infant	- residence
NE	2414	1.50	Inhal/Gnd Plane	Infant	- residence
ENE	4023	2.50	Vegetation	Child	- garden
E	4023	2.50	Vegetation	Infant	- garden
ESE	1207	0.75	Inhal/Gnd Plane	Teenager	- residence
SE	2414	1.50	Vegetation	Child	- garden
SSE	2414	1.50	Vegetation	Adult	- garden
S	4023	2.50	Inhal/Gnd Plane	Child	- residence
SSW	3218	2.00	Inhal/Gnd Plane	Infant	- hypothetical
SW	1432	0.90	Vegetation	Child	- garden
WSW	8047	5.00	Cow/Milk	Infant	- hypothetical
W	8047	5.00	Cow/Milk	Infant	- hypothetical
WNW	7242	4.50	Inhal/Gnd Plane	Infant	- residence
NW	8047	5.00	Cow/Milk	Infant	- hypothetical
NNW	2414	1.50	Inhal/Gnd Plane	Child	- residence

2

Table based on 1983 Land Use Census

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~~ 2.0-34 12

$\sum$ = 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.

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TABLE 2.3-1

ATMOSPHERIC DISPERSION PARAMETERS* FOR TECHNICAL SPECIFICATIONS 4.11.2.1.1, 4.11.2.2, 4.11.2.3, 4.11.2.5.1

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	7.188×10^{-8}	3.520×10^{-10}
SE	1.817×10^{-7}	8.420×10^{-10}
SSE	7.600×10^{-7}	3.100×10^{-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}	2.793×10^{-10}
NNW	1.373×10^{-6}	4.174×10^{-9}

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

1

2

TABLE 2.3-1

ATMOSPHERIC DISPERSION PARAMETERS* FOR TECHNICAL SPECIFICATIONS 4.11.2.2, 4.11.2.3, 4.11.2.5.1

SECTOR	MILES	X/Q	D/Q
N	0.75	1.868×10^{-6}	7.751×10^{-9}
NNE	0.75	1.129×10^{-6}	5.298×10^{-9}
NE	1.50	2.391×10^{-7}	1.437×10^{-9}
ENE	2.50	7.358×10^{-8}	4.34×10^{-10}
E	2.50	8.434×10^{-8}	4.581×10^{-10}
ESE	0.75	5.134×10^{-7}	3.348×10^{-9}
SE	1.50	2.628×10^{-7}	1.474×10^{-9}
SSE	1.50	3.760×10^{-7}	1.288×10^{-9}
S	2.50	3.038×10^{-7}	9.074×10^{-10}
SSW	2.00	5.063×10^{-7}	1.068×10^{-9}
SW	0.90	3.001×10^{-6}	4.440×10^{-9}
WSW	5.00	3.931×10^{-7}	3.177×10^{-10}
W	5.00	4.259×10^{-7}	3.746×10^{-10}
WNW	4.50	3.164×10^{-7}	3.739×10^{-10}
NW	5.00	1.584×10^{-7}	2.733×10^{-10}
NNW	1.50	7.237×10^{-7}	2.342×10^{-9}

* Reference: Grand Gulf Nuclear Station, Environmental Report, Table 6.1.28, 6.1.29 and ODCM Table 2.2-3.

2.4 Definitions of Gaseous Effluents Parameters

b = 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)~~ 3

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)~~

3

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 (m² · 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~~ (uCi/sec) (2.1.1)

3

2.4 Definitions of Gaseous Effluents Parameters (Continued)

$\overline{Q'}_i$ = 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)~~

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

$\overline{\chi/Q''_i}$ = 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/m³) or (m² • 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)~~

3

3

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)~~

3

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)

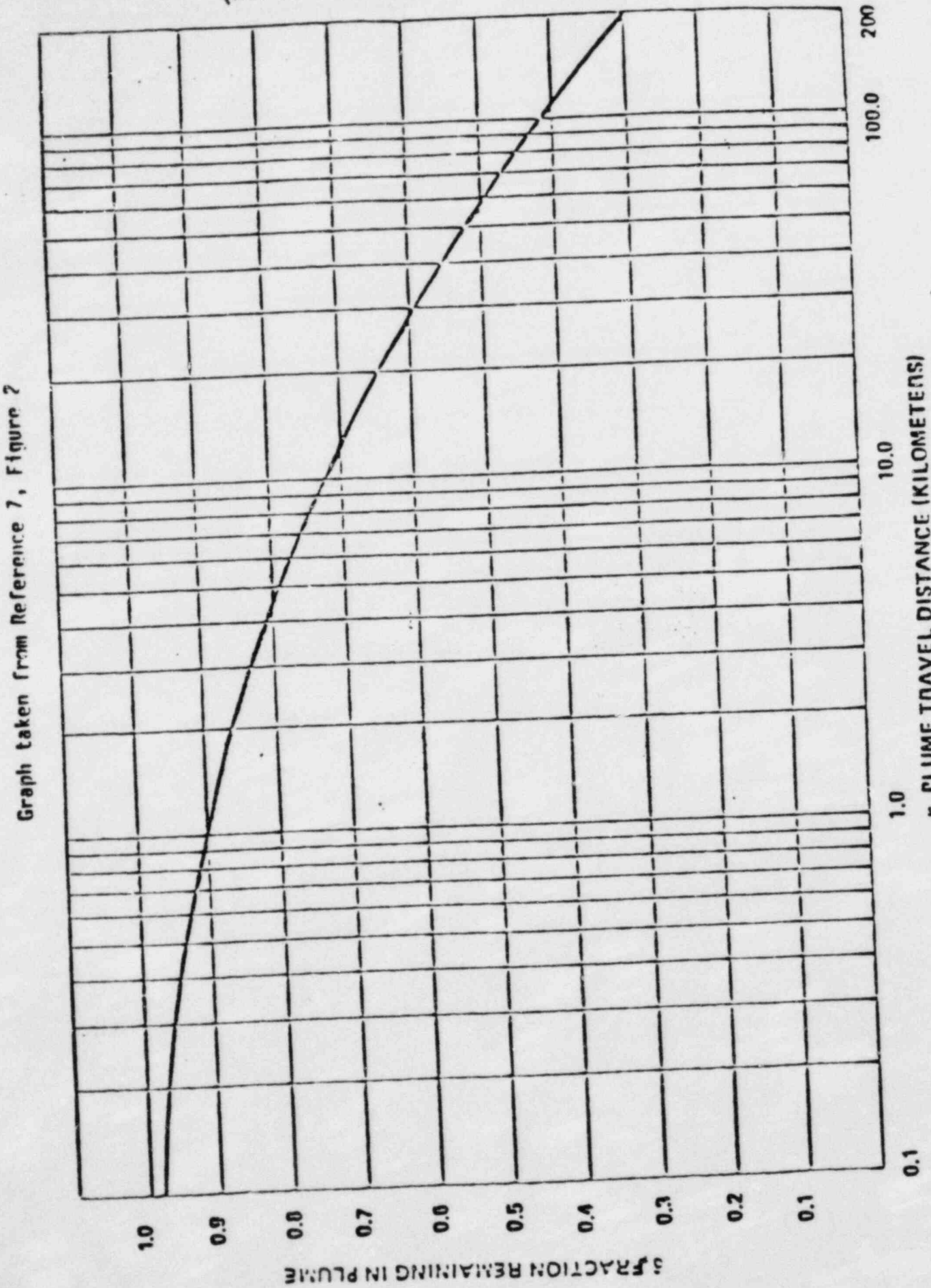
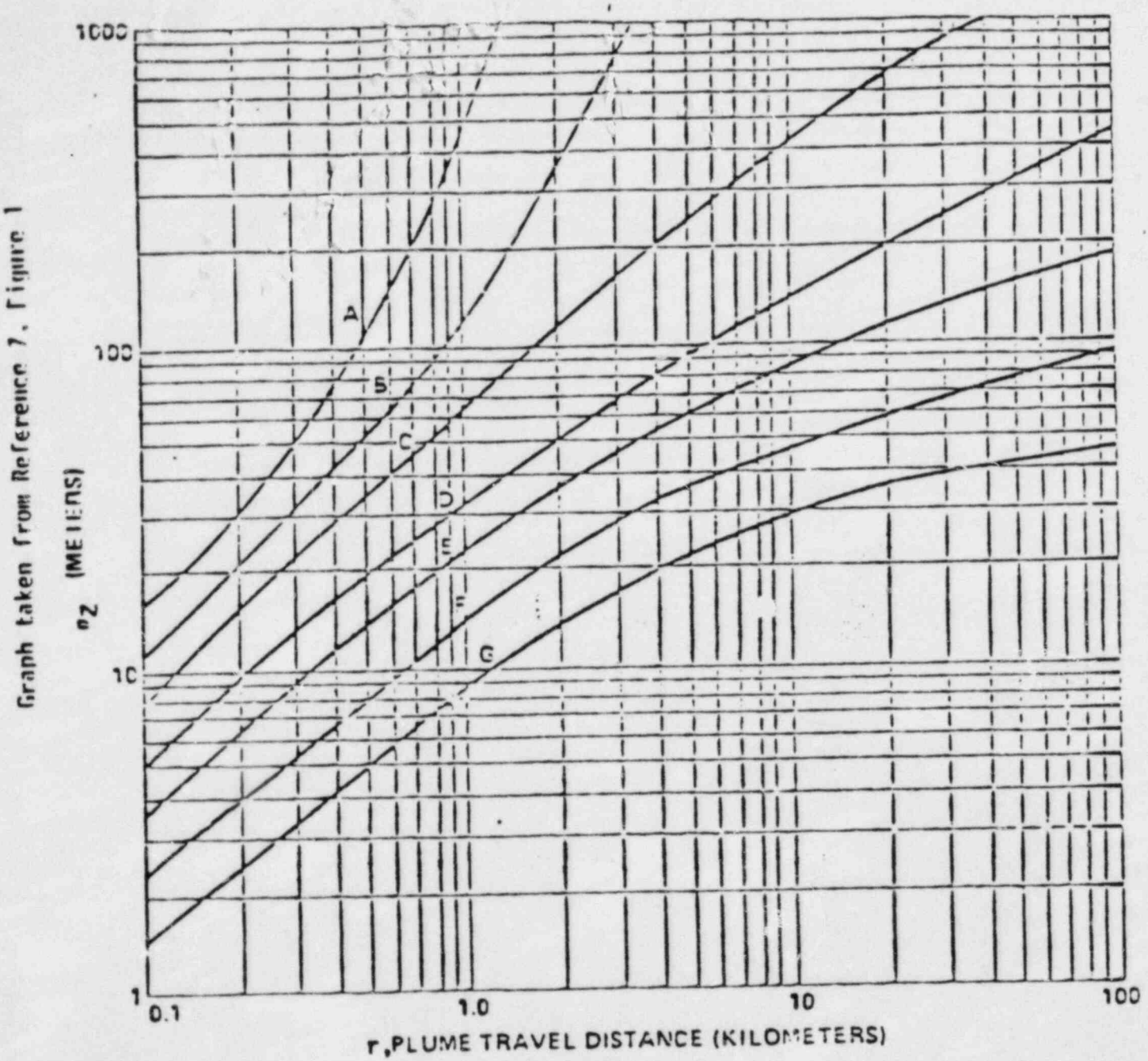


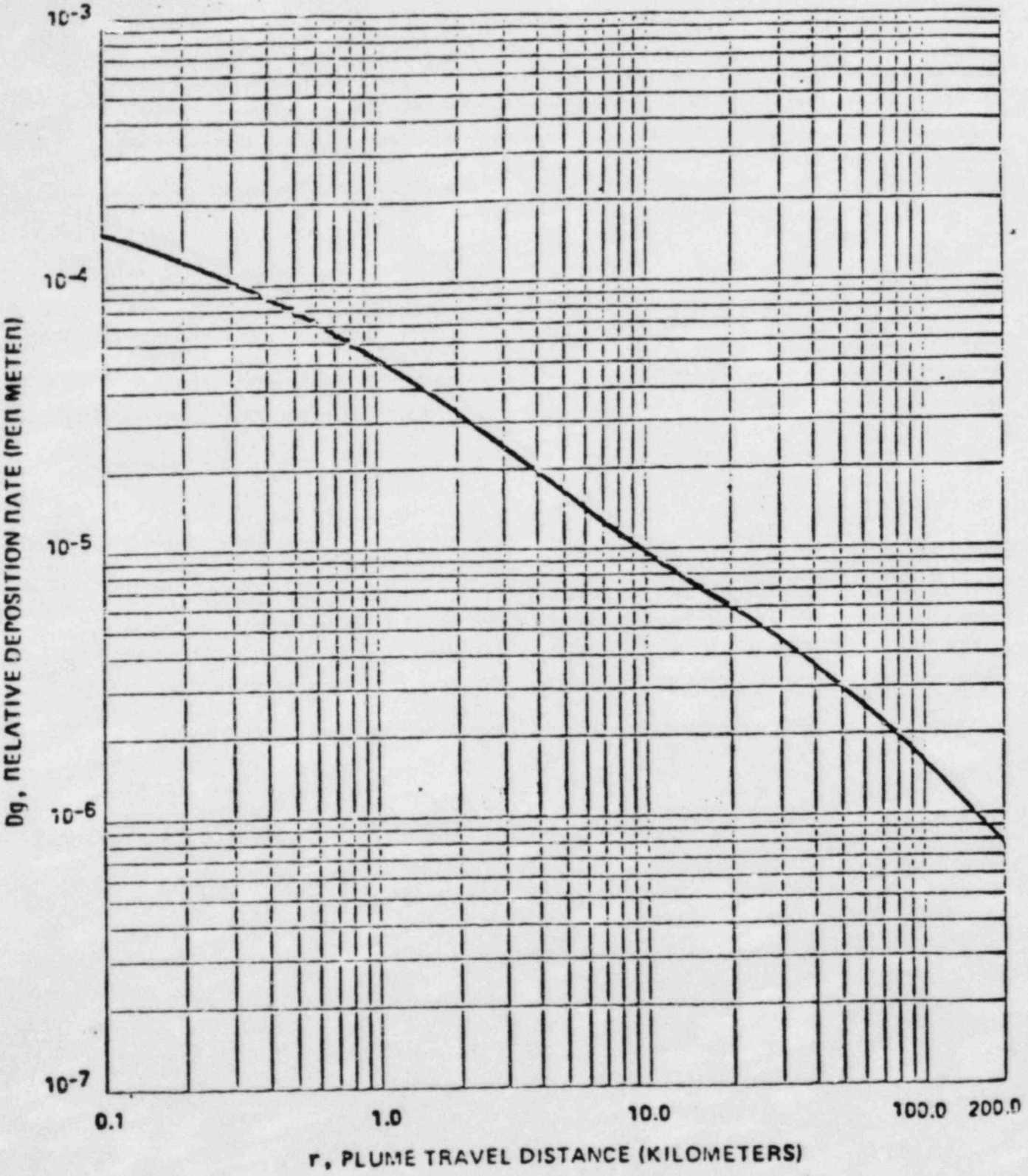
Figure 2.3-2 Vertical Standard Deviation of Material in a Plume (Letters Denote Pasquill Stability Class)



Graph taken from Reference 7, Figure 1

Temperature Change with Height (Γ) (°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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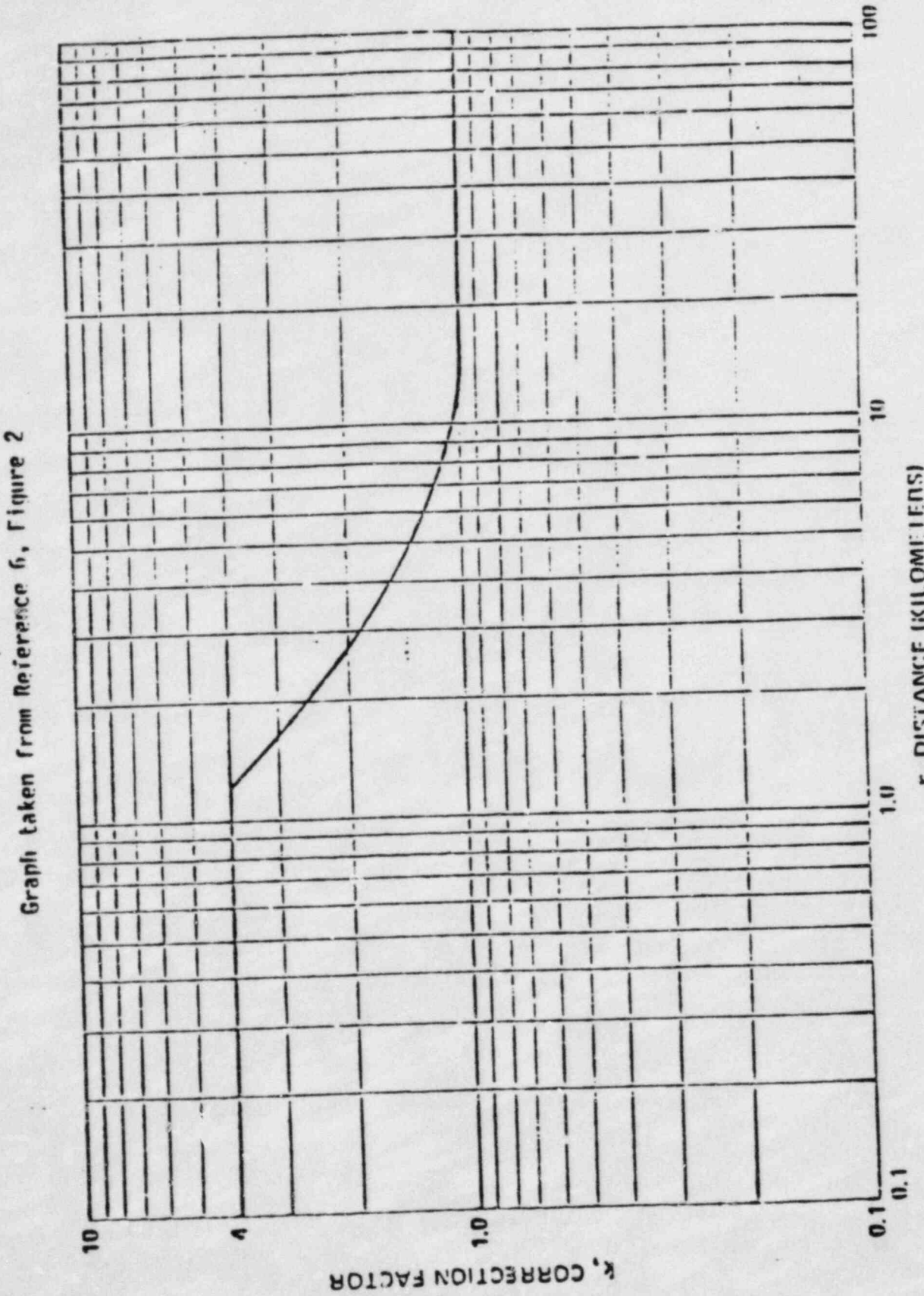
Figure 2.3-4 Open Terrain Recirculation Factor



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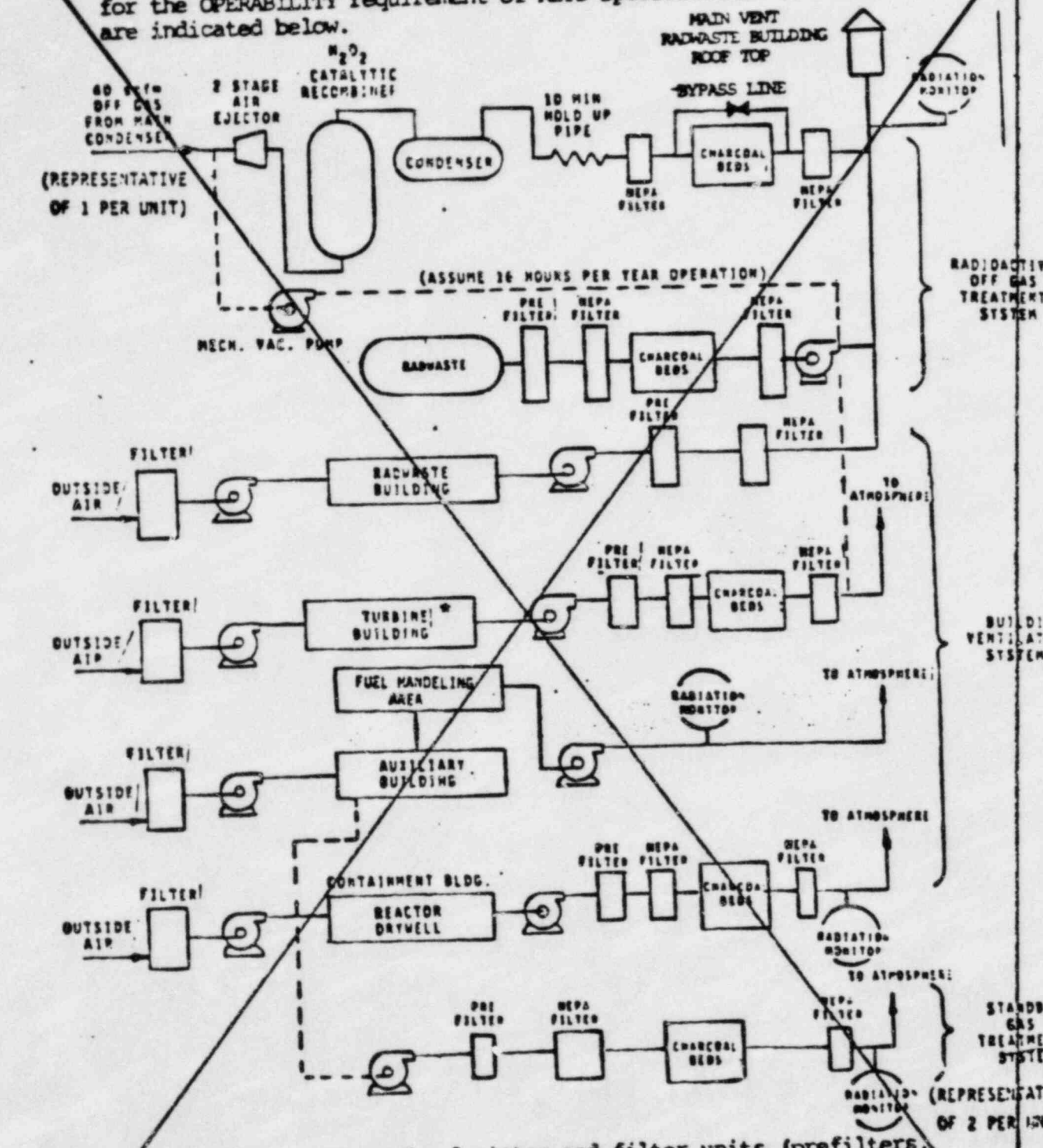
2.5 GASEOUS RADWASTE TREATMENT SYSTEM

The essential components of the gaseous radwaste treatment system for the OPERABILITY requirement of RETS Specification 3/4.11.2.4 are indicated below.

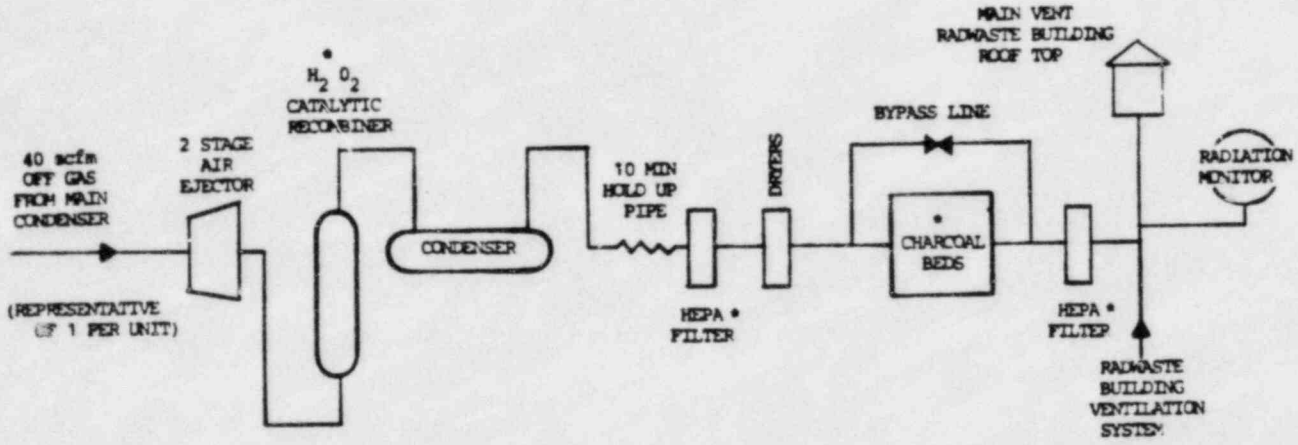


*During normal operations the demister and filter units (prefilters, charcoal filters and HEPA filters) are not installed in the filter train. However, the filter train is available to be operable at a later date when the filter and demister are installed.

Taken from Reference 4, Figure 3-8.

2.5 GASEOUS RADWASTE TREATMENT SYSTEM

The essential components of the GASEOUS RADWASTE TREATMENT (OFFGAS) SYSTEM for the OPERABILITY requirement of RETS Specification 3/4.11.2.4 are indicated below by an asterisk (*).



NOTES

1. The essential components included above are those necessary to process gaseous radwaste prior to discharge to the environment.
2. The charcoal beds may be bypassed provided the limits of Technical Specification 3.11.2.1 are not exceeded. The charcoal beds will be used as much as possible to ensure releases are as low as reasonably achievable.

3

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 3.0-4. | 1

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TABLE 3.0-1

AIR SAMPLER COLLECTION SITES

AIR SAMPLERS

NUMBER	FIGURE	LOCATION	
* AS-1 PG	3.0-3	Southwest of GGNS at the Port Gibson City Rain. (Sector G Radius 5 miles)	3
AS-2 61N	3.0-2	North Northeast of GGNS, on Hwy 61 South across from the Yokena Church. ~~Approximately 20 miles from GGNS.~~ (Sector B Radius 13 miles)	3
* AS-3 61 VA	3.0-2	North Northeast of GGNS on Hwy 61 south at the Vicksburg Airport. (Sector B Radius 18 miles)	
* AS-4 GJOE	3.0-1	Southwest of GGNS. Glodjo property on Waterloo Road. (Sector L Radius .9 miles)	
AS-5 TC	3.0-1	South of GGNS behind MP&L training center building. (Sector J Radius .4 miles)	3 1
AS-6 RS	3.0-1	Northeast of GGNS, South of Grand Gulf Road. (Sector C Radius .8 miles)	
* AS-7 MT	3.0-1	North of GGNS, Located next to the Meteorological met tower. ~~and met tower control building~~. (Sector A Radius .8 miles)	3
AS-8 WR	3.0-1	East of GGNS, located at Maggie Jackson's trailer on Waterloo Road near the Eastern Site Boundary. (Sector E Radius .5 miles)	
* AS-9 GGMP	3.0-1	North of GGNS, located in Grand Gulf Military Park. (Sector A Radius 1.5 miles)	3
AS-10 NLT	3.0-3	West Northwest of GGNS, located at Newellton, Louisiana. (Sector P Radius 12.5 miles)	
AS-11 STJ	3.0-3	West Southwest of GGNS, located at St. Joseph, Louisiana. (Sector M Radius 13.0 miles)	

* Technical Specification requirements

From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. ~~1982.~~ 3

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TABLE 3.0-2

MISCELLANEOUS COLLECTION SITES

	Figure	
MILK SAMPLES (CONTROL LOCATION)		
Alcorn State University*	3.0-3	Located Southwest of GGNS. (Sector K Radius 10.5 miles)
Rosco Johnson farm	3.0-3	Located Southeast of GGNS. (Sector G Radius 9 miles)
Hazetta Warren farm	3.0-3	Located in Louisiana West Northwest of GGNS. (Sector N Radius 8.5 miles)
CISTERN WATER		
1. Trimble Cistern*	3.0-4	Located east of GGNS at the Trimble Tenant House. (Sector E Radius .5 miles)
2. Willis Cistern*	3.0-3	Located at the C.E. Willis house East Northeast of GGNS across from the Shiloh Baptist Church. (Sector D Radius 6 miles)
GROUND WATER		
1. PGWELL*	3.0-4	PORT GIBSON WELL - Taken at Port Gibson City Water lift Station. (Sector G Radius 5.0 miles)
2. GGMPWELL*	3.0-4	GRAND GULF MILITARY PARK - Taken from faucet at the Grand Gulf Military Park. (Sector A Radius 1.7 miles)
3. TRIMWELL*	3.0-4	TRIMBLE house faucet. (Sector E Radius 0.7 miles)
4. LAKE BRUIN	3.0-3	Taken from faucet at the bath house in Lake Bruin State Park, Louisiana. (Sector M Radius 9.5 miles)

* Technical Specification requirements

From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report, ~~1982~~.

	Figure		
SURFACE WATER			
Upstream *	3.0-4	4500 ft. upstream of the GGNS outfall to allow adequate mixing of the Mississippi and Big Black Rivers. (Sector Q)	3
Downstream *	3.0-4	5000 ft. downstream of GGNS outfall, near the most southern radial well. (Sector N)	3
Discharge Basin *	3.0-4	West of GGNS, 0.5 miles, Sector P	
VEGETATION			
Broad Leaf Vegetation*	3.0-4	South of GGNS in the MP&L garden near the training center, or South Southwest in Glodjo garden, or areas adjacent to these gardens. (Sector J, 0.4 miles)	
		Lake Claiborne Willis garden (Sector E, 3.0 miles)	
		Nelson Truck Farm (Sector E, 4.5 miles)	
		Alcorn State University Southwest of GGNS (Sector K, 10.5 miles)	3
FISH SAMPLES			
Catfish *	3.0-4	Downstream of the discharge point in the Mississippi River	
	3.0-4	Upstream of Discharge Point uninfluenced by Plant Operations.	

* Technical Specification requirements
From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. 3

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TABLE 3.0-2 (CONTINUED)

SURFACE WATER			
Upstream *	Figure 3.0-4	4500 ft. ~~500-1500 yards~~ upstream of the GGNS outfall to allow adequate mixing of the Mississippi and Big Black Rivers. (Sector Q)	13
Downstream *	3.0-4	5000 ft. ~~1500 yards~~ downstream of GGNS outfall, near the most southern radial well. (Sector N)	13
Discharge Basin *	3.0-4	West of GGNS, 0.5 miles, Sector P	
VEGETATION			
Broad Leaf Vegetation*	3.0-4	South of GGNS in the MP&L garden near the training center, or South Southwest in Glodjo garden, or areas adjacent to these gardens. (Sector J, 0.4 miles)	
		Lake Claiborne Willis garden (Sector E, 3.0 miles)	1
		Nelson Truck Farm (Sector E, 4.5 miles)	
		Alcorn State University Southwest of GGNS (Sector K, 10.5 miles	3
FISH SAMPLES			
Catfish *	3.0-4	Downstream of the discharge point in the Mississippi River	
	3.0-4	Upstream of Discharge Point uninfluenced by Plant Operations.	
SEDIMENT SAMPLES *			
	3.0-4	Collected semiannually during the low water periods of the Tidal Basin - samples taken downstream of the outfall in the vicinity of the boat landing near Hamilitaon Lake outlet and in the Barge Slip. (Sector N and Q, 2 miles)	3

SEDCONT

Collected upstream from barge slip at Upper Grand Gulf Landing (Sector R, 2.2 miles)

* Technical Specification requirements From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report, ~~1982.~~

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TABLE 3.0-3
TLD LOCATIONS
Page 1 of 6

* M-00 Maintained in Lead shield during the exposure period

TLD NO.	LOCATION	FIGURE	SECTOR	MILE
* M-01	REA Pole-East of Entry Gate at Lake Claiborne	3.0-3	E	3.5
M-02	REA Pole Left of Entry Gate Windsor Ruins	3.0-3	L	7.0
M-03	REA Pole-East Side Hwy 61 P.G. Country Club entrance	3.0-3	H	7.0
M-04	MP&L Pole-Hwy 547 North Side Between Twin Power Poles		G	6.5
M-05	50 yards North of Hwy 18 Approximately 5 miles East of U.S. 61	3.0-3	F	9.0
M-06	REA Pole-East of Willows Beyond MMB Church MS Hwy 462		E	8.0
* M-07	Port Gibson City Barn AS-1	3.0-3	G	5.5
M-08	West Side Big Black River South Entrance	3.0-3	C	8.5
* M-09	Oak Tree Hanger-South Warner Tully Camp	3.0-3	D	3.5
* M-10	Entrance Gate Grand Gulf Military Park	3.0-1	R	1.5
M-11	Hwy 61 3 miles North of Big Black River at Twin Tower	3.0-3	C	10.5
M-12	Hwy 61 at AS-2-61 North Yokena	3.0-2	B	13.0
M-13	Hwy 61 LeTourneau Hill West Side of Road	3.0-2	B	15.0
* M-14 (CONTROL)	Hwy 61 AS-3-61VA at Casket Company	3.0-2	B	18.0

* Technical Specification requirements
From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. ~~1982.~~

ODCM

TABLE 3.0-3 (CONTINUED)

TLD LOCATIONS

TLD NO.	LOCATION	FIGURE 3.0-1	SECTOR	MILE	
M-15	Barge Slip (South edge)		P	1.5	
* M-16	AS-7 MET Tower	3.0-1	A	~~1.0~~ 0.8	13
M-17	AS-6-RS Grand Gulf Road	3.0-1	C	0.5	
* M-18	Railroad Crossing Eastern Site Boundary	3.0-1	F	0.5	
M-19	Behind Burn Pit on Fence at Eastern Site Boundary	3.0-1	E	0.5	
M-20	Eastern Site Boundary Behind ~~Burn Pit (PINE)~~ hazardous waste storage area	3.0-1	F	0.5	12
M-21	AS-5-TC Training Center	3.0-1	J	0.54	13
M-22	100 yards South of RR Entrance Crossing ~~100 Yards~~ on West Side	3.0-1	G	0.5	13
M-23	County Road/Heavy Haul Road 50 Yards North on Power Pole	3.0-1	Q	0.5	1
M-24	Upper Grand Gulf Landing	3.0-1	R	2.02	13
* M-25	Hamilton Lake Boat Launch	3.0-1	N	1.0	
M-26	Hamilton Lake Outfall	3.0-1	N	1.05	13
* M-27	South Point Site Boundary 200 Yards along Property Line	3.0-1	M	1.05	13
* M-28	AS-4-Glodjo Residence Glodjo	3.0-1	L	~~1.0~~ 0.9	13
M-29	In sharp curve of Waterloo Road to Waterloo Plantation	3.0-1	K	1.5	
* M-30	Arnold Acres Trailer Park Entrance	3.0-1	J	1.01	13
M-31	Duplicate TLD Installed at designated Site Number	-	-	-	

* Technical Specification requirements

From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. ~~1982~~ 13

ODCM

TABLE 3.0-3 (CONTINUED)

TLD LOCATIONS

TLD NO.	LOCATION	FIGURE	SECTOR	MILE	
M-32	Duplicate TLD Installed at designated Site Number	-	-	-	
* M-33	Newellton, Louisiana Water Tower	3.0-3	P	12.~~0~~5	13
* M-34	Primary Levee at End of Country Road at Point Pleasant, Louisiana	3.0-3	R	~~7.5~~ 8.0	13
* M-35	Mor Landing - Lake Yucatan	3.0-3	Q	8.0	
* M-36	Curve on 608 Point Nearest GGNS, at Power Pole	3.0-3	P	5.0	
M-37	Winter Quarters Home	3.0-3	N	~~7.5~~ 8.0	13
* M-38	Lake Bruin State Park Second Pole	3.0-3	M	~~9.0~~ 9.5	13
* M-39	St. Joseph, Louisiana, Aux. Water Tank	3.0-3	M	~~12.0~~ 13.0	13
~~* M-00~~	~~Maintained in lead shield during the exposure period~~	~~—~~	~~—~~	~~—~~	
* M-40	International Paper Road, Approximately 5 miles from Site	3.0-3	M	5.0	
* M-41	Heavy Haul Road - J Pipe on Concrete Block	3.0-1	P	1.0	
* M-42	Heavy Haul Road North Iron Gate	3.0-1	Q	1.0	
* M-43	Gin Lake Entrance	3.0-1	R	1.2	
* M-44	Truck Bypass on Grand Gulf Road	3.0-1	C	0.5	
* M-45	Visitor Center Gate East Side	3.0-1	D	0.5	

* Technical Specification requirements

From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report, ~~1982.~~ 13

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TABLE 3.0-3 (CONTINUED)

TLD LOCATIONS

TLD NO.	LOCATION	FIGURE	SECTOR	MILE	
* M-46	Power Pole Across from Grand Gulf/Waterloo roads intersection	3.0-1	E	1.0	
* M-47	Bridge 0.6 miles past Rodney Road/Greenwood Road intersection North Side	3.0-3	L	5.02	13
* M-48	Property Line Fence 0.4 miles on Greenwood Road on West Side	3.0-3	K	~~5.0~~ 4.8	13
* M-49	Fork in Weathers Road	3.0-3	H	4.5	
* M-50	~~Big Black River Boat Landing~~ Panola Hunting Club Entrance		B	5.05	13
* M-51	Power Pole 0.5 miles on Gravel Road to Big Black on West Side	3.0-3	C	~~5.0~~ 4.8	13
* M-52	Power Pole-Waterloo Road Marked with White Paint	3.0-1	K	1.0	
* M-53	Arnold Acres Property Fence Past Trailer Park	3.0-1	H	1.01	1/3
* M-54	Bottom of Curve past Arnold's ~~Acres~~ house	3.0-1	G	1.0	13
* M-55	Behind Bonner's Beauty Shop at MSBH Air Sample	3.0-3	D	5.0	
* M-56	Hwy 61 South at "All Creatures Veterinary Hospital"	3.0-3	G	5.0	
* M-57	Hwy 61 North Behind the Welcome to Port Gibson sign	3.0-3	F	4.5	
* M-58	Big Bayou Pierre Bridge Southwest End	3.0-3	E	5.0	
* M-59	Off Levee at Winter Quarters Hunting Camp	3.0-3	N	5.1	

* Technical Specification requirements From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report, ~~1982~~. 13

ODCM
TABLE 3.0-3 (CONTINUED)
TLD LOCATIONS
Page 5 of 6

TLD NO.	LOCATION	FIGURE	SECTOR	MILE	
~~M-60~~	Duplicate TLD	Not Shown	P	Onsite	
M-61	Protected area fence by the vehicle entrance gate	*	N	*	
M-62	Protected area fence North-east corner MP&L parking lot	*	parking lot	*	
M-63	Protected area fence middle MP&L parking lot	*	N	*	13
M-64	Protected area fence South-east corner MP&L parking lot	*	M	*	
M-65	South protected area fence behind MP&L warehouse	*	L	*	1
M-66	South protected area fence across from cooling tower	*	K	*	13
M-67	South protected area fence ~~West end North fence~~ EAST	*	J	*	
M-68	East protected area fence across from chlorination tank	*	H	*	
M-69	East protected area fence near electric Buss	*	G	*	
M-70	North fence behind turbine bldg.	*	F	*	3
M-71	~~133' RAILWAY BAY 166' level on Unit 2 side of~~ plant turbine bldg.	*	C	*	
M-72	~~133' RAILWAY BAY 166' level turbine~~ bldg. ~~Unit 2 side~~	*	B	*	
M-73	Corner of fence outside control bldg.	*	P	*	13

* Technical Specification requirements
From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. 1982.

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TABLE 3.0-3 (CONTINUED)

TLD LOCATIONS

TLD NO.	LOCATION	FIGURE	SECTOR	MILE	
~~M-60~~	~~Duplicate TLD~~	-	-	-	
M-61	Protected area fence by the vehicle entrance gate	Not Shown	P	Onsite	
M-62	Protected area fence North-east corner MP&L parking lot	*	N parking lot	*	
M-63	Protected area fence middle MP&L parking lot	*	N	*	13
M-64	Protected area fence South-east corner MP&L parking	*	M	*	
M-65	South protected area fence behind MP&L warehouse	*	L	*	
M-66	South protected area fence across from cooling tower	*	K	*	1
M-67	South protected area fence ~~West~~ East end North fence	*	J	*	13
M-68	East protected area fence across from chlorination tank	*	H	*	
M-69	East protected area fence near electric Buss	*	G	*	
M-70	North fence behind turbine bldg.	*	F	*	
M-71	133' Railway Bay ~~166' level on Unit 2 side of plant turbine bldg.~~	*	C	*	3
M-72	133' Railway Bay ~~166' level turbine bldg. Unit 2 side~~	*	B	*	
M-73	Corner of fence outside control bldg.	*	P	*	

* Technical Specification requirements

From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report, 1982.

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TABLE 3.0-3 (CONTINUED)

TLD LOCATIONS

TLD NO.	LOCATION	FIGURE	SECTOR	MILE	
M-74	Midway of North fence	Not Shown	P	Onsite	
M-75	Corner in fence in front of Maintenance Shop	"	A	"	
M-76	Southeast corner SSW Basins	"	A	"	
M-77	Protected area fence beside maintenance shop	"	R	"	
M-78	Outside vault in Admin. Bldg.	"	Q	"	
M-79	Wall in Central Records (middle)	"	Q	"	13
M-80	Wall in Central Records Old library location	"	Q	"	
M-81	Inside Admin. Bldg., 2nd floor, northeast wall	"	Q	"	1
M-82	Tech Support Area	"	Q	"	
M-83	Tech Support Secretary's office	"	Q	"	13
M-84	Security Island	"	P	"	
M-85	Rotating duplicate	-	-	-	
* M-86	Bechtel Gate North Site Boundary	3.0-1	B	0.5	
* M-87	Intersection of Rodney Road & transmission line	3.0-3	J	4.5	

Insert

* Technical Specification requirements From Grand Gulf Nuclear Station's Annual Radiological Environmental Operating Report. 1982

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M-88	River mile marker 409.5	3.0-1	A	4.2	
M-89	Middle Ground Island	3.0-1	R	4.4	3
M-90	Across from middle Ground Island	3.0-1	Q	3.5	
M-91	Transmission line by pond	3.0-1	J	4.5	

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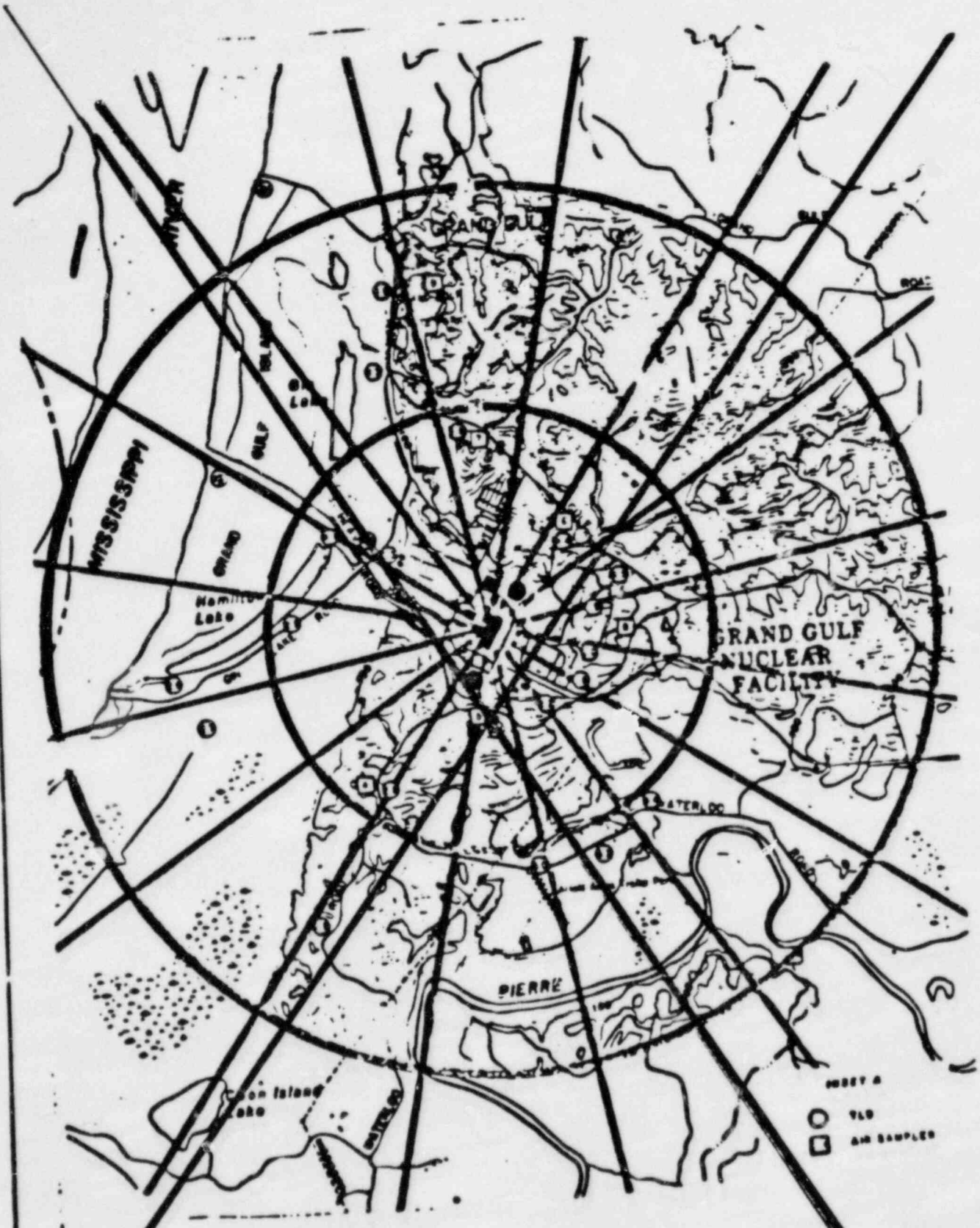
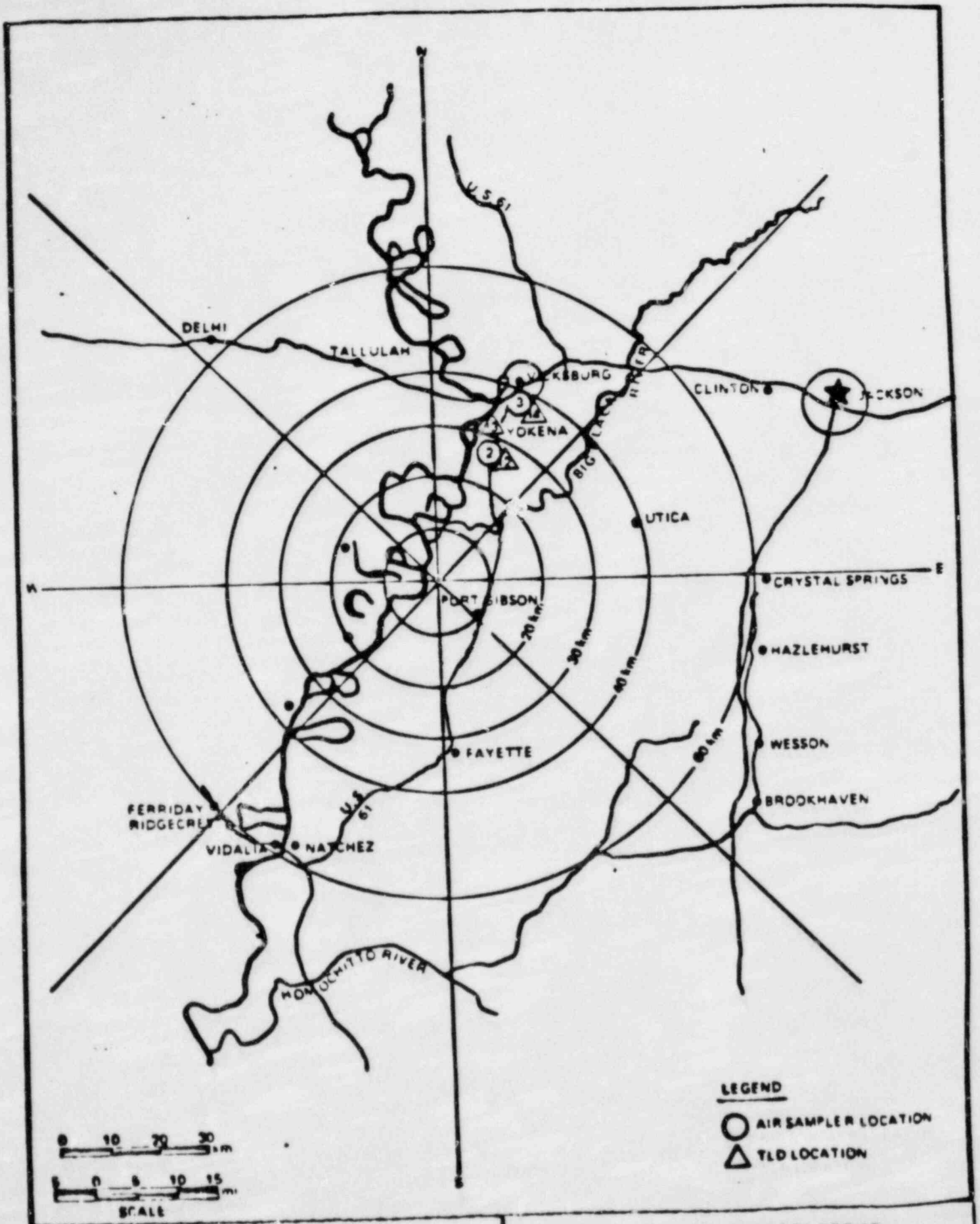


MISSISSIPPI POWER & LIGHT COMPANY GRAND GULF NUCLEAR STATION UNIT 1 & 2 ODCM	COLLECTION SITE LOCATIONS GENERAL AREA MAP FIGURE 3.0-1

Rev. 1 - 7/83

MISSISSIPPI POWER & LIGHT COMPANY GRAND GULF NUCLEAR STATION UNIT 1 & 2 ODCM	COLLECTION SITE LOCATIONS 0.5 MILE AREA MAP FIGURE 3.0-1



MISSISSIPPI POWER & LIGHT COMPANY
GRAND GULF NUCLEAR STATION
UNITS 1 & 2
ODCM

COLLECTION SITE LOCATIONS
GENERAL AREA MAP

FIGURE 3.0-2

Rev. 1 - 7/83

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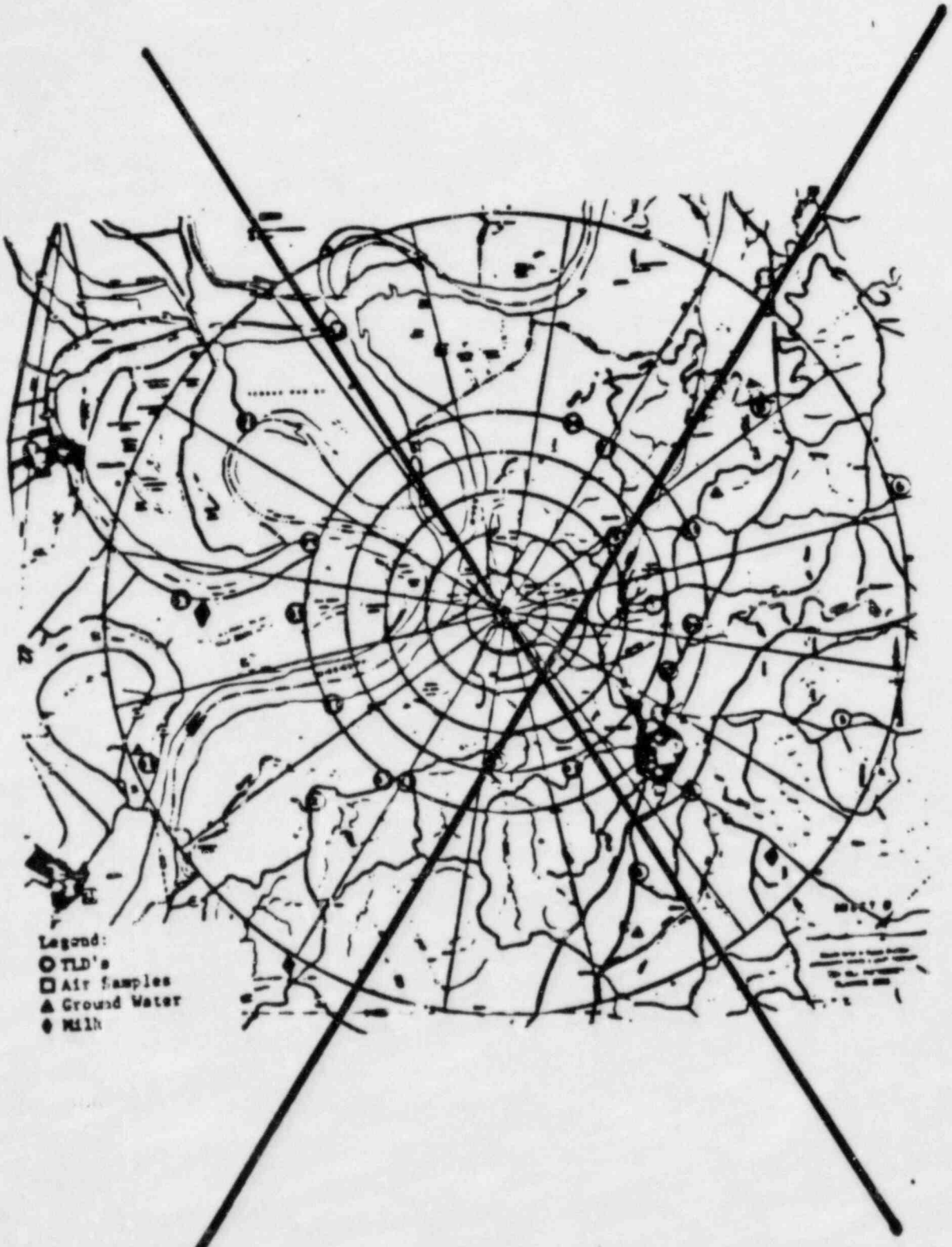
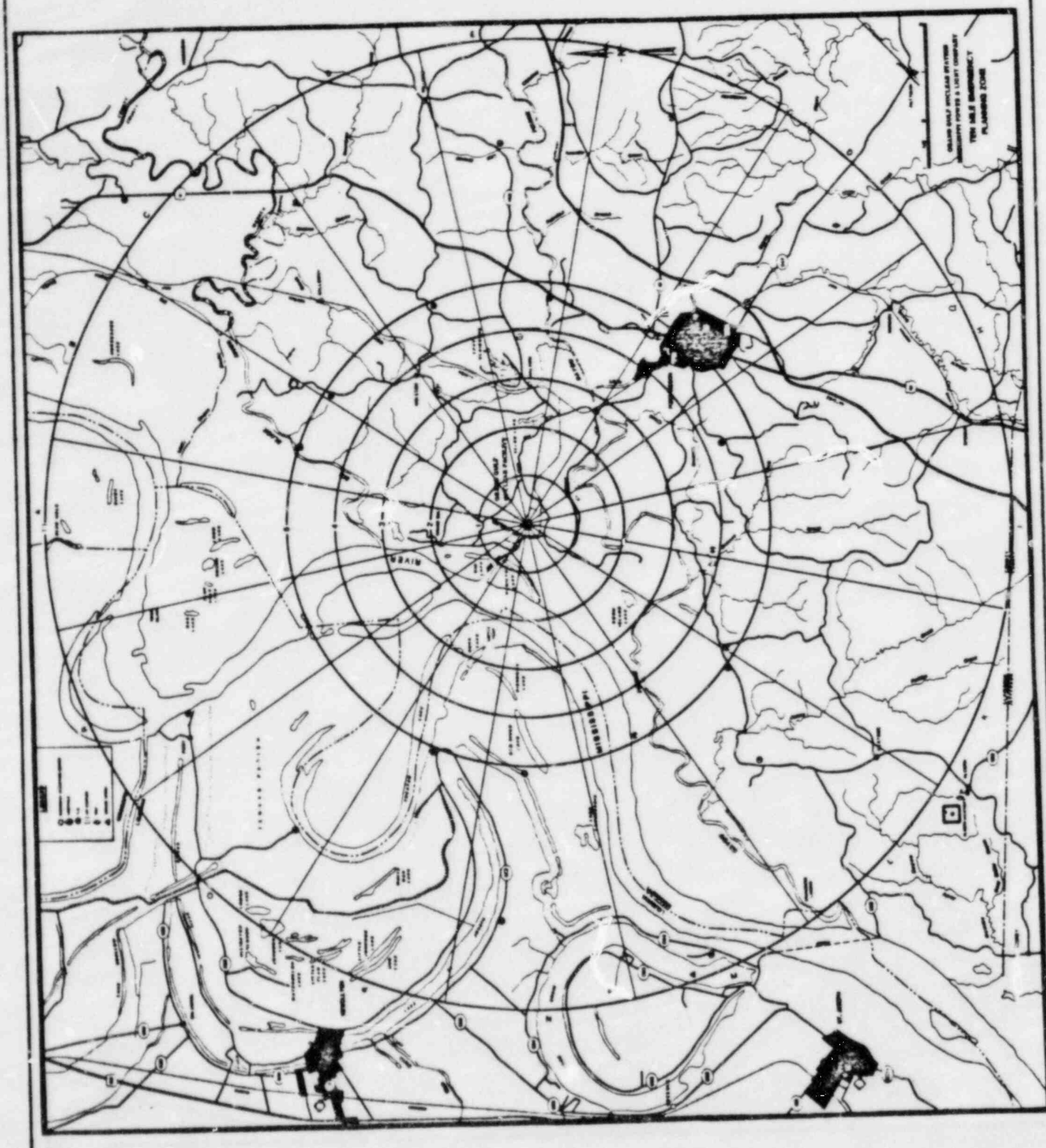


MISSISSIPPI POWER & LIGHT COMPANY
GRAND GULF NUCLEAR STATION
UNITS 1 & 2
ODCM

COLLECTION SITE LOCATIONS
SITE PERIMETER
FIGURE 3.0-3



MISSISSIPPI POWER & LIGHT COMPANY
GRAND GULF NUCLEAR STATION
UNIT 1 & 2
ODCM

COLLECTION SITE LOCATIONS
0-10 MILE AREA MAP
FIGURE 3.0-3

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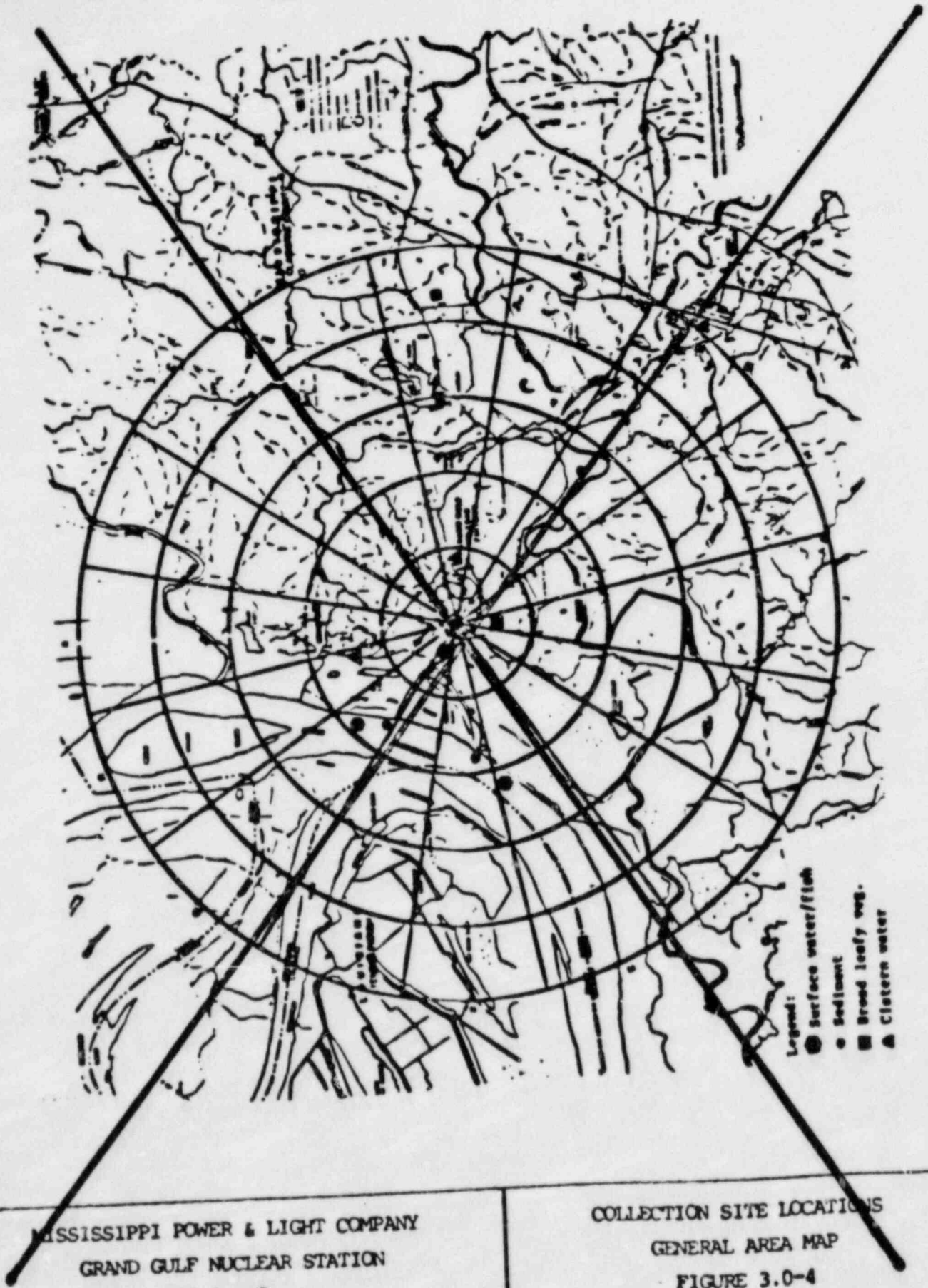

MISSISSIPPI POWER & LIGHT COMPANY GRAND GULF NUCLEAR STATION UNITS 1 & 2 ODCM	COLLECTION SITE LOCATIONS GENERAL AREA MAP FIGURE 3.0-4

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