Jan. 26, 1979

DRAFT

OFFSITE DOSE CALCULATION MANUAL

JOSEPH M. FARLEY NUCLEAR PLANT

UNITS 1 AND 2

ALABAMA POWER COMPANY

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Dose Calculation Due to Liquid Effluents

4.11.1.2.1 Liquid Effluents-Dose Calculations

The dose contributions for the total time period $\sum_{\ell=1}^{m} \Delta t_\ell$ shall be determined by the following calculation and a cumulative summation of these total body and any organ doses shall be maintained for each calendar quarter. These dose contributions shall be calculated for all radionuclides measured in liquid effluents released to unrestricted areas using the following expression:

$$D_\tau = \Sigma[A_{i\tau} \sum_{\ell=1}^{m} \Delta t_\ell \, C_{i\ell} \, F_{i\ell}]$$

where:

D_τ = the cumulative dose or dose commitment to the total body or an organ τ from the liquid effluents for the total time period $\sum_{\ell=1}^{m} \Delta t_\ell$, in mrem.

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

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

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

$$A_{i\tau} = k_o U_f B_{Fi} DF_i$$

where:

k_o = unit conversion factor, 1.14×10^5 (year/hr).(ml/l).(pCi/µCi)

U_f = adult fish consumption, 21 kg/yr.

B_{Fi} = the bioaccumulation factor in fish for each measured radionuclide i, in pCi/kg per pCi/liter (Table 1).

D_{Fi} = the dose conversion factor for nuclide i for adults, in mrem/pCi (Table 2).

F_ℓ = the near field average dilution factor for $C_{i\ell}$ during any liquid effluent release. Defined as the ratio of the maximum undiluted liquid waste flow during release to the product of the average flow from the site discharge structure to unrestricted receiving waters times 5. (5 is the site specific applicable factor for the mixing effect of the discharge structure.)

For radionuclides not determined in each batch or weekly composite, the dose contribution to the current calendar quarter cumulative summation may be approximated by assuming an average monthly concentration based on the previous monthly or quarterly composite analyses.

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Dose Calculation Due to Gaseous Effluents

3.11.2.1 Gaseous Effluents-Dose Calculations

The dose rate in unrestricted areas due to radioactive materials released in gaseous effluents from the site shall be limited to the following expressions:

(a) Release rate limit for noble gases:

$$10^6 \frac{pCi}{\mu Ci} \left[\sum_i K_i \sum_v^2 [(\overline{x/Q})_v Q_{iv}] \right] < 500 \text{ mrem/yr, and}$$

$$10^6 \frac{pCi}{\mu Ci} \left[\sum_i (L_i + 1.1\, M_i) \sum_v^2 [(\overline{x/Q})_v Q_{iv}] \right] < 3000 \text{ mrem/yr}$$

where the terms are defined below:

(b) Release rate limit for all radioiodines and radioactive materials in particulate form, with half lives greater than 8 days:

$$238 \times 10^6 \frac{pCi}{\mu Ci} \left[\sum_i P_i \sum_v^2 [(\overline{x/Q})_{mv} Q_{iv}] \right] < 1500 \text{ mrem/yr}$$

where:

238 = the factor to convert inhalation dose to grass-cow-milk pathway dose.

K_i = the total body dose factor due to gamma emissions for each identified radionuclide, in mrem/yr per pCi/m^3 (Tabel 3).

L_i = the skin dose factor due to beta emissions for each identified radionuclide, in mrem/yr per pCi/m^3 (Table 3).

M_i = the air dose factor due to gamma emissions for each identified radionuclide, in mrad/yr per pCi/m^3 (Table 3).

P_i = the product of the largest inhalation dose factor for any organ of an infant for each identified radionuclide and the infant inhalation rate of 1900 m^3/yr, in mrem/yr per pCi/m^3. The infant age group and pathways are the most restrictive, thus the infant dose factors in Table 4 usually apply. However, for the kidney and for some radionuclides, the adult inhalation dose factors in Table 5 are applicable.

$(\overline{x/Q})_v$ = the highest value of the annual average atmospheric dispersion factor at the site boundary, for all sectors, in sec/m^3. The value of 7.5×10^{-7} sec/m^3 will be used for the plant vent and 1.2×10^{-5} sec/m^3 for the turbine building steam jet air ejector.

TABLE 2* (Continued)

NUCLIDE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
53I 133	1.43E-06	2.39E-06	7.57E-07	4.77E-04	4.33E-06	0.0	2.18E-06
53I 134	1.06E-07	2.88E-07	1.03E-07	3.74E-05	4.59E-07	0.0	2.51E-10
53I 135	4.43E-07	1.17E-06	4.29E-07	1.53E-04	1.86E-06	0.0	1.31E-06
55CS 134M	2.13E-08	4.44E-08	2.30E-08	0.0	2.44E-08	3.83E-09	1.53E-08
55CS 134	6.22E-05	1.48E-04	1.21E-04	0.0	4.80E-05	1.59E-05	2.59E-06
55CS 135	1.95E-05	1.30E-05	8.99E-06	0.0	6.92E-06	2.05E-06	6.21E-07
55CS 136	6.51E-06	2.57E-05	1.85E-05	0.0	1.43E-05	1.96E-06	2.92E-06
55CS 137	7.97E-05	1.09E-04	7.15E-05	0.0	3.71E-05	1.23E-05	2.10E-06
55CS 138	5.52E-08	1.09E-07	5.41E-08	0.0	8.02E-08	7.92E-09	4.65E-13
55CS 139	3.41E-08	5.06E-08	1.85E-08	0.0	4.07E-08	3.70E-09	0.0
56BA 139	9.71E-08	6.92E-11	2.84E-09	0.0	6.47E-11	3.92E-11	1.72E-07
56BA 140	2.03E-05	2.55E-08	1.33E-06	0.0	8.58E-09	1.46E-08	4.18E-05
56BA 141	0.0	3.56E-11	1.59E-09	0.0	3.31E-11	2.02E-11	2.22E-17
56BA 142	2.13E-08	2.19E-11	1.34E-09	0.0	1.85E-11	1.24E-11	0.0
57LA 140	2.50E-09	1.26E-09	3.33E-10	0.0	0.0	0.0	9.25E-05
57LA 141	3.19E-10	9.91E-11	1.62E-11	0.0	0.0	0.0	1.16E-05
57LA 142	1.28E-10	5.82E-11	1.45E-11	0.0	0.0	0.0	4.25E-07
58CE 141	9.37E-09	6.34E-09	7.19E-10	0.0	2.94E-09	0.0	2.42E-05
58CE 143	1.65E-09	1.22E-06	1.35E-10	0.0	5.38E-10	0.0	4.56E-05
58CE 144	4.89E-07	2.04E-07	2.62E-08	0.0	1.21E-07	0.0	1.65E-04
59PR 143	9.21E-09	3.70E-09	4.57E-10	0.0	2.13E-09	0.0	4.03E-05
59PR 144	3.02E-11	1.25E-11	1.53E-12	0.0	7.06E-12	0.0	4.33E-18
60ND 147	6.30E-09	7.28E-09	4.35E-10	0.0	4.25E-09	0.0	3.49E-05
61PM 147	7.55E-08	7.10E-09	2.87E-09	0.0	1.34E-08	0.0	8.93E-06
61PM 148M	3.07E-08	7.95E-09	6.08E-09	0.0	1.21E-08	0.0	6.74E-05
61PM 148	7.18E-09	1.19E-09	6.00E-10	0.0	2.25E-09	0.0	9.34E-05
61PM 149	1.52E-09	2.15E-10	8.79E-11	0.0	4.07E-10	0.0	4.03E-05
61PM 151	6.97E-10	1.17E-10	5.92E-11	0.0	2.09E-10	0.0	3.22E-05
62SM 151	6.91E-08	1.17E-08	2.86E-09	0.0	1.33E-08	0.0	5.25E-06
62SM 153	8.58E-10	7.16E-10	5.23E-11	0.0	2.32E-10	0.0	2.55E-05
63EU 152	1.95E-07	4.44E-08	3.91E-08	0.0	2.75E-07	0.0	2.55E-05
63EU 154	6.16E-07	7.57E-08	5.39E-08	0.0	3.62E-07	0.0	5.48E-05
63EU 155	8.61E-08	1.22E-08	7.88E-09	0.0	5.64E-08	0.0	9.60E-06
63EU 156	1.37E-08	1.06E-08	1.71E-09	0.0	7.09E-09	0.0	7.26E-05
65TB 160	4.70E-08	0.0	5.86E-09	0.0	1.94E-08	0.0	4.33E-05
67HO 166M	2.73E-07	8.44E-08	6.41E-08	0.0	1.26E-07	0.0	0.0
74W 181	9.92E-09	3.24E-09	3.46E-10	0.0	0.0	0.0	3.66E-07
74W 185	4.06E-07	1.35E-07	1.42E-08	0.0	0.0	0.0	1.56E-05
74W 187	1.03E-07	8.62E-08	3.02E-08	0.0	0.0	0.0	2.82E-05
82PB 210	1.53E-02	4.39E-03	5.44E-04	0.0	1.23E-02	0.0	5.42E-05
83BI 210	4.62E-07	3.19E-06	3.97E-08	0.0	3.84E-05	0.0	4.75E-05
84PO 210	3.57E-04	7.57E-04	8.60E-05	0.0	2.52E-03	0.0	6.36E-05

*Obtained from Regulatory Guide 1.109 (March, 1976)

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$\overline{(x/Q)}_{mv}$ = the highest value of the annual average atmospheric dispersion factor at the distance of 5 miles, for all sectors, in sec/m^3. The value of 7.6×10^{-8} sec/m^3 will be used for the plant vent and 5.1×10^{-7} sec/m^3 for the turbine building steam jet air ejector.

Q_{iv} = the average release rate of nuclide i in gaseous effluent from each vent release point v at the site, in μCi/sec. Noble gases may be averaged over a period of 1 hour, and any other nuclides may be averaged over a period of 1 week.

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TABLE 3****

DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS

Nuclide	Ni* β-Air* (DF^{β}_i)	Li** β-Skin** (DFS_i)	Mi* γ-Air* (DF^{γ}_i)	Ki** γ-Body** (DFB_i)
Kr-83m	2.88E-04***	---	1.93E-05	7.56E-08
Kr-85m	1.97E-03	1.46E-03	1.23E-03	1.17E-03
Kr-85	1.95E-03	1.34E-03	1.72E-05	1.61E-05
Kr-87	1.03E-02	9.73E-03	6.17E-03	5.92E-03
Kr-88	2.93E-03	2.37E-03	1.52E-02	1.47E-02
Kr-89	1.06E-02	1.01E-02	1.73E-02	1.66E-02
Kr-90	7.83E-03	7.29E-03	1.63E-02	1.56E-02
Xe-131m	1.11E-03	4.76E-04	1.56E-04	9.15E-05
Xe-133m	1.48E-03	9.94E-04	3.27E-04	2.51E-04
Xe-133	1.05E-03	3.06E-04	3.53E-04	2.94E-04
Xe-135m	7.39E-04	7.11E-04	3.36E-03	3.12E-03
Xe-135	2.46E-03	1.86E-03	1.92E-03	1.81E-03
Xe-137	1.27E-02	1.22E-02	1.51E-03	1.42E-03
Xe-138	4.75E-03	4.13E-03	9.21E-03	8.83E-03
Ar-41	3.28E-03	2.69E-03	9.30E-03	8.84E-03

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

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

*** 2.88E-04 = 2.88×10^{-4}

****Obtained from Regulatory Guide 1.109 (March, 1976)

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Dose Calculations Due to Noble Gases

3.11.2.2 Noble Gases - Dose Calculations

I. Method A: Real Time Meteorological Input (Normal Mode)

The air dose in unrestricted areas due to noble gases released in gaseous effluents from each reactor at the site shall be determined by using the following expressions:

(a) During any calendar quarter, for gamma radiation:

$$D_{\theta\gamma} = 110 \sum_i M_i \sum_{j=1}^{n} \Delta t_j \, [(x/Q)_{j\theta v} Q_{ijv}], \text{ and}$$

During any calendar quarter, for beta radiation:

$$D_{\theta\beta} = 110 \sum_i N_i \sum_{j=1}^{n} \Delta t_j \, [(x/Q)_{j\theta v} Q_{ijv}], \text{ and}$$

(b) During any calendar year, for gamma radiation:

$$D_{\theta\gamma} = 110 \sum_i M_i \sum_{j=1}^{n} \Delta t_j \, [(x/Q)_{j\theta v} Q_{ijv}], \text{ and}$$

During any calendar year, for beta radiation:

$$D_{\theta\beta} = 110 \sum_i N_i \sum_{j=1}^{n} \Delta t_j \, [(x/Q)_{j\theta v} Q_{ijv}]$$

where:

$D_{\theta\beta}$ = the total beta air dose in sector θ from gaseous effluents for the total time period $\sum_{j=1}^{n} \Delta t_j$, in mrad.

$D_{\theta\gamma}$ = the total gamma air dose in sector θ from gaseous effluents for the total time period $\sum_{j=1}^{n} \Delta t_j$, in mrad.

Δt_j = the length of the j^{th} time period over which $(x/Q)_{j\theta}$ and Q_{ij} are averaged for all gaseous releases, in hours. For batch releases, no time period Δt_j shall be more than 1 hour; for continuous releases, no time period Δt_j shall be more than a week.

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N_i = the air dose factor due to beta emissions for each identified radionuclide, in mrad/yr per pCi/m^3 (Table 3).

$(\chi/Q)_{j\theta v}$ = the average atmospheric dispersion factor for the time period Δt_j in sector θ, from all vent release points at the site, in sec/m^3. When Δt_j is greater than 1 hour, the average shall be based on observations of wind speed and atmospheric stability taken at least every hour during Δt_j.

The turbine building steam jet air ejector is considered a ground-level release at all times. The plant vent is a mixed-mode release (elevated at times, ground level at times, and mixed at times). However, for ease of implementation, the licensee may consider the plant vent to be a ground level release and calculate $(\chi/Q)_{j\theta v}$ values using the following equation.

$$(\chi/Q)_{j\theta v} = k_\theta L_{\theta v}/\overline{u}$$

$$L_{\theta v} = 2.03/r_\theta \Sigma_z$$

$$\Sigma_z = (\sigma_z^2 + 0.5h_v^2/\pi)^{1/2}$$

subject to the condition

$$\Sigma_z \leq \sqrt{3}\,\sigma_z$$

The values of $L_{\theta v}$ are provided in Table 6 for the site boundary and food pathways.

σ_z = the vertical standard deviation of the plume for the applicable atmospheric stability class (Pasquill Category) determined at least hourly, for the distance r_θ during the time period Δt_j.

r_θ = the distance from the midpoint between the vent stacks to the receptor for each sector θ, in meters, provided in Table 6.

$\overline{u}$ = the average wind speed determined at least hourly, during time period Δt_j in sector θ, at a height of 10 meters for vent releases, in m/sec.

k_θ = the recirculation factor accounting for spatial and temporal variations in air flow. For noncontinuous releases, its value is unity. For continuous releases, see figure 1 for correction factor.

h_v = the height of the tallest adjacent structure, which is the containment building (=40 m).

Since the plant vent is actually a mixed-mode release, when these effects are taken into consideration, $(x/Q)_{jev}$ is calculated using methods described in Regulatory Positions C.1.c, C.2.a, C.2.b, and C.2.c of Regulatory Guide 1.111 (March 1976). As an alternative method, the dispersion factor may be calculate using values from joint frequency tables summarizing hourly meteorological observations during release period.

TABLE 6

FARLEY NUCLEAR PLANT VALUES OF $I_{\theta v}$ IN METERS^{-2}

SITE BOUNDARY

VENT	SITE BOUNDARY $I_{\theta v}$ m^{-2}							
SECTOR θ	DISTANCE	PASQUILL CATEGORY						
	r_{θ} (m)	A	B	C	D	E	F	G
N	1290.	1.57E-06	8.14E-06	1.89E-05	3.76E-05	4.98E-05	6.87E-05	9.19E-05
NNE	1450.	1.40E-06	6.05E-06	1.52E-05	3.13E-05	4.17E-05	5.88E-05	7.58E-05
NE	1450.	1.40E-06	6.05E-06	1.52E-05	3.13E-05	4.17E-05	5.88E-05	7.58E-05
ENE	1450.	1.40E-06	6.05E-06	1.52E-05	3.13E-05	4.17E-05	5.88E-05	7.58E-05
E	1290.	1.57E-06	8.14E-06	1.89E-05	3.76E-05	4.98E-05	6.87E-05	9.19E-05
ESE	1290.	1.57E-06	8.14E-05	1.89E-05	3.76E-05	4.98E-05	6.87E-05	9.19E-05
SE	1450.	1.40E-06	6.05E-06	1.52E-05	3.13E-05	4.17E-05	5.88E-05	7.58E-05
SSE	1610.	1.26E-06	4.64E-06	1.25E-05	2.66E-05	3.56E-05	5.10E-05	6.43E-05
S	1610.	1.26E-06	4.64E-06	1.25E-05	2.66E-05	3.56E-05	5.10E-05	6.43E-05
SSW	1610.	1.26E-06	4.64E-06	1.25E-05	2.66E-05	3.56E-05	5.10E-05	6.43E-05
SW	1450.	1.40E-06	6.05E-06	1.52E-05	3.13E-05	4.17E-05	5.88E-05	7.58E-05
WSW	1450.	1.40E-06	6.05E-06	1.52E-05	3.13E-05	4.17E-05	5.88E-05	7.5[illegible]E-05
W	1290.	1.57E-06	8.14E-06	1.89E-05	3.76E-05	4.99E-05	6.87E-05	9.19E-05
WNW	1290.	1.57E-06	8.14E-06	1.88E-05	3.76E-05	4.98E-05	6.87E-05	9.19E-05
NW	1450.	1.40E-06	6.05E-06	1.52E-05	3.13E-05	4.17E-05	5.88E-05	7.58E-05
NNW	1450.	1.40E-06	6.05E-06	1.52E-05	3.13E-05	4.17E-05	5.88E-05	7.58E-05

Note: hv = 40m

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FARLEY NUCLEAR PLANT VALUES OF $L_{\theta v}$ IN METERS^{-2}

LIMITING FOOD PATHWAY DISTANCE

VENT		FOOD PATHWAY $L_{\theta v}$ m^{-2}						
		PASQUILL CATEGORY						
DIRECTION	DISTANCE (M)	A	B	C	D	E	F	G
N	4020.	5.05E-07	5.05E-07	2.38E-06	6.25E-06	8.80E-06	1.43E-05	2.02E-05
NNE	3860.	5.26E-07	5.26E-07	2.55E-06	6.67E-06	9.32E-06	1.51E-05	2.13E-05
NE	3700.	5.49E-07	5.49E-07	2.75E-06	7.13E-06	9.91E-06	1.59E-05	2.24E-05
ENE	3860.	5.26E-07	5.26E-07	2.55E-06	6.67E-06	9.32E-06	1.51E-05	2.13E-05
E	4340.	4.68E-07	4.68E-07	2.08E-06	5.53E-06	7.88E-06	1.29E-05	1.84E-05
ESE	4830.	4.20E-07	4.20E-07	1.73E-06	4.65E-06	6.75E-06	1.12E-05	1.61E-05
SE	5470.	3.71E-07	3.71E-07	1.39E-06	3.81E-06	5.64E-06	9.46E-06	1.37E-05
SSE	7240.	2.80E-07	2.80E-07	8.50E-07	2.43E-06	3.76E-06	6.48E-06	9.59E-06
S	5630.	3.61E-07	3.61E-07	1.32E-06	3.64E-06	5.41E-06	9.10E-06	1.32E-05
SSW	2090.	9.71E-07	2.39E-06	7.74E-06	1.77E-05	2.37E-05	3.54E-05	4.65E-05
SW	1930.	1.05E-06	2.93E-06	8.97E-06	2.01E-05	2.69E-05	3.96E-05	5.14E-05
WSW	1450.	1.40E-06	6.05E-06	1.52E-05	3.13E-05	4.17E-05	5.88E-05	7.58E-05
W	1450.	1.40E-06	6.05E-06	1.52E-05	3.13E-05	4.17E-05	5.88E-05	7.58E-05
WNW	3380.	6.01E-07	6.60E-07	3.22E-06	8.24E-06	1.13E-05	1.80E-05	2.51E-05
NW	4500.	4.51E-07	4.51E-07	1.95E-06	5.21E-06	7.48E-06	1.23E-05	1.76E-05
NNW	3220.	6.30E-07	7.66E-07	3.50E-06	8.90E-06	1.21E-05	1.91E-05	2.66E-05

Note: This table may be updated based on annual land census results as required in STS Section 3.12.2.

Note: hv = 40m

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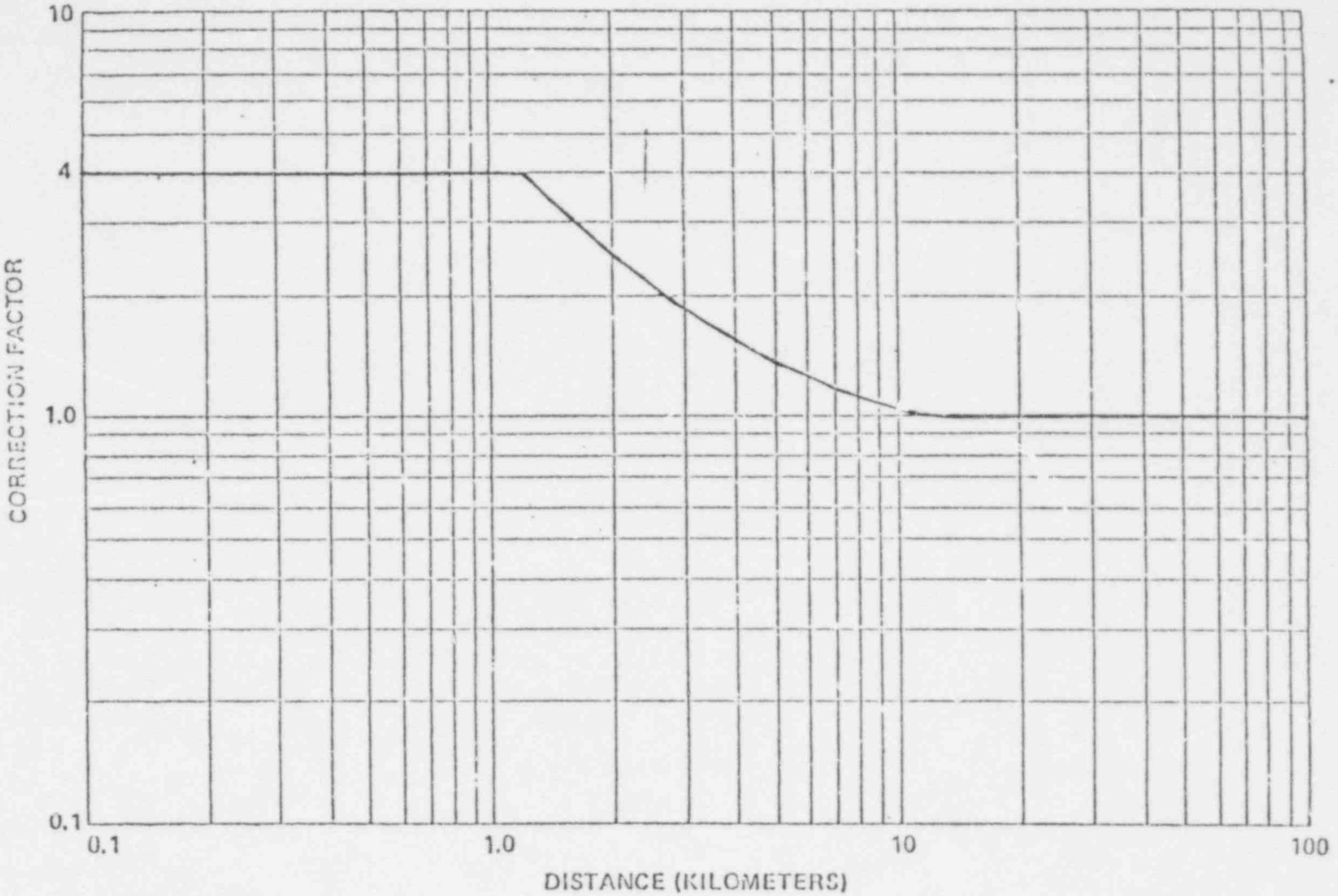

FIGURE 1*
OPEN TERRAIN CORRECTION FACTOR

*Obtained from Regulatory Guide 1.111 (March, 1976)

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3.11.2.2 Noble Gases - Dose Calculations (Cont'd)

II. Method B: This method is to be used when the real time meteorological inputs are not applicable.

The dose contribution due to noble gases in gaseous effluents shall be calculated using the following expressions:

(a) During any calendar quarter, for gamma radiation:

$$D_{\gamma} = 3.17 \times 10^{-2} \sum_i M_i \overline{(x/Q)}_v Q_i, \text{ and}$$

During any calendar quarter, for beta radiation:

$$D_{\beta} = 3.17 \times 10^{-2} \sum_i N_i \overline{(x/Q)}_v Q_i, \text{ and}$$

(b) During any calendar year, for gamma radiation:

$$D_{\gamma} = 3.17 \times 10^{-2} \sum_i M_i \overline{(x/Q)}_v Q_i, \text{ and}$$

During any calendar quarter, for beta radiation:

$$D_{\beta} = 3.17 \times 10^{-2} \sum_i N_i \overline{(x/Q)}_v Q_i$$

where:

D_{γ} = the total gamma air dose from gaseous effluents, in mrad.

D_{β} = the total beta air dose from gaseous effluents, in mrad.

$\overline{(x/Q)}_v$ = the highest value of the annual average atmospheric dispersion factor at the site boundary, for all sectors, in sec/m^3. The value of 7.5×10^{-7} sec/m^3 will be used for the plant vent and 1.2×10^{-5} sec/m^3 for the turbine building steam jet air ejector.

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

Other terms are defined in Specifications 3.11.2.1.

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3.11.2.3 Radioiodines and Radioactive Materials in Particulate Form - Dose Calculations

I. Method A: Real Time Meteorological Input (Normal Mode)

The dose to an individual from radioiodines and radioactive materials in particulate form, with half lives greater than 8 days, in gaseous effluents released from each reactor at the site to unrestricted areas (see Figure 5.1-1) shall be the following expressions:

(a) During any calendar quarter:

$$D_{\theta\tau} = 110 \sum_{i=1} R_{\theta i} \sum_{j=1}^{n} \Delta t_j \, [W_i Q_{ijv}]$$

(b) During any calendar year:

$$D_{\theta\tau} = 110 \sum_{i=1} R_{\theta i} \sum_{j=1}^{n} \Delta t_j \, [W_i Q_{ijv}]$$

where:

$D_{\theta\tau}$ = the cumulative dose from gaseous effluents to the total body or an organ τ of an individual in sector θ for the total time period $\sum_{j=1}^{n} \Delta t_j$, in mrem.

$R_{\theta i}$ = the dose factor for each identified radionuclide into sector θ, in mrem/yr per pCi/m^3 for tritium and in mrem/yr per pCi/m^2-sec for other isotopes, from Table 7. For sectors with real pathways within 5 miles from the point at the midway between the Unit 1 plant vent stack and the Unit 2 plant vent stack, the values of $R_{\theta i}$ have been determined based on these real pathways. For sectors with no real pathways within 5 miles from the point at the midway between the Unit 1 plant vent stack and the Unit 2 plant vent stack, $R_{\theta i}$ has been determined assuming that all pathways exist at the 5-mile distance.

W_i = dispersion parameter for calculation of food pathway dose,

$W_i = (x/Q)_{j\theta v}$ for tritium (H-3)

$W_i = (D/Q)_{j\theta v}$ for other isotopes.

f_θ = factor which eauls 1 if wind in hour t is into sector θ and is equal to 0 otherwise.

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$(D/Q)_{j\theta v}$ = relative deposition (areal) for the time period Δt_j, in sector θ, in meters^{-2}. When Δt_j is greater than one hour, relative deposition shall be based on observation of atmospheric stability taken at least every hour during Δt_j.

$$(D/Q)_{j\theta v} = \frac{k_\theta\ f_\theta}{0.3927\ r_\theta} \quad [\ (1-E)\ \delta_{\theta ve} + E\delta_{\theta vg}\ ]$$

$0.3927 r_\theta$ = width (arc length) of 22.5 degree sector at distance r_θ, in meter.

$\delta_{\theta ve}$ = relative deposition rate (linear) at distance r_θ in sector θ for stability class of interest and release height h_e in meter^{-1}. (Figures 3, 4, 5)

$\delta_{\theta vg}$ = relative deposition rate (linear) at distance r_θ for stability class of interest and for ground level release, in meter^{-1}. (Figure 2)

E = fraction of effluent entrained in building wake.

$E = 1$	if $(W_o/\overline{u}_e) \leq 1$ or $h_s \leq h_v$
$E = 2.58-1.58\ (W_o/\overline{u}_e)$	if $1. \leq (W_o/\overline{u}_e) \leq 1.5$
$E = 0.3-0.06\ (W_o/\overline{u}_e)$	if $1.5 \leq (W_o/\overline{u}_e) \leq 5.0$
$E = 0$	if $(W_o/\overline{u}_e) \geq 5.0$

TABLE 7

Dose Factor $R_{\theta i}$

mrem/yr per pCi/m^3 for H-3

mrem/yr per pCi/m^2-sec for all other isotopes

FARLEY NUCLEAR PLANT

SECTOR	N	NNE	NE	ENE	E	ESE	SE	SSE
DISTANCE r_{θ} (m)	4020.	3860.	3700.	3860.	4340.	4830.	5470.	7240.
Radionuclide								
H-3	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03
CR-51	2.10E+01	2.10E+01	2.10E+01	2.10E+01	2.10E+01	2.10E+01	2.10E+01	2.10E+01
MN-54	2.70E+03	2.70E+03	2.70E+03	2.70E+03	2.70E+03	2.70E+03	2.70E+03	2.70E+03
FE-59	3.59E+03	3.59E+03	3.59E+03	3.59E+03	3.59E+03	3.59E+03	3.59E+03	3.59E+03
CO-58	1.51E+03	1.51E+03	1.51E+03	1.51E+03	1.51E+03	1.51E+03	1.51E+03	1.51E+03
CO-60	2.95E+04	2.95E+04	2.95E+04	2.95E+04	2.95E+04	2.95E+04	2.95E+04	2.95E+04
ZN-65	5.11E+03	5.11E+03	5.11E+03	5.11E+03	5.11E+03	5.11E+03	5.11E+03	5.11E+03
SR-89	4.24E+04	4.24E+04	4.24E+04	4.24E+04	4.24E+04	4.24E+04	4.24E+04	4.24E+04
SR-90	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.60E+06
ZR-95	3.62E+03	3.62E+03	3.62E+03	3.62E+03	3.62E+03	3.62E+03	3.62E+03	3.62E+03
I-131	2.53E+04	2.53E+04	2.53E+04	2.53E+04	2.53E+04	2.53E+04	2.53E+04	2.53E+04
I-133	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02
CS-134	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04
CS-136	4.87E+02	4.87E+02	4.87E+02	4.87E+02	4.87E+02	4.87E+02	4.87E+02	4.87E+02
CS-137	4.19E+04	4.19E+04	4.19E+04	4.19E+04	4.19E+04	4.19E+04	4.19E+04	4.19E+04
BA-140	4.18E+02	4.18E+02	4.18E+02	4.18E+02	4.18E+02	4.18E+02	4.18E+02	4.18E+02
CE-141	6.86E+02	6.86E+02	6.86E+02	6.86E+02	6.86E+02	6.86E+02	6.86E+02	6.86E+02

Note: 1) This table may be updated based on annual land census results as required in STS Section 3.12.2.

2) Sector is wind into. distance in meters.

TABLE 7 (CONTINUED)

Dose Factor $R_{\theta i}$

mrem/yr per pCi/m^3 for H-3

mrem/yr per pCi/m^2-sec for all other isotopes

FARLEY NUCLEAR PLANT

SECTOR	S	SSW	SW	WSW	W	WNW	NW	NNW
DISTANCE r_θ (m)	5630.	2090.	1930.	1450.	1450.	3380.	4500.	3220.
Radionuclide								
H-3	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03	4.29E-03
CR-51	2.10E+01	2.10E+01	2.10E+01	2.10E+01	2.10E+01	2.10E+01	2.10E+01	2.10E+01
MN-54	2.70E+03	2.70E+03	2.70E+03	2.70E+03	2.70E+03	2.70E+03	2.70E+03	2.70E+03
FE-59	3.59E+03	3.59E+03	3.59E+03	3.59E+03	3.59E+03	3.59E+03	3.59E+03	3.59E+03
CO-58	1.51E+03	1.51E+03	1.51E+03	1.51E+03	1.51E+03	1.51E+03	1.51E+03	1.51E+03
CO-60	2.95E+04	2.95E+04	2.95E+04	2.95E+04	2.95E+04	2.95E+04	2.95E+04	2.95E+04
ZN-65	5.11E+03	5.11E+03	5.11E+03	5.11E+03	5.11E+03	5.11E+03	5.11E+03	5.11E+03
SR-89	4.24E+04	4.24E+04	4.24E+04	4.24E+04	4.24E+04	4.24E+04	4.24E+04	4.24E+04
SR-90	1.60E+06	1.60E+06	1.60E+06	1.60E+06	1.6[illegible]+06	1.60E+06	1.60E+06	1.60E+06
ZR-95	3.62E+03	3.62E+03	3.62E+03	3.62E+03	3.62E+03	3.62E+03	3.62E+03	3.62E+03
I-131	2.53E+04	2.53E+04	2.53E+04	2.53E+04	2.53E+04	2.53E+04	2.53E+04	2.53E+04
I-133	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02	3.89E+02
CS-134	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04
CS-136	4.87E+02	4.87E+02	4.87E+02	4.87E+02	4.87E+02	4.87E+02	4.87E+02	4.87E+02
CS-137	4.19E+04	4.19E+04	4.19E+04	4.19E+04	4.19E+04	4.19E+04	4.19E+04	4.19E+04
BA-140	4.18E+02	4.18E+02	4.18E+02	4.18E+02	4.18E+02	4.18E+02	4.18E+02	4.18E+02
CE-141	6.86E+02	6.86E+02	6.86E+02	6.86E+02	6.86E+02	6.86E+02	6.86E+02	6.86E+02

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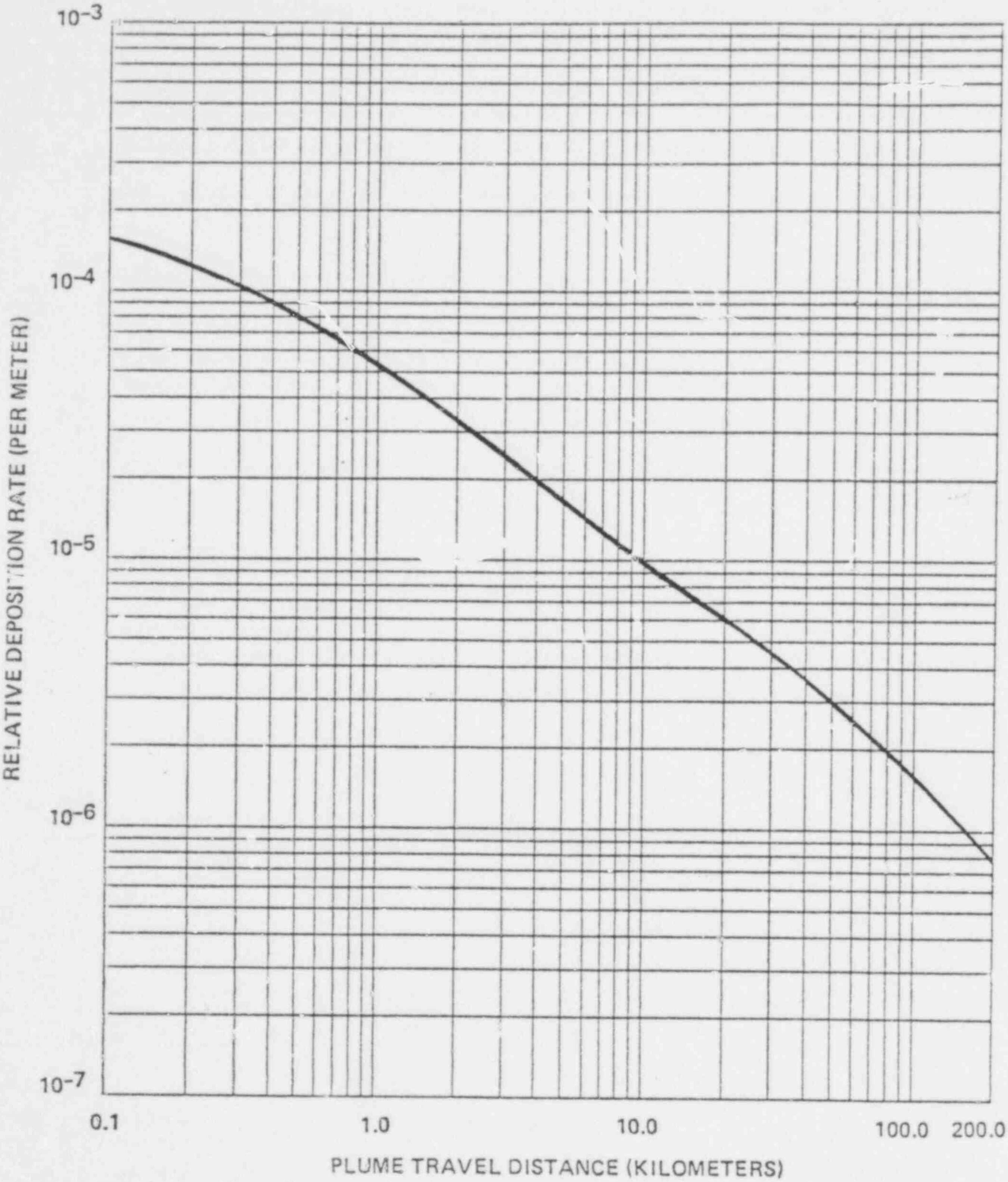
Note: 1) This table may be updated based on annual land census results as required in STS Section 3.12.2.

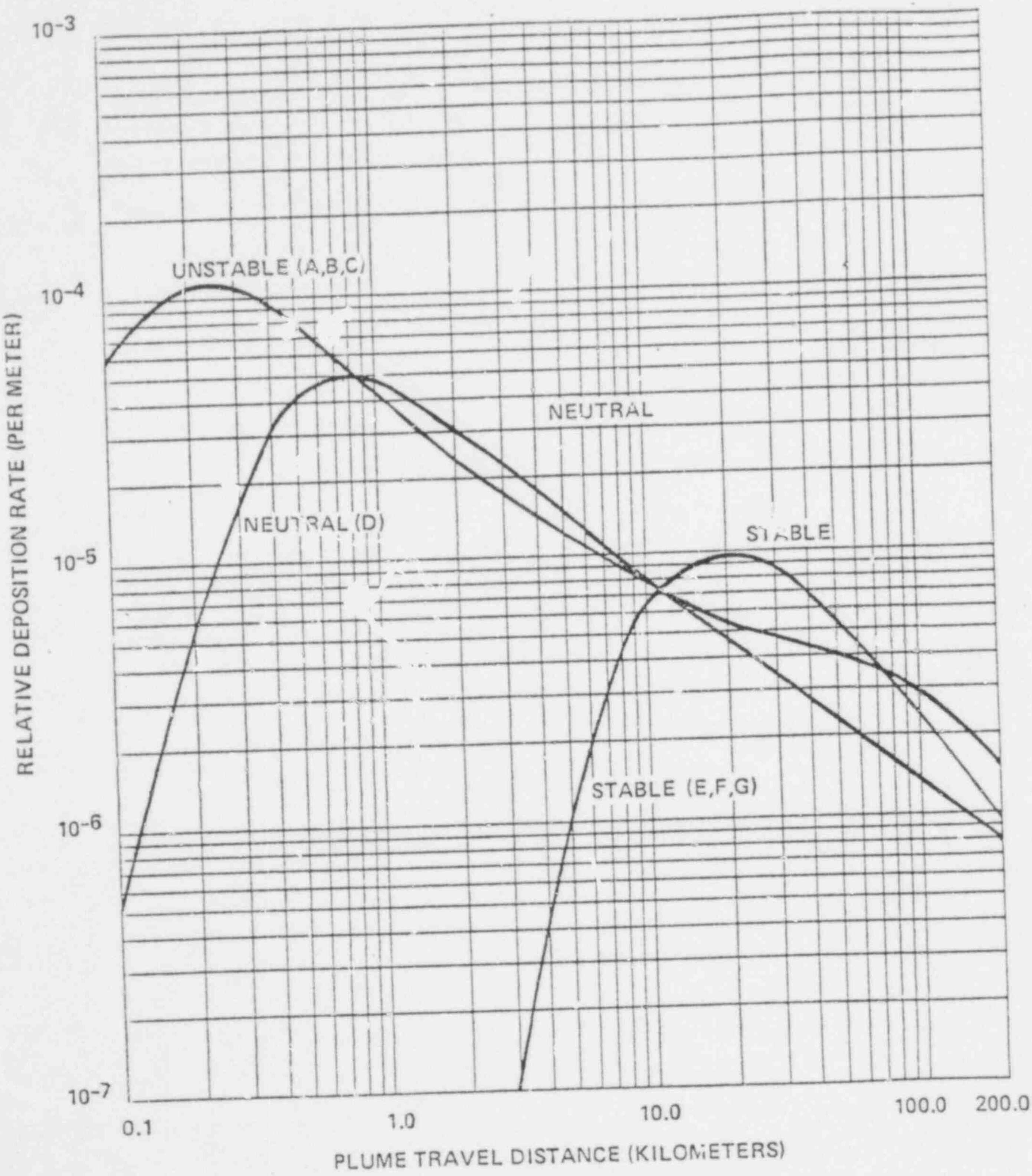
2) Sector is wind into. distance in meters.



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

FIGURE 2* 346 167

*Obtained from Regulatory Guide 1.111 (March, 1976)



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

FIGURE 3*

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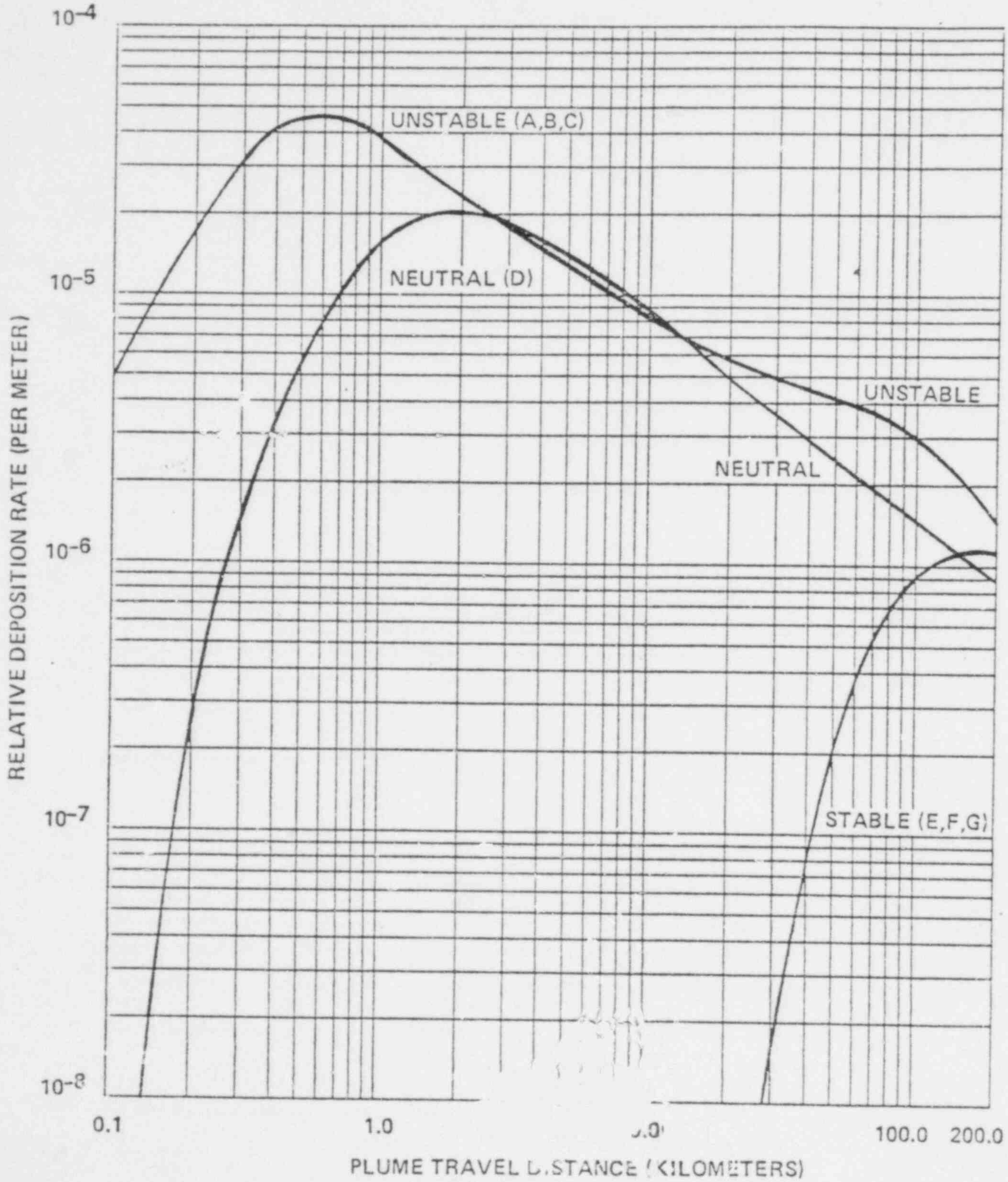
*Obtained from Regulatory Guide 1.111 (March, 1976)



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

FIGURE 4*

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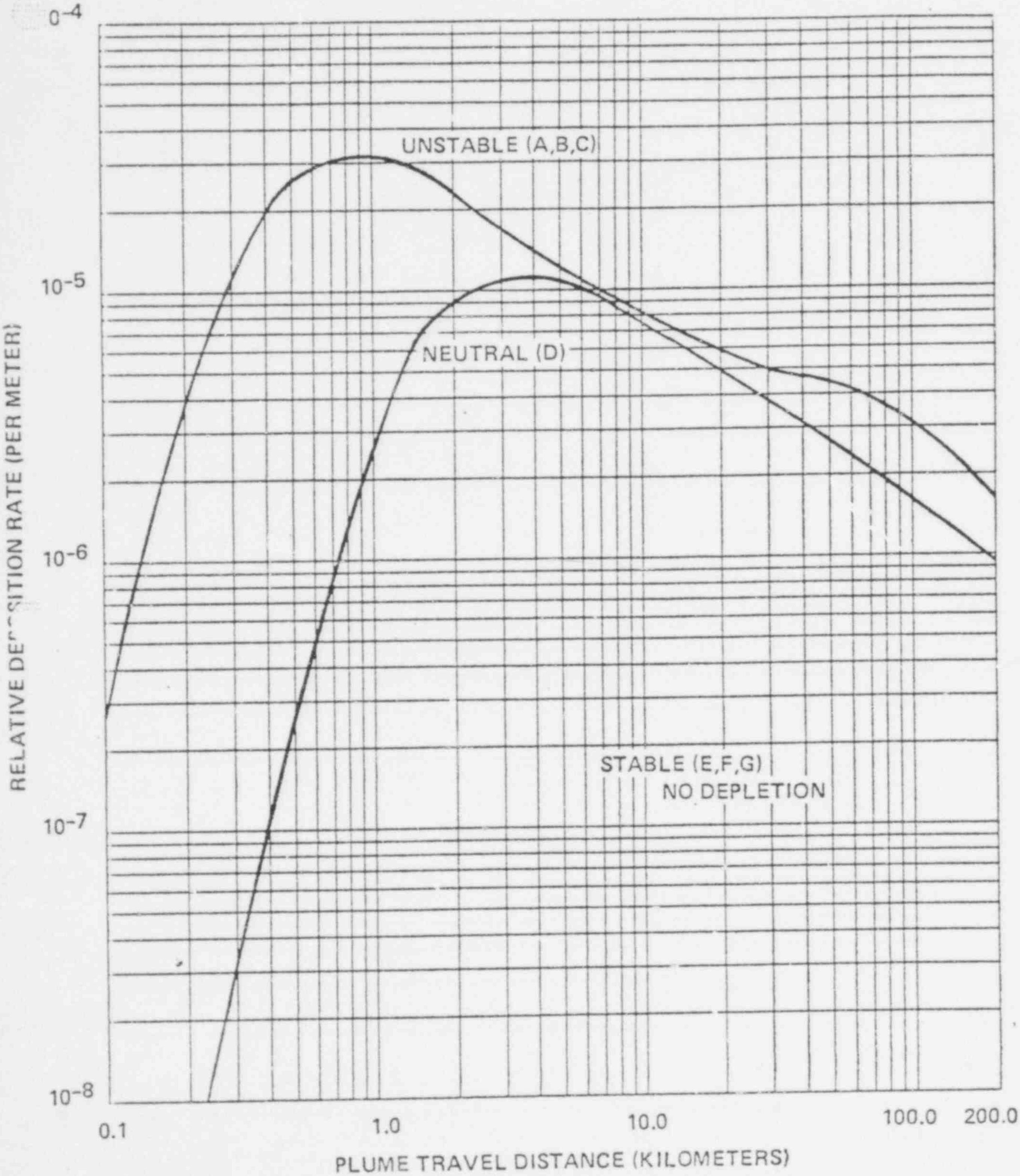
*Obtained from Regulatory Guide 1.111(March, 1976)



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

FIGURE 5*

*Obtained from Regulatory Guide 1.111 (March, 1976)

3.11.2.3 Radioiodines and Radioactive Materials in Particulate Form - Dose Calculations (Cont'd)

II. Method B: This method is to be used when the real time meteorological inputs are not available.

The dose contribution due to radioiodines, radioactive materials in particulate form, with half lives greater than 8 days, in gaseous effluents shall be calculated using the following expressions:

(a) During any calendar quarter:

$$D_I = 3.17 \times 10^{-8} \sum_i R_i W Q_i \text{, and}$$

(b) During any calendar year:

$$D_I = 3.17 \times 10^{-8} \sum_i R_i W Q_i$$

where:

D_I = the cumulative dose from radioiodines and radioactive materials in particulate form with half lives greater than 8 days in gaseous effluents in mrem.

R_i = the dose factor for each identified radionuclide, i., in m^2 (mrem/yr) per µCi/sec or mrem/yr per µCi/m^3 from Table 8.

W = the annual average dispersion parameter for estimating the dose to an individual at the critical location:

$W = (\overline{x/Q})$ for the inhalation pathway, in sec/m^3 from Table 9a.

$W = (\overline{D/Q})$ for the food and ground plane pathways, in meters^{-2} from Table 9b.

Q_i = the release of radioiodines, radioactive materials in particulate, with half lives greater than 8 days in gaseous effluents. Releases shall be cumulative over the calendar month or quarter as appropriate.

TABLE 8

FARLEY NUCLEAR PLANT

PATHWAY DOSE FACTORS DUE TO RADIONUCLIDES OTHER THAN NOBLE GASES

Radionuclide	Inhalation Pathway R_i (mrem/yr per μCi/m^3)	Meat Pathway R_i (m^2·mrem/yr per μCi/sec)	Ground Plane Pathway R_i (m^2·mrem/yr per μCi/sec)	Cow-Milk-Infant Pathway R_i (m^2·mrem/yr per μCi/sec)	Leafy Vegetables Pathway R_i (m^2·mrem/yr per μCi/sec)
H-3	1.12E+03	2.33E+02	0.	2.38E+03	2.47E+02
CR-51	1.70E+04	4.98E+05	5.31E+06	5.75E+06	1.63E+06
MN-54	1.57E+06	7.60E+06	1.56E+09	3.70E+07	5.38E+07
FE-59	1.27E+06	6.49E+08	3.09E+08	4.01E+08	1.10E+08
CO-58	1.10E+06	9.49E+07	4.27E+08	7.01E+07	4.55E+07
CO-60	7.06E+06	3.61E+08	2.44E+10	2.25E+08	1.54E+08
ZN-65	9.94E+05	1.05E+09	8.28E+08	1.99E+10	2.24E+08
SR-89	2.15E+06	4.89E+08	2.42E+04	1.28E+10	5.39E+09
SR-90	1.01E+08	1.01E+10	0.	1.19E+11	9.85E+10
ZR-95	2.23E+06	6.09E+08	2.73E+08	8.76E+05	1.13E+08
I-131	1.62E+07	2.60E+09	1.01E+07	4.95E+11	2.08E+10
I-133	3.84E+06	6.45E+01	1.43E+06	4.62E+09	3.88E+08
CS-134	1.01E+06	1.42E+09	7.70E+09	6.37E+10	1.96E+09
CS-136	1.71E+05	5.06E+07	1.64E+08	6.61E+09	1.60E+08
CS-137	9.05E+05	1.27E+09	1.15E+10	5.75E+10	1.80E+09
BA-140	1.74E+06	5.00E+07	2.2[illegible]E+07	2.75E+08	2.03E+08
CE-141	5.43E+05	1.45E+07	1.48E+07	1.43E+07	8.99E+07

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FARLEY NUCLEAR PLANT

TABLE 9a

DISPERSION PARAMETER $\overline{(X/Q)}_V$

Distance to the control location, in miles

Sector	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	2.2E-06	6.9E-07	4.8E-07	3.1E-07	2.1E-07	1.6E-07	1.2E-07	1.0E-07	9.1E-08	7.6E-08
NNE	2.4E-06	7.4E-07	4.8E-07	3.0E-07	2.0E-07	1.5E-07	1.1E-07	9.2E-08	8.3E-08	6.8E-08
NE	2.2E-06	7.1E-07	4.8E-07	3.1E-07	2.0E-07	1.6E-07	1.2E-07	9.6E-08	8.6E-08	7.1E-08
ENE	1.1E-06	4.0E-07	3.2E-07	2.2E-07	1.5E-07	1.2E-07	9.3E-07	7.6E-08	6.9E-08	5.7E-08
E	1.2E-06	4.0E-07	3.0E-07	2.0E-07	1.4E-07	1.1E-07	8.5E-08	7.1E-08	6.4E-08	5.4E-08
ESE	1.5E-06	4.5E-07	3.0E-07	2.0E-07	1.3E-07	1.1E-07	8.1E-08	6.7E-08	6.1E-08	5.1E-08
SE	2.5E-06	6.6E-07	4.4E-07	2.8E-07	1.9E-07	1.5E-07	1.1E-07	9.5E-08	8.6E-08	7.3E-08
SSE	2.8E-06	7.6E-07	5.5E-07	3.5E-07	2.4E-07	2.0E-07	1.5E-07	1.3E-07	1.1E-07	9.8E-08
S	2.5E-06	6.6E-07	4.9E-07	3.4E-07	2.4E-07	2.0E-07	1.5E-07	1.3E-07	1.2E-07	1.0E-07
SSW	2.0E-06	6.7E-07	5.1E-07	3.3E-07	2.3E-07	1.8E-07	1.4E-07	1.2E-07	1.2E-07	1.0E-07
SW	2.0E-06	8.1E-07	6.4E-07	4.0E-07	2.7E-07	2.1E-07	1.6E-07	1.3E-07	1.3E-07	1.1E-07
WSW	1.9E-06	7.4E-07	5.9E-07	3.7E-07	2.5E-07	1.9E-07	1.6E-07	1.3E-07	1.1E-07	9.3E-08
W	1.7E-06	6.1E-07	5.0E-07	3.2E-07	2.1E-07	1.7E-07	1.7E-07	1.3E-07	1.2E-07	9.7E-08
WNW	1.4E-06	4.5E-07	3.4E-07	2.8E-07	1.9E-07	1.7E-07	1.7E-07	1.4E-07	1.2E-07	9.8E-08
NW	1.3E-06	4.3E-07	3.2E-07	2.2E-07	1.5E-07	1.4E-07	1.2E-07	1.2E-07	1.1E-07	8.7E-08
NNW	1.7E-06	5.5E-07	4.0E-07	2.6E-07	1.8E-07	1.4E-07	1.1E-07	1.0E-07	9.4E-08	7.8E-08

Note: Values are based on the joint frequency data between 1971 and 1975.

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FARLEY NUCLEAR PLANT

TABLE 9b

DISPERSION PARAMETER $\overline{(X/Q)}_g$

Distance to the control location, in miles

Sector	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	7.3E-05	1.3E-05	5.8E-06	2.9E-06	1.6E-06	1.2E-06	8.2E-07	6.1E-07	5.4E-07	4.2E-07
NNE	6.2E-05	1.1E-05	4.9E-06	2.4E-06	1.4E-06	1.0E-06	6.9E-07	5.1E-07	4.5E-07	3.5E-07
NE	5.9E-05	1.1E-05	4.7E-06	2.3E-06	1.3E-06	9.5E-07	6.5E-07	4.8E-07	4.2E-07	3.3E-07
ENE	5.3E-05	9.6E-06	4.2E-06	2.1E-06	1.2E-06	8.6E-07	5.9E-07	4.4E-07	3.8E-07	3.0E-07
E	6.3E-05	1.1E-05	4.9E-06	2.4E-06	1.4E-06	1.0E-06	7.1E-07	5.2E-07	4.6E-07	3.6E-07
ESE	6.2E-05	1.1E-05	4.7E-06	2.4E-06	1.4E-06	1.0E-06	7.0E-07	5.2E-07	4.6E-07	3.5E-07
SE	9.5E-05	1.6E-05	7.2E-06	3.8E-06	2.1E-06	1.5E-06	1.1E-06	8.0E-07	7.0E-07	5.5E-07
SSE	1.4E-04	2.5E-05	1.1E-05	5.5E-06	3.2E-06	2.3E-06	1.6E-06	1.2E-06	1.1E-06	8.4E-07
S	1.5E-04	2.6E-05	1.2E-05	5.9E-06	3.4E-06	2.5E-06	1.8E-06	1.3E-06	1.2E-06	9.0E-07
SSW	9.8E-05	1.7E-05	7.5E-06	3.7E-06	2.2E-06	1.6E-06	1.1E-06	8.2E-07	7.2E-07	5.6E-07
SW	7.4E-05	1.3E-05	5.8E-06	2.9E-06	1.6E-06	1.2E-06	8.3E-07	6.1E-07	5.4E-07	4.2E-07
WSW	6.0E-05	1.1E-05	4.8E-06	2.3E-06	1.3E-06	9.6E-07	6.7E-07	4.9E-07	4.3E-07	3.3E-07
W	5.8E-05	1.0E-05	4.5E-06	2.2E-06	1.3E-06	9.2E-07	6.4E-07	4.7E-07	4.1E-07	3.2E-07
WNW	5.6E-05	9.9E-06	4.4E-06	2.2E-06	1.2E-06	8.9E-07	6.2E-07	4.6E-07	4.0E-07	3.1E-07
NW	5.9E-05	1.0E-05	4.5E-06	2.2E-06	1.3E-06	9.3E-07	6.4E-07	4.7E-07	4.2E-07	3.2E-07
NNW	6.6E-05	1.2E-05	5.2E-06	2.6E-06	1.5E-06	1.1E-06	7.5E-07	5.5E-07	4.9E-07	3.8E-07

Note: Values are based on the joint frequency data between 1971 and 1975.

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FARLEY NUCLEAR PLANT

TABLE 9c

DISPERSION PARAMETER (D/Q)

Distance to the control location, in miles

Sector	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	3.8E-08	1.1E-08	5.0E-09	2.3E-09	1.3E-09	8.7E-10	5.6E-10	3.9E-10	3.4E-10	2.5E-10
NNE	4.6E-08	1.3E-08	5.7E-09	.7E-09	1.4E-09	9.9E-10	6.4E-10	4.4E-10	3.8E-10	2.9E-10
NE	4.8E-08	1.3E-08	5.9E-09	2.8E-09	1.5E-09	1.0E-09	6.6E-10	4.6E-10	4.0E-10	3.0E-10
ENE	2.7E-08	8.2E-09	3.7E-09	1.7E-09	9.4E-10	6.6E-10	4.2E-10	3.0E-10	2.6E-10	1.9E-10
E	2.9E-08	8.5E-09	3.7E-09	1.8E-09	9.5E-10	6.6E-10	4.2E-10	3.0E-10	2.5E-10	1.9E-10
ESE	3.3E-08	9.2E-09	4.0E-09	1.8E-09	9.9E-10	6.9E-10	4.4E-10	3.1E-10	2.7E-10	2.0E-10
SE	5.3E-08	1.4E-08	5.9E-09	2.7E-09	1.5E-09	1.0E-09	6.5E-10	4.5E-10	3.9E-10	2.9E-10
SSE	5.1E-08	1.4E-08	6.2E-09	2.9E-09	1.5E-09	1.1E-09	6.8E-10	4.8E-10	4.1E-10	3.1E-10
S	4.9E-08	1.4E-08	5.9E-09	2.7E-09	1.5E-09	1.0E-09	6.5E-10	4.6E-10	3.9E-10	2.9E-10
SSW	4.3E-08	1.3E-08	5.8E-09	2.7E-09	1.5E-09	1.0E-09	6.4E-10	4.5E-10	3.9E-10	2.9E-10
SW	4.7E 08	1.5E-08	6.5E-09	3.0E-09	1.6E-09	1.1E-09	6.9E-10	4.8E-10	4.1E-10	3.1E-10
WSW	4.5E-08	1.5E-08	6.1E-09	2.8E-09	1.5E-09	1.0E-09	6.5E-10	4.5E-10	3.9E-10	2.9E-10
W	4.0E-08	1.2E-08	5.3E-09	2.5E-09	1.3E-09	9.0E-10	5.9E-10	4.1E-10	3.5E-10	2.7E-10
WNW	3.2E-08	9.4E-09	4.1E-09	2.0E-09	1.1E-09	7.3E-10	4.9E-10	3.5E-10	3.0E-10	2.4E-10
NW	2.8E-08	8.2E-09	3.6E-09	1.7E-09	9.1E-10	6.4E-10	4.1E-10	1.9E-10	2.5E-10	1.9E-10
NNW	3.2E-08	9.6E-09	4.4E-09	2.0E-09	1.1E-09	7.7E-10	4.9E-10	3.4E-10	3.0E-10	2.2E-10

Note: Values are based on the joint frequency data between 1971 and 1975.

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FARLEY NUCLEAR PLANT

TABLE 9d

DISPERSION PARAMETER $\overline{(D/Q)}_g$

Distance to the control location, in miles

Sector	0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0
N	2.5E-07	4.1E-08	1.5E-08	6.3E-09	3.3E-09	2.2E-09	1.4E-09	9.8E-10	8.3E-10	6.1E-10
NNE	2.5E-07	4.1E-08	1.4E-08	6.3E-09	3.2E-09	2.2E-09	1.4E-09	9.7E-10	8.2E-10	6.0E-10
NE	2.5E-07	4.1E-08	1.4E-08	6.3E-09	3.2E-09	2.2E-09	1.4E-09	9.7E-10	8.2E-10	6.1E-10
ENE	1.7E-07	2.8E-08	9.8E-09	4.3E-09	2.2E-09	1.5E-09	9.8E-10	6.6E-10	5.6E-10	4.1E-10
E	1.7E-07	2.8E-08	9.8E-09	4.3E-09	2.2E-09	1.5E-09	9.8E-10	6.6E-10	5.6E-10	4.1E-10
ESE	1.8E-07	2.9E-08	1.0E-08	4.5E-09	2.3E-09	1.6E-09	1.0E-09	6.9E-10	5.8E-10	4.3E-10
SE	2.8E-07	4.5E-08	1.6E-08	7.5E-09	3.6E-09	2.4E-09	1.6E-09	1.1E-09	9.1E-10	6.7E-10
SSE	3.7E-07	6.0E-08	2.1E-08	9.3E-09	4.8E-09	3.2E-09	2.1E-10	1.4E-09	1.2E-09	8.9E-10
S	3.7E-07	6.0E-08	2.2E-08	9.4E-09	4.8E-09	3.3E-09	2.1E-09	1.4E-09	1.2E-09	9.0E-10
SSW	2.8E-07	4.5E-08	1.6E-08	7.0E-09	3.6E-09	2.4E-09	1.6E-09	1.1E-09	9.1E-1[illegible]	6.7E-10
SW	2.6E-07	4.3E-08	1.5E-08	6.6E-09	3.4E-09	2.3E-09	1.5E-09	1.0E-09	8.6E-10	6.3E-10
WSW	2.3E-07	3.8E-08	1.3E-08	5.8E-09	3.0E-09	2.0E-09	1.3E-09	9.0E-10	7.6E-10	5.6E-10
W	2.1E-07	3.4E-08	1.2E-08	5.3E-09	2.7E-09	1.9E-09	1.2E-09	8.3E-10	7.0E-10	5.1E-10
WNW	1.8E-07	3.0E-08	1.1E-08	4.6E-09	2.4E-09	1.6E-09	1.1E-09	7.2E-10	6.0E-10	4.4E-10
NW	1.7E-07	2.8E-08	1.0E-08	4.4E-09	2.3E-09	1.5E-09	1.0E-09	6.8E-10	5.7E-10	4.2E-10
NNW	2.1E-07	3.5E-08	1.2E-08	5.4E-09	2.8E-09	1.9E-09	1.2E-09	8.3E-10	7.0E-10	5.2E-10

Note: Values are based on the joint frequency data between 1971 and 1975.

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3.11.2.5 Dose Assessment for Environmental Radiation Standards

The Radiological Effluent Technical Specification 3.11.2.5 specifies in the Action that when the calculated doses associated with the effluent releases exceed twice the limits of any one of the Specifications 3.11.1.2, 3.11.2.2 or 3.11.2.3, it is required to prepare and submit a Special Report to the Commission and limit subsequent releases such that the dose or dose commitment to the critical individual from all uranium fuel cycle sources is limited to ≤ 25 mrem to the total body or any organ (except the thyroid, which is limited to ≤ 75 mrem) over 12 consecutive months.

The dose assessment which will be described in a Special Report, shall include dose contributions from direct radiation from the plant and its components. A variety of techniques is available for assessing this contribution. A simple calculation may be sufficient to demonstrate that the contribution is unimportant, or conditions may dictate more complex analyses. The most appropriate assessment technique will be determined in the course of preparing the Special Report and will be documented in the Special Report.

CALCULATION OF CONSTANT FOR DOSE EQUATIONS IN ODCM SECTIONS 3.11.2.2 AND 3.11.2.3.

$$D_{\theta\gamma} = 110 \sum_i M_i \sum_{j=1}^{m} \Delta t_j \left[(X/Q)_{j\theta v} \, Q_{ijv} \right]$$

WHERE

M_i = DOSE FACTOR, $\frac{\text{MRAD/YR}}{\text{PCi/M}^3}$

Δt_j = RELEASE TIME, HOURS

$(X/Q)_{j\theta v}$ = AVERAGE ATMOSPHERIC DISPERSION FACTOR, SEC/M^3

Q_{ijv} = AVERAGE RELEASE RATE, μCi/SEC

$$D_{\theta\gamma} = \frac{\text{MRAD/YR}}{\text{PCi/M}^3} \cdot \text{HRS} \cdot \frac{\text{SEC}}{\text{M}^3} \cdot \frac{\mu\text{Ci}}{\text{SEC}} \cdot \left(\frac{10^6 \text{ pCi}/\mu\text{Ci}}{8.76 \cdot 10^3 \text{ HR/YR}} \right)^{*}$$

$= 114.2$ MRAD

THUS,

$$D_{\theta\gamma} = 114.2^{*} \sum_i M_i \sum_{j=1}^{m} \Delta t_j \left[(X/Q)_{j\theta v} \, Q_{ijv} \right]$$

* UNITS CONVERSION CONSTANT

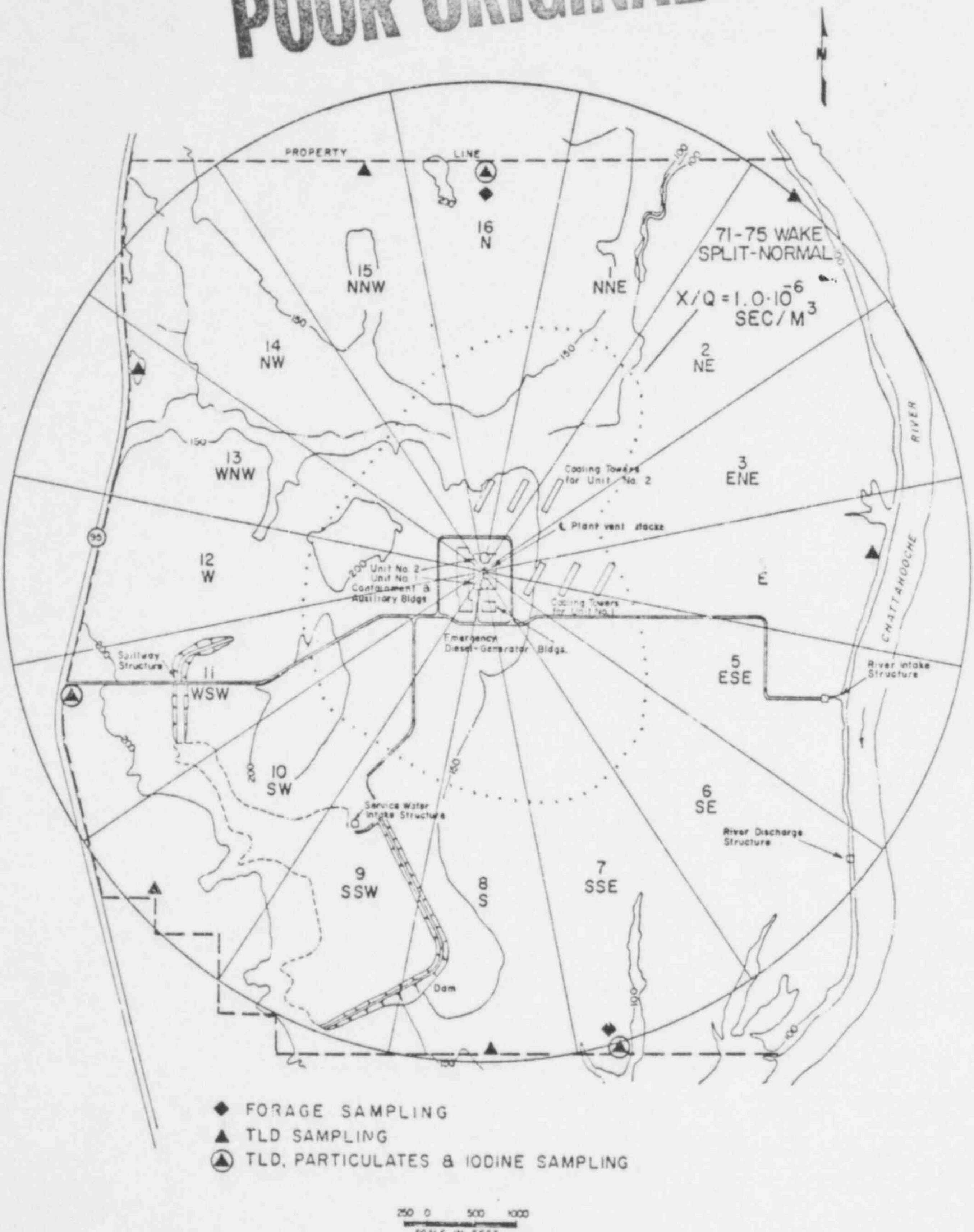

FIGURE 3.12-1 INDICATOR SAMPLING LOCATIONS FOR AIRBORNE ENVIRONMENTAL RADIOACTIVITY AT THE FARLEY NUCLEAR PLANT.

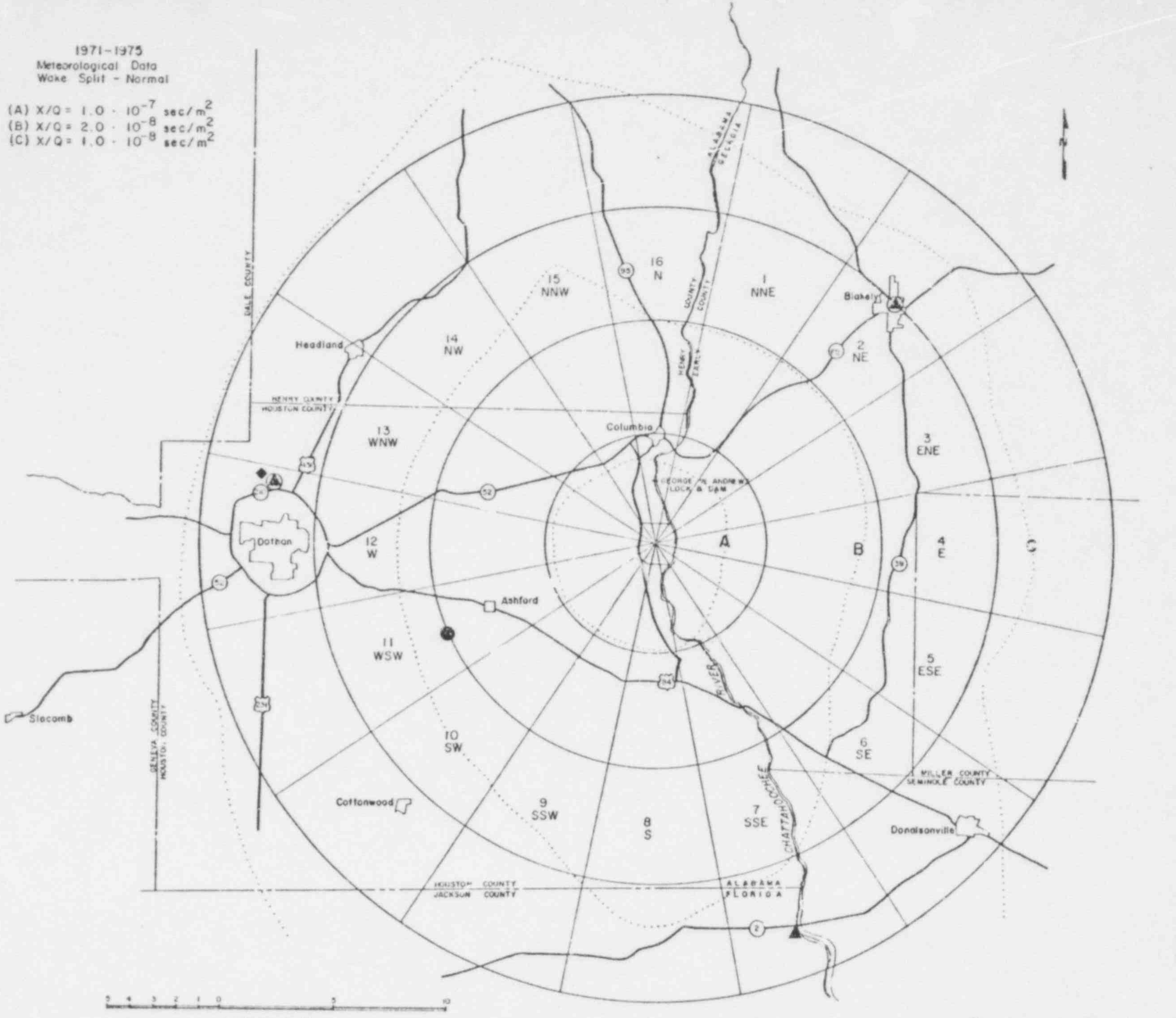

FIGURE 3.12-2 CONTROL SAMPLING LOCATIONS FOR AIRBORNE ENVIRONMENTAL RADIOACTIVITY IN THE FARLEY NUCLEAR PLANT AREA.

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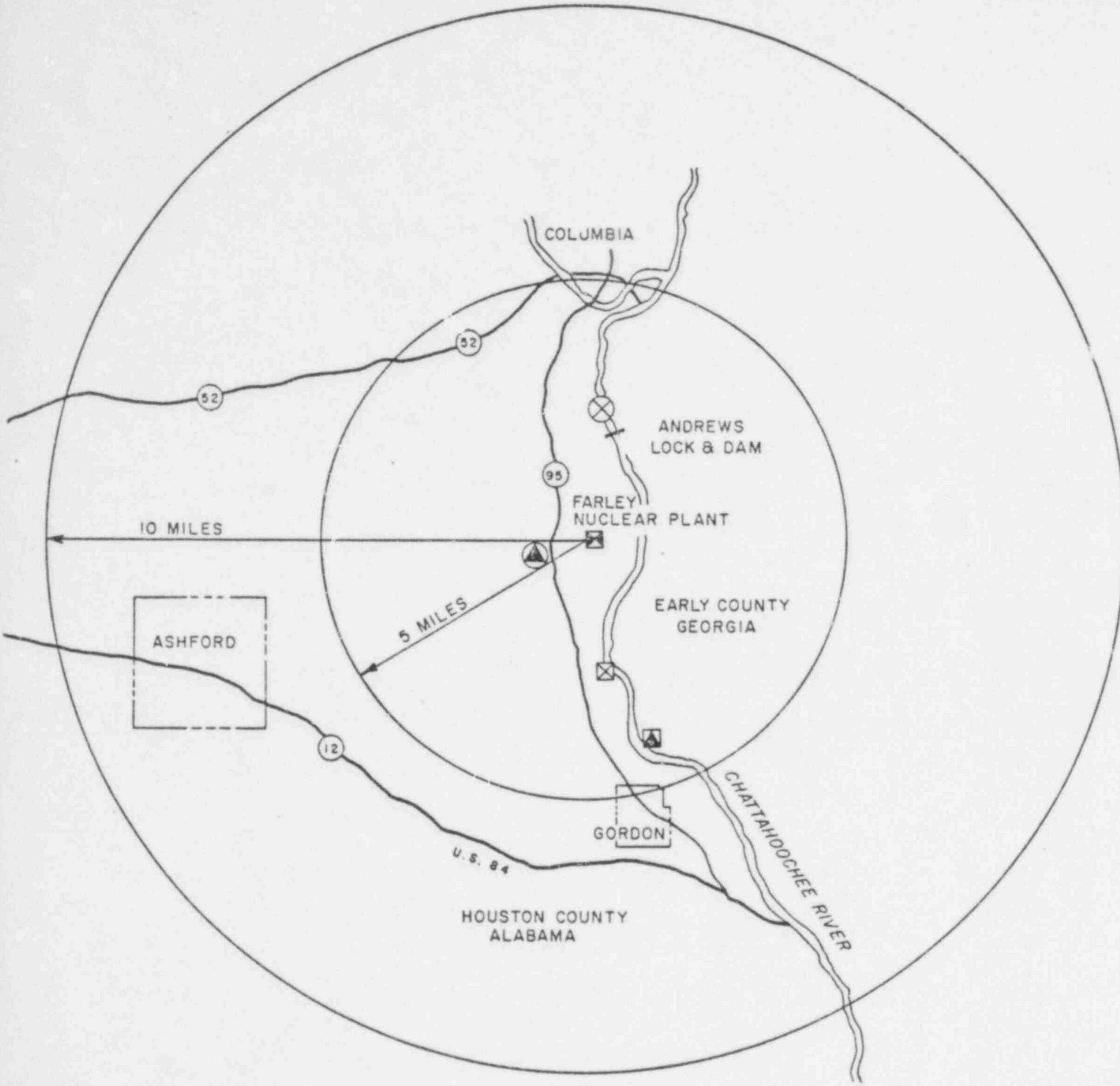

INDICATOR STATIONS

- SURFACE AND GROUND WATER
- FISH AND SEDIMENT

CONTROL STATIONS

- SURFACE WATER AND FISH
- GROUND WATER

FIGURE 3.12-3 INDICATOR AND CONTROL SAMPLING LOCATIONS FOR WATERBORNE ENVIRONMENTAL RADIOACTIVITY IN THE FARLEY NUCLEAR PLANT AREA.

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TABLE 3.12-1

RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

EXPOSURE PATHWAY AND/OR SAMPLE	SAMPLING LOCATIONS	SAMPLE IDENTIFICATION
1. AIRBORNE		
a. Particulates	Indicator Stations:	
	Plant Entrance-Nearest Residence (WSW-0.9)	PI - 1101
	South Perimeter (SSE-1.0)	PI - 0701
	North Perimeter (N-0.8)	PI - 1601
	Control Stations:	
	Blakely, Ga. (NE-15)	PB - 0215
	Dothan, Ala. (W-18)	PB - 1218
b. Radioiodine	Indicator Stations:	
	Plant Entrance - Nearest Residence (WSW-0.9)	II - 1101
	South Perimeter (SSE-1.0)	II - 0701
	North Perimeter (N-0.8)	II - 1601
	Control Stations:	
	Blakely, Ga. (NE-15)	IB - 0215
	Dothan, Ala. (W-18)	IB - 1218

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EXPOSURE PATHWAY AND/OR SAMPLE	SAMPLING LOCATIONS	SAMPLE IDENTIFICATION
2. Direct Radiation	Indicator Stations:	
	Plant Perimeter	
	(NE-1.0)	RI - 0201
	(E-0.8)	RI - 0401
	(SSE-1.0)	RI - 0701
	(S-1.0)	RI - 0801
	(SW-0.9)	RI - 1001
	(WSW-0.9)	RI - 1101
	(NNW-0.9)	RI - 1501
	(N-0.8)	RI - 1601
	Control Stations:	
	Blakely, Ga. (NE-15)	RB - 0215
	Neals Landing, Fla. (SSE-18)	RB - 0718
	Dothan, Ala. (W-18)	RB - 1218
3. WATERBORNE		
a. Surface	Indicator Station:	
	Great Southern Paper Intake Structure (River Mile-40)	WRI
	Control Station:	
	Andrews Lock & Dam Upper Pier (River Mile-47)	WRB
b. Ground	Indicator Station:	
	Great Southern Paper Co.Well (SSE-4)	WGI - 07
	Control Station:	
	Kings Court Trailer Park (WSW-0.9)	WGB - 12

TABLE 3.12-1 (Cont'd)

EXPOSURE PATHWAY AND/OR SAMPLE	SAMPLING LOCATIONS	SAMPLE IDENTIFICATION
c. Sediment	Indicator Station: Smith's Bend (River Mile-41)	RSI
4. INGESTION a. Milk	Indicator Station: None	- - - -
	Control Station: Brooks-Silcox Dairy, Ashford, Ala. (WSW-10)	MB-1110
b. Fish	Indicator Station: Smith Bend (River Mile-41) Game Fish Bottom Feeding Fish	 FGI FBI
	Control Station: Andrews Lock & Dam Reservior (River Mile-47) Game Fish Bottom Feeding Fish	 FGB FBB
c. Forage	Indicator Stations: South Perimeter (SSE-1.0) North Perimeter (N-0.8)	 FI - 0701 FI - 1601
	Control Station: Dothan, Alabama (W-18)	FB - 1218

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