ENCLOSURE 3

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL

ODCM Changes

This report is to comply with Technical Specifications Section 6.10 reporting requirement for changes to the ODCM. The original ODCM was submitted in 1983 and has been revised extensively. The Radiological Effluent Technical Specifications (RETS) were implemented at BFN on May 6, 1987. Therefore, this is our first report of ODCM changes and includes all the changes since 1983. Because of the large number of changes, a copy of the entire current ODCM is included with this report.

Description of changes

The revised Section 1.0 (Gaseous Effluents) of the Browns Ferry Nuclear Plant (BFN) Offsite Dose Calculation Manual (ODCM) is attached. A summary of the major changes (those involving the dose calculational methodology) is as follows:

1. Meteorological data period of record revised from 1974-75 to 1977-79.
2. Split-level JFD not considered for release rate limits.
3. Wind speed midpoint for > 10.9 m/s revised.
4. Instantaneous release rate limits revised due to new meteorological data and new finite cloud approximation.
5. Finite cloud approximation revised for stack releases.
6. Critical receptor locations revised to agree with latest land-use census data.
7. Nuclides analyzed on a monthly basis were expanded for noble gases and iodines and particulates.
8. Meteorology for dose projections has been included.

Analysis or Evaluation Justifying the Change

These changes are made to reflect changes in methodology which have been implemented at other TVA plants in the time since the BFN ODCM was originally submitted to NRC in 1983. These changes are an attempt to make the BFN ODCM consistent with other plants and with the current models being used for dose assessment in TVA.

Determination of the EFfect of the Change on the Accuracy or reliability of the Setpoints or Dose Calculations

These changes will cause the setpoint calculations and dose calculations to be more reliable and more accurate due to the improvements in the model.

Description of change

Section 2.0 (Liquid Effluents) was rewritten to clarify the descriptions of the calculations being performed. The majority of the changes were not changes in methodology; rather, they involved the movement of paragraphs, the addition and/or deletion of text to make the description clearer to the reader, and the changing of subscript identifiers in order to use the same subscripts for the same quantity throughout the section. These minor editorial changes require no analysis or justification and will not change the setpoints or dose calculations.

The major changes involving the dose calculational methodology being used are outlined below:

Section 2.3.3 Monthly Analysis

1. The list of isotopes considered was expanded to include 18 single isotopes and two parent/daughter pairs in the calculation.
2. The list of organs considered in the calculation was expanded. Organs considered are the bone, gastrointestinal tract, thyroid, liver, and total body.
3. The child age group was added to the adult age group for consideration.
4. The volume of water used for dilution in the calculation was changed from the dilution flow during releases to the average riverflow past the site for the month.
5. A recreational dose is calculated for the monthly analysis which considers 4 isotopes (Co-58, Co-60, Cs-134 and Cs-137) which are expected to contribute over 95% of the total recreational dose. The total body dose due to shoreline exposure is calculated for these 4 nuclides and added to both the total body and the maximum organ doses.
6. The administrative (guideline) release limits, given in curies, were deleted.
7. Several sentences were added to section 2.3.2.4 to outline how the final monthly doses are obtained, i.e., how the individual pathway doses are summed to find the total body and maximum organ doses to be compared to the Technical Specifications.

Description of changes (continued)

Section 2.3.3 Quarterly and Annual Analysis

1. The recreation pathway was added to the quarterly and annual analysis section.
2. The skin was added as an organ to be considered in the analysis.
3. The child age group was added to the calculation.
4. The consumption rates were made consistent by taking all values from Regulatory Guide 1.109.
5. A calculation of population doses was added.
6. The section containing activity limits for releases was deleted.
7. Table 2.1 was replaced with an updated table reflecting the addition of nuclides to the ones already in use, and the addition of the child as an age group to be considered.
8. Tables 2.2, 2.3, and 2.4 were added to include information which is used in the calculation of doses.

Analysis or Evaluation Justifying the Change

These changes are made to reflect changes in methodology which have been implemented at other TVA plants in the time since the BFN ODCM was originally submitted to the NRC in 1983. These changes are an attempt to make the BFN ODCM consistent with other plants, and with the current models being used for dose assessment in TVA.

Determination of the Effect of the Change on the Accuracy or reliability of the Setpoints or Dose Calculations

These changes will cause the dose calculations to be more reliable and more accurate due to the improvements in the model. Setpoint calculations are not affected by these changes.

Description of changes

The revised Section 3.0 (Environmental Monitoring) of the Browns Ferry Nuclear Plant (BFN) Offsite Dose Calculation Manual (ODCM) is attached. A summary of the major changes is as follows:

1. References to appropriate sections of the Radiological Effluent Manual (REM) were included.
2. Table 3.3 (issued with the 1983 ODCM) is deleted.
3. A Table 3.3, outlining detection capabilities, is added.
4. Table 3.1 is revised to more accurately reflect the program including references to locations identified in the figures and tables.
5. Table 3.2 is updated to show currently identified sampling locations.
6. Figures 2.1 through 3.4 are updated.

Analysis or Evaluation Justifying the Change

These changes to the BFN ODCM reflect changes identified in the land-use surveys conducted for BFN. The changes are required to accurately reflect the environmental monitoring program at BFN.

Determination of the Effect of the Change on the Accuracy or reliability of the Setpoints or Dose Calculations

These changes will have no effect on the setpoint or dose calculations.

0596m

Description of changes

Section 4.0 is added describing the method of assuring that 40 CFR 190 dose limits are met.

Analysis or Evaluation Justifying the Change

The addition of this section will document in the ODCM how the total doses are obtained for this 40 CFR 190 evaluation. It will make the section of the ODCM more consistent with the RETS requirements.

Determination of the Effect of the Change on the Accuracy or reliability of the Setpoints or Dose Calculations

This change will have no effect on the setpoint or dose calculations.

Radiological Effluent Technical Specification (RETS) Manual

Prepared By John A Wilson / 5/5/87
Date

Reviewed By Robert M Keen / 5/5/87
PORC Chairman Date

Approved By for Plant Superintendent / 5/5/87
Date

RETS MANUAL

Section III

OFFSITE DOSE CALCULATION MANUAL (ODCM)

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.1 Gaseous Effluents

1.1 Alarm/Trip Setpoints

Technical Specification 3.8.B.1 requires that the dose rate in unrestricted areas (Figure 1.1) due to gaseous effluents from the BFN site shall be limited at all times to the following values:

1. 500 mrem/yr to the total body and 3,000 mrem/yr to the skin from noble gases.

2. 1,500 mrem/yr to any organ from radioiodines and particulates.

Technical Specification 3.2.K.1 requires gaseous effluent monitors to have alarm/trip setpoints to ensure that the above dose rates are not exceeded. This section of the ODCM describes the methodology that will be used to determine these setpoints.

The methodology for determining alarm/trip setpoints is divided into two major parts. The first consists of backcalculating from a dose rate to a release rate limit relation for each nuclide type and release point. The second consists of using the release rate limit relations to determine the physical settings on the monitors. The methodology for the latter is contained in Technical Instruction 15.

1.1.1 Release Rate Limit Methodology - μCi/s

Step 1 Dose Rates

The first step involves calculating a dose rate based on the design objective source term mix used in the licensing of the plant. Historical meteorological data are used in this calculation. Doses are determined for (1) noble gases and (2) iodines and particulates. Depending on the pathway involved, either air concentrations or ground concentrations are calculated. Figures 1.2 and 1.3 show the Offgas System, the Standby Gas Treatment System and normal building ventilation with effluent monitor locations.

A. Noble Gases

Equations and assumptions for calculating doses from noble gases are as follows:

Assumptions:

1. Doses to be calculated are total body and skin.

2. Exposure pathway is submersion within a cloud of noble gases.

3. Noble gas radionuclide mix is based on the expected source term given in Table 1.1.

4. Basic radionuclide data are given in Table 1.2.

5. All releases are treated as ground level or elevated.

6. Meteorological data are expressed as joint-frequency distributions of wind speed and wind direction by atmospheric stability for the period January 1977 to December 1979 (Table 1.3). Releases fron the radwaste, reactor and turbine buildings are treated as 100 percent ground level, whereas stack releases are considered 100 percent elevated.

7. Raw meteorological data for ground level releases consist of wind speed and direction measurements at 10m and temperature measurements at 10m and 45m. Windspeeds and directions for elevated releases were measured at 93m. Stability Class D was assumed to persist during the entire period for elevated releases.

8. Dose is to be evaluated at the nearest land site boundary point in each sector and at other locations expected to be maximum exposure points (Table 1.4).

9. A semi-infinite cloud model is used. The use of a finite cloud model would result in calculated doses of 0 to 10 percent higher than those calculations using the semi-infinite cloud model for BFN.

10. No credit is taken for shielding by residence.

11. Plume depletion (Figure 1.4) and radioactive decay are considered consistent with Regulatory Guide 1.111 methodology.

12. Building wake effects on effluent dispersion are considered.

13. A sector-average dispersion equation is used consistent with Regulatory Guide 1.111.

14. The wind speed classes that are used are as follows:

Number	Range (m/s)	Midpoint (m/s)
1	< 0.3	0.13
2	0.3-0.6	0.45
3	0.7-1.5	1.10
4	1.6-2.4	1.99
5	2.5-3.3	2.88
6	3.4-5.5	4.45
7	5.6-8.2	6.91
8	8.3-10.8	9.59
9	> 10.9	10.95

15 The stability classes used are the standard A theough G classifications. Stability classes 1-7 will correspond to A=1, B=2, ... G=7.

16. Terrain effects are not considered.

17. Environmental transfer data are consistent with NUREG/CR-1004.

Equations

To calculate the dose from radiological effluents discharged from a given release point for any one of the 16 potential maximum-exposure points, the following equations are used.

For determining the air concentration of any radionuclide:

$$x_i = \sum_{j=1}^{9} \sum_{k=1}^{7} (2/\pi)^{1/2} \frac{f_{jk} Q_i p}{\sigma_{zk} u_j (2\pi x/n)} \exp(-\lambda_i x/u_j) \exp(-h_e^2/2\sigma_{zk}^2) \quad (1.1)$$

where

x_i = air concentration of radionuclide i, $\mu Ci/m^3$.

f_{jk} = joint relative frequency of occurrence of winds in windspeed class j, stability class k, blowing toward this exposure point, expressed as a fraction.

Q_i = average release rate of radionuclide i, μCi/s.

p = fraction of radionuclide remaining in plume (Figure 1.4), consistent with Regulatory Guide 1.111 methodology.

Σ_{zk} = vertical dispersion coefficient for stability class k which includes a building wake adjustment,

$$\Sigma_{zk} = (\sigma_{zk}^2 + 0.5A/\pi)^{1/2}$$

where σ_{zk} = the vertical dispersion coefficient for stability class k (m) see Figure 1.5,
0.5 = a building shape factor, and
A = the minimum building cross-sectional area, (2400 m^2).

u_j = midpoint value of wind speed class interval j, m/s.

x = downwind distance, m.

n = number of sectors, 16.

λ_i = radioactive decay coefficient of radionuclide i, s^{-1}.

$2\pi x/n$ = sector width at point of interest, m.

h_e = effective release height, m.

For effluents exhausted from release points that are higher than twice the height of adjacent structures (elevated releases) the effective release height is determined by the following equation, consistent with Regulatory Guide 1.111

$$h_e = h_s + h_{pr} - h_t - c$$

where

c = correction factor for low relative exit velocity,

$$c = 3(1.5 - W_o/u)d,$$

where

W_o = the vertical plume exit velocity (m/s)

u = mean wind speed (m/s) and

d = inside diameter of the release point, m.

h_{pr} = plume rise above release point as determined by the Briggs equations given in Sagendorf (ERL ARL-42), m

h_s = physical height of release point, m.

h_t = maximum terrain height between release point and receptor location, m.

For effluents released from points less than the height of adjacent structures, a ground level release is assumed ($h_e = 0$).

For effluents released from points at the level of or above adjacent structures, but lower than elevated release points, releases are treated as follows:

Case 1 - elevated if $W_o/u \geq 5$.
Case 2 - ground level ($h_e = 0$) if $W_o/u \leq 1$.
Case 3 - split level if $1 < w_o/u < 5$.

Under Case 3 a split level dispersion approach is implemented using a model that requires for each release point two JFDs, one for elevated releases and one for ground level releases. The summation of the elevated and ground level JFDs account for the total period of record. Releases are considered to be elevated $100(1-E_t)$ percent of the time and ground level 100 E_t percent of the time where the entrainment coefficient, E_t, is defined by

$$E_t = 2.58 - 1.58(W_o/u) \text{ for } 1 < W_o/u \leq 1.5 \qquad (1.1b)$$

$$E_t = 0.3 - 0.06(W_o/u) \text{ for } 1.5 < W_o/u \leq 5 \qquad (1.1c)$$

For determining the total body dose rate:

$$D_{TB} = \sum_i \chi_i DFB_i \qquad (1.2)$$

where

D_{TB} = total body dose rate, mrem/yr.

χ_i = air concentration of radionuclide i, $\mu Ci/m^3$.

DFB_i = total body dose factor due to gamma radiation, mrem/yr per $\mu Ci/m^3$ (Table 1.5).

For determining the skin dose rate

$$D_S = \sum_i \chi_i (DFS_S + 1.11\ DF_{\gamma i}) \qquad (1.3)$$

where

D_S = skin dose rate, mrem/yr.

$\bar{\chi}_i$ = air concentration of radionuclide i, μCi/m³.

DFS_i = skin dose factor due to beta radiation, mrem/yr per μCi/m³ (Table 1.5).

1.11 = the average ratio of tissue to air energy absorption coefficients, mrem/mrad.

$DF_{\gamma i}$ = gamma-to-air dose factor for radionuclide i, mrad/yr per μCi/m³ (Table 1.5).

The above dose calculations are repeated for each release point (vent or stack) and then summed to obtain maximum total body and skin dose rates. The maximum total body and skin dose rates will then be used in step 2.

B. Iodines and Particulates

Equations and assumptions for calculating doses from radioiodines and particulates are as follows;

Assumptions, same as 1.1.1.A, except:

1. Dose is to be calculated for the critical organ, thyroid, and the critical age group, infant.

2. Exposure pathways from iodines and particulates are milk ingestion, ground contamination, and inhalation.

3. The radioiodine and particulate mix is based on the expected source term given in Table 1.1.

4. Real cow locations are not considered.

5. Deposition is calculated based on the curves given in Figure 1.5.

6. A milk cow obtains 100 percent of her food from pasture grass.

Equations

To calculate the dose from radiological effluents discharged from a given release point for any one of the potential maximum-exposure points, the following equations are used:

1. Inhalation

Equation for calculating air concentration, χ, is the same as in the Noble Gas Section, 1.1.1.A.

For determining the thyroid dose rate:

$$D_{THI} = 10^{-6} \sum_i \chi_i \, DFI_i \qquad (1.4)$$

where:

D_{THI} = thyroid dose rate due to inhalation, mrem/yr.

χ_i = air concentration of radionuclide i, $\mu Ci/m^3$.

DFI_i = infant inhalation dose factor, mrem/yr per $\mu Ci/cm^3$, based on Regulatory Guide 1.109 dose conversion factors (mrem/pCi) and an assumed 1400 m^3/yr infant breathing rate.

10^{-6} = m^3/cm^3 conversion factor.

2. Ground Contamination

For determining the ground concentration of any nuclide:

$$G_i = 3.15 \times 10^7 \sum_{k=1}^{7} \frac{f_k Q_i DR}{(2\pi x/n)\lambda_i} [\, 1-\exp-(\lambda_i t_b) \,] \qquad (1.5)$$

where:

G_i = ground concentration of radionuclide i, $\mu Ci/m^2$.

k = stability class.

f_k = joint relative frequency of occurrence of winds in stability class k blowing toward this exposure point, expressed as a fraction.

Q_i = average release rate of radionuclide i, $\mu Ci/s$.

DR = relative deposition rate, m^{-2} (Figure 1.6). The choice of figures is governed by the effective release height calculation by equation 1.1a. A linear interpolation is used for effluent release heights that fall in between the given curves.

x = downwind distance, m.

n = number of sectors, 16.

$2\pi x/n$ = sector width at point of interest, m.

λ_i = radioactive decay coefficient of radionuclide i, yr^{-1}.

t_b = time for buildup of radionuclides on the ground, 35y.

3.15×10^7 = s/yr conversion factor.

For determining the thyroid dose rate from ground contamination:

$$D_{THG} = (8,760)\ 10^6 \sum_i G_i\ DFG_i \qquad (1.6)$$

where:

D_{THG} = thyroid dose rate due to ground contamination, mrem/yr.

G_i = ground concentration of radionuclide i, $\mu Ci/m^2$.

DFG_i = dose factor for standing on contaminated ground, mrem/h per pCi/m^2 (Table 1.7).

8,760 = occupation time, h/yr.

10^6 = pCi/μCi conversion factor

3. Milk Ingestion

For determining the concentration of any nuclide (except H-3) in and on vegetation:

$$CV_i = 3,600 \sum_{k=1}^{7} \frac{f_k\ Q_i\ DR}{(2\pi x/n)} \left[\frac{r(1-\exp(-\lambda_{Ei}\ t_e))}{Y_v \lambda_{Ei}} + \frac{B_{iv}(1-\exp(-\lambda_i\ t_b))}{P\ \lambda_i} \right] \qquad (1.7)$$

where:

CV_i = concentration of radionuclide i in and on vegetation, μCi/kg.

k = stability class.

f_k = frequency of this stability class and wind direction combination, expressed as a fraction.

Q_i = average release rate of radionuclide i, μCi/s.

DR = relative deposition rate, m^{-1} (Figure 1.6). The choice of figures is governed by the effective release height calculation by equation 1.1a. A linear interpolation is used for effluent release heights that fall in between the given curves.

x = downwind distance, m.

n = number of sectors, 16.

$2\pi x/n$ = sector width at point of interest, m.

r = fraction of deposited activity retained on vegetation, 0.47, consistent with NUREG/CR-1004.

λ_{Ei} = effective removal rate constant,

$$\lambda_{Ei} = \lambda_i + \lambda_w,$$

where:

λ_i = the radioactive decay coefficient, h^{-1},
λ_w = a measure of physical loss of weathering (λ_w = .0023 h^{-1} for particulates and 0.0017 for iodines).

t_e = period over which deposition occurs, 720 h.

Y_v = agricultural yield, 1.18 kg/m^2.

B_{iv} = transfer factor from soil to vegetation of radionuclide i (Table 1.6).

λ_i = radioactive decay coefficient of radionuclide i, h^{-1}

t_b = time for buildup of radionuclides on the ground, 3.07×10^5 h (35 yr).

P = effective surface density of soil, 240 kg/m^2.

3,600 = s/h conversion factor.

For determining the concentration of H-3 in vegetation:

$$\overline{CV_T} = 10^3 \, x_T \, (0.75)(0.5/H) \qquad (1.8)$$

where:

CV_T = concentration of H-3 in vegetation, μCi/kg.

x_T = air concentration of H-3, μCi/m³.

0.75 = fraction of total plant mass that is water,

0.5 = ratio of tritium concentration in plant water to tritium concentration in atmospheric water.

H = absolute humidity of the atmosphere, 9 g/m³.

10^3 = g/kg conversion factor.

For determining the concentration of any nuclide in cow's milk:

$$CM_i = CV_i \, FM_i \, Q_f \exp(-\lambda_i \, t_f) \qquad (1.9)$$

where:

CM_i = concentration of radionuclide i (including H-3) in cow's milk, μCi/ℓ.

CV_i = concentration of radionuclide i in and on vegetation, μCi/kg.

FM_i = transfer factor from feed to milk for radionuclide i, d/ℓ (Table 1.6).

Q_f = amount of feed consumed by the cow per day, kg/d.

λ_i = radioactive decay coefficient of radionuclide i, d^{-1}.

t_f = transport time of activity from milking to ingestion, 1 day

For determining the thyroid dose rate from ingestion of cow's milk:

$$D_{THM} = 10^6 \sum_i CM_i \, DFING_i \, UM \qquad (1.10)$$

where:

D_{THM} = thyroid dose rate due to milk ingestion, mrem/yr.

CM_i = concentration of radionuclide i in cow's milk, μCi/ℓ.

$DFING_i$ = infant ingestion dose factor, mrem/pCi, (Regulatory Guide 1.109, Table E-14)

UM = infant ingestion rate for milk, 330 ℓ/yr.

10^6 = pCi/μCi conversion factor.

4. Total Thyroid Dose Rate

For determining the total thyroid dose rate from iodines and particulates:

$$D_{TH} = D_{THI} + D_{THG} + D_{THM} \qquad (1.11)$$

where:

D_{TH} = total thyroid dose rate, mrem/yr.

D_{THI} = thyroid dose rate due to inhalation, mrem/yr.

D_{THG} = thyroid dose rate due to ground contamination, mrem/yr.

D_{THM} = thyroid dose rate due to milk ingestion, mrem/yr.

The above dose calculations are repeated for each release point. Dose rates from building vents are summed. The calculated thyroid dose rates from the vents and stack will then be used in step 2.

Step 2 (Setpoints)

The dose rate limits of interest (10CFR 20) are

Total body = 500 mrem/yr
Skin = 3,000 mrem/yr
Maximum organ = 1,500 mrem/yr

Dividing the above limits by the appropriate dose rates calculated in step 1 yields the following ratios:

$$\frac{\text{Dose Rate Limit}}{\text{Vent Dose Rate (step 1)}} = R_1; \quad \frac{\text{Dose Rate Limit}}{\text{Stack Dose Rate (step 1)}} = R_2$$

These ratios, R_i, represent how far above or below the guidelines the step 1 calculation was. Multiplying the original source terms Q_i by the appropriate ratio R_i will give release rates, r_i, that will result in the dose rate limits given above.

Instantaneous release rates (q_i) for each nuclide type and release point are now limited by the following equations:

For noble gas releases:

$$\frac{q_1}{r_1} + \frac{q_2}{r_2} \leq 1$$

where

q_1 = instantaneous release rate from building exhaust vents in Ci/s.

q_2 = instantaneous release rate from main stack in Ci/s.

For iodines and particulates with half-lives > 8 days.

$$\frac{q_3}{r_3} + \frac{q_4}{r_4} \leq 1$$

where

q_3 = instantaneous release rate from building exhaust vents in μCi/s.

q_4 = instantaneous release rate from main stack in μCi/s.

To simplify the dynamic operation of the plant, the dose rate limits were transformed into conservative release rate limits based on historical source terms and meteorology. The values listed below were used as administrative guidelines for operation and development of alarm/trip setpoints (see Technical Instruction 15) to ensure that the instantaneous dose rate limits are not exceeded.

Airborne	Noble Gas	Iodine and Particulate
Elevated	14.4 Ci/s	35.7 μCi/s
Ground Level	0.15 Ci/s	2.19 μCi/s

1.2 Monthly Dose Calculations

Dose calculations will be performed monthly to determine compliance with specifications 3.8.B.3 and 3.8.B.5. The specifications require that the dose rate in unrestricted areas due to gaseous effluents from each reactor at the site shall be limited to the following values:

For noble gases,

1. During any calendar quarter, 5 mrad to air for gamma radiation and 10 mrad to air for beta radiation.

2. During any calendar year, 10 mrad to air for gamma radiation and 20 mrad to air for beta radiation.

For iodines and particulates,

1. During any calendar quarter, 7.5 mrem to any organ.

2. During any calendar year, 15 mrem to any organ.

This section of the ODCM describes the methodology that will be used to perform these monthly calculations.

Doses will first be calculated by a simplified conservative approach (step 1). If these exceed these limits, a more realistic calculation will be performed (step 2).

1.2.1 Noble Gases

Step 1

Doses will be calculated using the methodology described in this step. If 50% of the applicable limits are exceeded, step 2 will be performed.

Equations and assumptions for calculating doses from releases of noble gases are as follows:

Assumptions

1. Doses to be calculated are gamma and beta air doses.
2. The highest annual-average χ/Q based on licensing meteorology for any offsite location (not necessarily a site boundary location) will be used. Elevated meteorology is assumed for stack releases. All other vent releases assume ground level meteorology.
3. No credit is taken for radioactive decay.
4. For gamma and beta doses, releases of Ar-41, Kr-85m, Kr-85, Kr-87, Kr-88, Xe-131m, Xe-133m, Xe-133, Xe-135, Xe-135m, and Xe-138 are considered.
5. Dose factors are calculated using data from TVA's nuclide library.
6. The dose calculations are extrapolated assuming that only 90 percent of total dose was contributed.
7. A semi-infinite cloud model is used.
8. Building wake effects on effluent dispersion are considered.

Equations

For determining the gamma dose to air:

$$D_\gamma = \frac{(\chi/Q)}{0.9} \quad \frac{10^6}{3.15 \times 10^7} \quad \sum_i Q_i \, DF_{\gamma i} \qquad (1.12)$$

where:

D_γ = gamma dose to air from continuous releases, mrad.

χ/Q = highest annual-average relative concentration,
1.84×10^{-6} s/m^3 (ground level)
2.08×10^{-8} s/m^3 (elevated)

0.9 = fraction of total gamma dose expected to be contributed by these nuclides.

10^6 = μCi/Ci conversion factor

3.15×10^7 = s/yr conversion factor

Q_i = monthly release of radionuclide i, Ci.

$DF\gamma_i$ = gamma-to-air dose factor for radionuclide i, mrad/yr per μCi/m³ (Table 1.5). For Kr-88 and Xe-138, the dose factors for Kr-88+D and Xe-138+D are used to account for daughter buildup.

This equation then reduces to

$$D\gamma = 6.49 \times 10^{-8} \sum_i Q_i \quad DF\gamma_i \quad \text{(ground level)} \quad (1.13)$$

$$D\gamma = 7.34 \times 10^{-10} \sum_i Q_i \quad DF\gamma_i \quad \text{(stack)} \quad (1.14)$$

For determining the beta dose to air:

$$D\beta = \frac{(\chi/Q)}{0.9} \quad \frac{10^6}{3.15 \times 10^7} \quad \sum_i Q_i \quad DF\beta_i \quad (1.15)$$

where:

$D\beta$ = beta dose to air, mrad.

χ/Q = highest annual-average relative concentration,
1.84×10^{-6} (ground level)
2.08×10^{-8} (elevated)

0.9 = fraction of total beta dose expected to be contributed by these nuclides.

10^6 = μCi/Ci conversion factor

3.15×10^7 = s/yr conversion factor

Q_i = monthly release of radionuclide i, Ci.

$DF\beta_i$ = Beta-to-air dose factor for radionuclide i, mrad/yr per μCi/m³ (Table 1.5). For Kr-88 and Xe-138, the dose factors for Kr-88+D and Xe-138+D are used to account for daughter buildup.

This equation then reduces to:

$$D\beta = 6.49 \times 10^{-8} \sum_i Q_i \, DF\beta_i \quad \text{(ground level)} \quad (1.16)$$

$$D\beta = 7.34 \times 10^{-10} \sum_i Q_i \, DF\beta_i \quad \text{(stack)} \quad (1.17)$$

Step 2

This methodology is to be used if the calculations in Step 1 yield doses that exceed 50% of the applicable limits.

Equations and assumptions for calculating doses to air from releases of noble gases are the same as those in Section 1.1.1, Step 1, Part A, with the following exceptions:

Assumptions

1. Doses to be calculated are gamma and beta air doses.
2. Dose is to be evaluated at the nearest site boundary point in each sector and at other locations expected to be maximum exposure points.
3. Historical onsite meteorological data for the appropriate months from the period 1977-1979 will be used.
4. Releases from the radwaste and reactor buildings are treated as split level.
5. Raw meteorological data for ground level portion of the split level JFD consist of wind speeds and directions measured at the 10m level and temperature measurements at 10m and 45m. The elevated portion of the split level JFD is based on wind speeds and directions measured at the 46m level and temperature measurements at 45m and 90m.
6. All measured radionuclide releases are considered.
7. A semi-infinite cloud model is used.
8. Radioactive decay is considered.
9. Building wake effects on effluent dispersion are considered.
10. Dose factors are calculated using data from TVA's radionuclide library.

Equations

Equations for calculating air concentration, χ, is the same as in Section 1.1.1, step 1, part A. Air concentrations are calculated for the site boundary in each sector.

For determining the gamma dose to air

$$D_{\gamma n} = t_m \sum_i \chi_{ni} \, DF_{\gamma i} \qquad (1.18)$$

where:

$D_{\gamma n}$ = gamma dose to air for sector n, mrad.

χ_{ni} = air concentration of radionuclide i in sector n, $\mu Ci/m^3$.

$DF_{\gamma i}$ = gamma-to-air dose factor for radionuclide i, mrad/yr per $\mu Ci/m^3$ (Table 1.5.).

t_m = time period considered, yr.

For determining the beta dose to air:

$$D_{\beta n} = t_m \sum_i \chi_{ni} DF_{\beta i} \qquad (1.19)$$

where:

$D_{\beta n}$ = beta dose to air for sector n, mrad.

χ_{ni} = air concentration of radionuclide i in sector n, $\mu Ci/m^3$

$DF_{\beta i}$ = beta to air dose factor for radionuclide i, mrad/yr per $\mu Ci/m^3$ (Table 1.5)

t_m = time period considered, yr

The sector having the highest total dose is then used to check compliance with specification 3.8.8.3.

1.2.2 Iodines and Particulates

Step 1

Doses will be calculated using the methodology described in this step. If 50% of the applicable limits are exceeded, step 2 will be performed.

Equations and assumptions for calculating doses from releases of iodines and particulates are as follows:

Assumptions

1. Dose is to be calculated for the infant thyroid from milk ingestion and for the child bone and teen g.i. tract from vegetation ingestion.

2. Real cow locations are considered for the milk pathway and nearest resident-locations with home-use gardens are considered for the vegetable pathway.

3. The highest annual-average χ/Qs and D/Qs for any location (not necessarily a site boundary location) are used based on licensing methodology. Elevated meteorology is assumed for stack releases. All other vent releases assume ground level meteorology.

4. No credit is taken for radioactive decay.

5. Releases of H-3, I-131 and I-133 are considered for the milk pathway. H-3, Sr-89, Sr-90, Cs-134 and Cs-137 releases are considered for the vegetable pathway to the child bone.

   H-3, Co-58 and Co-60 releases are considered for the vegetable pathway to the teen g.i. tract.

6. The dose calculations are extrapolated assuming that only 90 percent of the total dose was contributed.

7. The cow is assumed to graze on pasture grass for the whole year.

Equations

For determining the thyroid dose from milk ingestion:

$$D_{TH} = \frac{\sum_i (Q_i DF_i)\ D/Q \times 10^6 + (Q_T DF_T)\ \chi/Q}{0.9 \times 3.15 \times 10^7} \qquad (1.20)$$

where:

D_{TH} = thyroid dose from H-3, I-131, and I-133, mrem.

Q_i = monthly release of iodine nuclide i, Ci.

Q_T = monthly release of H-3, Ci.

DF_i = nuclide i milk ingestion dose factor to infant, 7.24×10^{11} mrem/yr per $\mu Ci/m^2$-s for I-131 and 1.52×10^{10} mrem/yr per $\mu Ci/m^2$-s for I-133 (consistent with Regulatory Guide 1.109 and NUREG/CR-1004 methodologies).

DF_T = H-3 milk ingestion dose factor, 3.53×10^{9} mrem/yr per $\mu Ci/cc$ (consistent with Regulatory Guide 1.109 and NUREG/CR-1004 methodologies).

D/Q = relative deposition rate, 2.30×10^{-10} m^{-2} (stack), 3.16×10^{-10} m^{-2} (ground level)

x/Q = relative air concentration, 1.69×10^{-8} s/m^3 (stack), 1.47×10^{-7} s/m^3 (ground level)

0.9 = fraction of dose expected to be contributed by H-3, I-131, and I-133.

3.15×10^{7} = s/yr.

10^{6} = $\mu Ci/Ci$

Equation 1.20 then reduces to:

$$D_{TH} = 8.11 \times 10^{-12} \sum_i Q_i DF_i + 2.10 \times 10^{-6} Q_T \text{ (stack)}$$

$$= 1.11 \times 10^{-11} \sum_i Q_i DF_i + 1.83 \times 10^{-5} Q_T \text{ (ground level)}$$

For determining the bone dose from vegetable ingestion:

$$DBC_i = \frac{\sum_i (Q_i DF_i)\ D/Q \times 10^{6} + Q_T DF_T\ X/Q}{0.9 \times 3.15 \times 10^{7}} \qquad (1.21)$$

where:

DBC = bone dose to child, mrem.

Q_i = monthly release of particulate nuclide i, Ci.

Q_T = monthly release of H-3, Ci.

DF_i = vegetable ingestion dose factor to child, 2.25×10^{11}, 1.36×10^{13}, 1.59×10^{11}; and 2.58×10^{11} mrem/yr per $\mu Ci/m^2$-s for Sr-89, Sr-90, Cs-134, and Cs-137, respectively (consistent with Regulatory Guide 1.109 and NUREG/CR-1004 methodologies).

DF_T = vegetable ingestion dose factor for H-3, 4.53×10^9 mrem/yr per μCi/cc

$\overline{D/Q}$ = relative deposition rate, 1.05×10^{-9} m^{-2} (stack), 5.29×10^{-9} m^{-2} (ground level)

X/Q = relative air concentration, 9.50×10^{-9} s/m^3 (stack), 1.84×10^{-6} s/m^3 (ground level)

3.15×10^7 = s/yr.

10^6 = μCi/Ci

0.9 = fraction of total bone dose expected to be contributed by H-3, Sr-89, Sr-90, Cs-134, and Cs-137

Equation 1.21 then reduces to:

$$DBC_i = 3.70 \times 10^{-11} \sum_i Q_i \, DF_i + 1.52 \times 10^{-6} \, Q_T \text{ (stack)}$$

$$= 1.87 \times 10^{-10} \sum_i Q_i \, DF_i + 2.94 \times 10^{-4} \, Q_T \text{ (ground level)}$$

For determining the gastrointestinal (g.i.) tract dose from vegetable ingestion:

$$DGI_T = \frac{\sum_i (Q_i DF_i) \, D/Q \times 10^6 + (Q_T DF_T) \, X/Q}{0.9 \times 3.15 \times 10^7} \qquad (1.22)$$

where:

DGI_T = teen g.i. tract dose from H-3, Co-58, and Co-60, mrem

Q_i = monthly release of cobalt nuclide i, Ci.

Q_T = monthly release of H-3, Ci

DF_i = vegetable ingestion dose factor for the teen g.i. tract, 3.87×10^9 mrem/yr per μCi/m^2-s for Co-58 and 3.31×10^{10} mrem/yr per μCi/m^2-s for Co-60 (consistent with Regulatory Guide 1.109 and NUREG/CR-1004 methodologies).

DF_T = vegetable ingestion dose factor for H-3, 2.92×10^9 mrem/yr per μCi/cc (consistent with Regulatory Guide 1.109 and NUREG/CR-1004 methodologies).

D/Q = relative deposition rate, 1.05×10^{-9} m^{-2} (stack), 5.29×10^{-9} m^{-2} (ground level)

$\overline{X/Q}$ = relative air concentration, 9.50×10^{-9} s/m^3 (stack), 1.84×10^{-6} s/m^3 (ground level)

3.15×10^{7} = s/yr

10^{6} = µCi/Ci

0.9 = fraction of total g.i. tract dose expected to be contributed by H-3, Co-58, and Co-60

Equation 1.22 then reduces to :

$$DGI_T = 3.70 \times 10^{-11} \sum_i (Q_i DF_i) + 9.78 \times 10^{-7} Q_T \quad \text{(stack)}$$

$$= 1.87 \times 10^{-10} \sum_i (Q_i DF_i) + 1.90 \times 10^{-4} Q_T \quad \text{(ground level)}$$

Step 2

This methodology is to be used if the calculations in step 1 yield doses that exceed 50% of the applicable limits.

Doses for releases of iodines and particulates shall be calculated using the methodology in Section 1.1.1, step 1, part B, with the following exceptions:

1. All measured radionuclide releases will be used.

2. Dose will be evaluated at real cow locations and will consider actual grazing information.

3. Releases from the radwaste and reactor buildings are treated as split-level.

4. Raw meteorological data for the ground level portion of the split level JFD consist of wind speeds and directions measured at the 10m level and temperature measurements at 10m and 45m. The elevated portion of the split level JFD is based on wind speeds and directions measured at the 46m level and temperature measurements at 45m and 90m.

The receptor having the highest total dose is then used to check compliance with specification 3.8.B.5.

1.3 Quarterly and Annual Dose Calculations

A complete dose analysis utilizing the total estimated gaseous releases for each calendar quarter will be performed and reported as required in the Technical Specification 6.7.5. Methodology for this analysis is the same as that described in Section 1.1.1, except that real pathways and receptor locations (Table 1.4) are considered and releases from the radwaste and reactor buildings are treated as split level. Also, raw meteorological data for ground level releases consist of windspeed and direction measurements at 10m and temperature measurements of 10m and 45 m. The ground level portion of the split level JFD consist of wind speeds and directions measured at the 10m level and temperature measurements at 10m and 45m. The elevated portion of the split level JFD is based on wind speeds and directions measured at the 46m level and temperature measurements at 45m and 90m. Windspeeds and directions for elevated releases are measured at 93m. Stability class D is assumed to persist during the entire period for elevated releases. In addition, meteorological data representative of each corresponding calendar quarter will be used. This analysis will replace the estimates in Section 1.2.

At the end of the year an annual dose analysis will be performed by calculating the sum of the quarterly doses to the critical receptors.

1.4 Gaseous Radwaste Treatment System Operation

The gaseous radwaste treatment system (GRTS) described below shall be maintained and operated to keep releases ALARA.

1.4.1 System Description

A flow diagram for the GRTS is given in Figure 1.3. The system includes the subsystems that process and dispose of the gases from the main condenser air ejectors, the startup vacuum pumps, and the gland seal condensers. One gaseous radwaste treatment system is provided for each unit. The processed gases from each unit are routed to the plant stack for dilution and elevated release to the atmosphere. The air-ejector off-gas line of each unit and the stack are continuously monitored by radiation monitors.

1.4.2 Dose Projections

Doses will be projected monthly in accordance with the procedures in the plant's Radiological Effluent Manual (REM). This will be done by averaging the calculated dose for the most recent month and the calculated dose for the previous month and assigning that average dose as the projection for the current month. These doses will be used to monitor radwaste system performance.

2.0 Liquid Effluents

2.1 Release Rate Limit Methodology

2.1.1 RETS Requirement

Specification 3.8.A.1 of the Radiological Effluent Technical Specifications (RETS) requires that the concentration of radioactive material released at any time from the site to unrestricted areas (Figure 2.1) shall be limited to the Maximum Permissible Concentration (MPC) specified in 10 CFR 20, Appendix B, Table II, Column 2 for nuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} μCi/ml total activity. To ensure compliance, the following approach will be used for each release.

2.1.2 Prerelease Analysis

Prior to release, a grab sample will be analyzed to determine the concentration (C_i) of each gamma emitting radionuclide i in the radwaste tank. The following equation is used to calculate MPC fractions (M_i).

$$M_i = \frac{C_i}{MPC_i} \qquad (2.1)$$

where:

M_i = MPC fraction of radionuclide i.

C_i = concentration of radionuclide i in the radwaste tank, μCi/mℓ.

MPC_i = MPC of radionuclide i as specified in Section 2.1.1, μCi/mℓ.

The sum of the ratios (R) will be calculated by the following relationship:

$$R = \sum_{i} M_i \qquad (2.2)$$

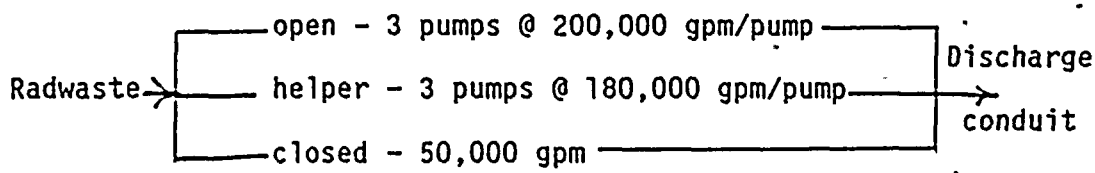
where:

R = the sum of the ratios.

M_i = MPC fraction from equation 2.1.

2.1.3 Release Flow Rate Calculations

There is one liquid release point into the discharge canal by one of three possible modes:



The sum of the ratios at the diffuser pipes must be ≤ 1 due to the releases from the above source. The following relationship will assure this criterion is met:

$$f\,(R-1) \leq F \qquad (2.3)$$

where:

f = the effluent flow rate (gallons/minute) before dilution.

R = the sum of the ratios as determined by Equation 2.2.

F = minimum dilution flow rate for prerelease analysis.

The allowable release rate is calculated before each release and the release rate is continuously monitored during the release so that the MPC limit is not exceeded.

2.2 Instrument Setpoints

2.2.1 Setpoint Determination

The setpoint for each liquid effluent monitor will be established using plant instructions. Concentration, flow rate, dilution, principal gamma emitter, geometry, and detector efficiency are combined to give an equivalent setpoint in counts per minute (cpm). The locations and identification numbers for each liquid effluent radiation detector are shown in figures 2.2 and 2.3.

The respective alarm/trip setpoints will be set such that Equation 2.3 is satisfied. The methodology describing the setpoint determination is contained in Technical Instruction 45.

2.2.2 Post-Release Analysis

A post-release analysis will be done using actual release data to ensure that the limits specified in Section 2.1.1 were not exceeded.

A composite list of concentrations (C_i) by isotope, will be used with actual liquid radwaste (f) and dilution (F) flow rates (or volumes) during the release. The data will be substituted into Equations 2.1, 2.2 and 2.3 to demonstrate compliance with the limits in Section 2.1.1. This data and setpoints will be recorded in auditable records by plant personnel.

2.3 Dose

2.3.1 RETS Requirements

Specification 3.8.A.3 of the Radiological Effluent Technical Specifications (RETS) requires that dose or dose commitment to an individual from radioactive material in liquid effluents released to unrestricted areas (Figure 2.1) from each reactor shall be limited:

a. During any calender quarter to $\leq$ 1.5 mrem to the total body and to $\leq$ 5 mrem to any organ, and

b. During any calendar year to $\leq$ 3 mrem to the total body and to $\leq$ 10 mrem to any organ.

To ensure compliance, cumulative dose calculations will be performed at least once per month according to the following methodology.

2.3.2 Monthly Analysis

Principal radionuclides will be used to conservatively estimate the monthly contribution to the cumulative dose. If the projected dose calculated by this monthly method exceeds the monthly fraction of the annual limits in section 2.3.1, then the methodology in Section 2.3.3 will be implemented.

The 20 nuclides (listed below), based on operational source terms, contribute more than 95 percent of the total estimated dose to the total body and the most critical organ for both the water and fish ingestion pathways. The organs considered for both water ingestion and fish ingestion are the gastrointestinal tract (GIT), bone, thyroid, and liver.

H-3	Fe-59	Sr-90	I-131
Na-24	Co-58	Zr/Nb-95	I-133
Cr-51	Co-60	Mo/Tc-99m	Cs-134
Mn-54	Zn-65	Ag-110m	Cs-136
Fe-55	Sr-89	Sb-124	Cs-137

A conservative calculation of the monthly dose will be done according to the following procedure. First, the monthly operating report containing the release data will be obtained and the activities reported (if any) for each of the above 20 radionuclides will be noted. This information will then be used in the following calculations.

2.3.2.1 Water Ingestion

The dose to an individual from ingestion of water is described by the following equation.

$$D_{jk} = \frac{10^{-3}}{0.95} \sum_{i=1}^{20} (DCF)_{ijk}\, I_{ik}, \text{ mrem} \qquad (2.4)$$

where:

D_{jk} = dose for the jth organ and the kth age group from the 20 radionuclides, mrem.

j = the organ of interest (bone, GIT, thyroid, liver or total body).

k = the age group being considered, child or adult.

0.95 = conservative correction factor, considering only 20 radionuclides.

DCF_{ijk} = ingestion dose commitment factor for the ith radionuclide for the jth organ for the kth age group, rem/μCi (Table 2.1)

I_{ik} = monthly activity ingested of the ith radionuclide by the kth age group, μCi.

10^{-3} = conversion from rem to mrem.

The activity ingested due to drinking water, I_{ik}, is described by:

$$I_{ik} = \frac{A_i\, V_k\, (30)}{F\, d\, (7.34 \times 10^{10})}, \mu Ci \qquad (2.5)$$

where:

A_i = activity released of ith radionuclide during the month, μCi.

V_k = maximum individual water consumption rate corresponding to the kth age group. (Adult = 2000 ml/d; Child = 1400 ml/d, from Regulatory Guide 1.109)

30 = days per month

F = average river flow rate for the month (cubic feet per second)

d = fraction of river flow available for dilution (0.20)

7.34×10^{10} = conversion from cubic feet per second to milliliters per month

Inserting this for I_{ijk} in equation 2.4, the dose equation for water ingestion then becomes:

$$D_{jk} = \frac{2.15 \times 10^{-6}}{F} \sum_{i=1}^{20} V_k \; DCF_{ijk} \; A_i \text{ , mrem} \qquad (2.6)$$

2.3.2.2 Fish Ingestion

The dose to an individual from the consumption of fish is described by Equation 2.4. In this case the activity ingested of the ith radionuclide due to eating fish (I_{ik}) is described by

$$I_{ik} = \frac{A_i B_i M_k}{Fd\ (7.34 \times 10^{10})}\ ,\ \mu Ci \qquad (2.7)$$

where:

A_i = activity released of the ith radionuclide during the month, μCi

B_i = effective fish concentration factor of ith radionuclide, μCi/g per μCi/ml. (Table 2.2.)

M_k = amount of fish eaten monthly by the kth age group (adult = 1750 g, child = 575 g, Regulatory Guide 1.109).

F = average river flow rate for the month, cubic feet per second.

d = fraction of river flow available for dilution, 0.20.

7.34×10^{10} = conversion from cubic feet per second to milliliters per month.

Inserting this for I_{ik} in equation 2.4, the dose equation for fish ingestion then becomes:

$$D_{jk} = \frac{7.17 \times 10^{-8}}{F} \sum_{i=1}^{20} A_i\ B_i\ M_k\ DCF_{ijk}\ ,\ mrem \qquad (2.8)$$

2.3.2.3 Recreation

For the recreation dose calculation, the total dose is estimated based on a calculation of the shoreline dose for Co-58, Co-60, Cs-134, and Cs-137. The shoreline dose due to these four nuclides is expected to contribute over 95 percent of the total recreation dose. The total body and maximum organ dose to an individual via the shoreline recreation pathway are assumed to be equal. The recreation dose is described by the following equation:

$$D_r = \frac{1}{0.95} \sum_{i=1}^{4} \frac{[(RDCF)_i \cdot \xi_i \cdot 67]}{8760}, \text{ mrem} \qquad (2.9)$$

where:

D_r = recreation dose from plant releases, mrem.

0.95 = conservative correction factor for considering only 4 radionuclides.

$RDCF_i$ = shoreline recreation dose commitment factor for the ith radionuclide, mrem/yr per $\mu Ci/cm^2$ (Table 2.3).(Note: For Cs-137, the dose commitment factor for its daughter, Ba-137m, is assumed.).

ξ_i = concentration of ith radionuclide in shoreline sediment, $\mu Ci/cm^2$, as described by the following equation (based on equation A-5 in Regulatory Guide 1.109).

$$\xi_i = 100 \cdot RHL_i \cdot C_i \cdot W [1 - \exp(-\lambda_i t)] \cdot 0.1 \qquad (2.10)$$

where:

100 = transfer constant defined in Regulatory Guide 1.109 equation A-4.

RHL_i = radiological half-life of the ith radioisotope, days (Table 2.1).

C_i = concentration of ith radionuclide in the Tennessee River, $\mu Ci/ml$.

$= A_i/(F \cdot d \cdot 7.34 \times 10^{10})$

where:

A_i = activity released of ith radionuclide during the month, μCi.

F = average river flow for the month, cubic feet per second.

d = fraction of river flow available for dilution, 0.20.

7.34×10^{10} = conversion from cubic feet per second to milliliters per month.

W = shoreline width factor, 0.3 for a lake shore, per Table A-2 Regulatory Guide 1.109.

λ_i = decay constant of the ith radionuclide, yr^{-1}.

t = buildup time in sediment, assumed 15 years, per Regulatory Guide 1.109.

67 = assumed monthly exposure time for maximum individual, = 500 h/yr = (~10 h/week) x 0.4 (fractional exposure for worst quarter ÷ 3 (months/quarter)).

8760 = conversion from year to hours.

0.1 = conversion factor, combining the conversions from m^2 to cm^2 and mℓ to ℓ.

The recreation dose equation then becomes:

$$D_r = \frac{1}{F}(0.00692\ A_1 + 0.00012\ A_2 + 0.00206\ A_3 + 0.00342\ A_4) \quad (2.11)$$

where:

A_1, A_2, A_3, A_4, = the activities of Co-60, Co-58, Cs-134, and Cs-137, respectively, μCi.

2.3.2.4 Monthly Summary

To obtain the total monthly dose to the total body, sum the total body dose from water ingestion, the total body dose from fish ingestion, and the recreation dose. This value will be compared to the Technical Specification limit for total body dose. To obtain the total monthly dose to the maximum organ, sum the maximum organ dose from water ingestion, the maximum organ dose from fish ingestion, and the recreation dose. This value will be compared to the Technical Specification limit for maximum organ dose. Calendar quarter doses are first estimated by summing the doses calculated for each month in that quarter. Calendar year doses are first estimated by summing the doses calculated for each month in that year. However, if the annual doses determined in this manner exceed or approach the specification limits, doses calculated for previous quarters with the methodology of Section 2.3.2 will be used instead of those quarterly doses estimated by summing monthly results. An annual check will be made to ensure that the monthly dose estimates account for at least 95 percent of the dose calculated by the method described in Section 2.3.3. If less than 95 percent of the dose has been estimated, either a new list if principal isotopes will be prepared or a new correction factor will be used. The latter option will not be used if less than 90 percent of the total dose is predicted.

2.3.3 Quarterly and Annual Analysis

A complete analysis utilizing the total estimated liquid releases for each calendar quarter will be performed and reported as required in Section 6.9 of the Technical Specifications. This analysis will replace previous estimates calculated using Section 2.3.2 methodology and will also include an approximation of population doses.

2.3.3.1 Individual Doses

The dose, D_{jk}, to the maximum individual from n nuclides is described by:

$$D_{jk} = \sum_{m=1}^{5} \sum_{i=1}^{n} D_{ijkm}, \text{ rem} \qquad (2.12)$$

$$= \sum_{i=1}^{n} \sum_{m=1}^{2} [(DCF)_{ijk} \cdot I_{ikm}] + \sum_{m=3}^{5} [(RDCF)_{ijm} \cdot \xi_{im} \cdot T_m \cdot \varphi], \text{ rem} \qquad (2.13)$$

where:

D_{ijkm} = dose to the jth organ for the kth age group from the ith radionuclide via the mth exposure path .

j = the organ of interest (bone, GI tract, thyroid, liver, total body and skin).

k = the age group being considered: adult or child for the ingestion pathways; adult for the recreation pathways.

m = exposure pathway of interest:
1. water ingestion,
2. fish ingestion,
3. shoreline recreation,
4. above water recreation, and
5. in-water recreation.

$(DCF)_{ijk}$ = ingestion dose commitment factor for the jth organ from the ith radionuclide for the kth age group, rem/μCi. Table 2.1 is a list of ingestion dose factors for the two age groups.

I_{ikm} = The activity ingested of the ith radionuclide, via the mth exposure pathway for the kth age group, μCi.

For the water ingestion pathway:

$$I_{ik1} = C_i V_k N \quad (2.14)$$

For the fish pathway:

$$I_{ik2} = C_i B_i M_k \quad (2.15)$$

where:

C_i = concentration of the ith radionuclide during the release period, μCi/mℓ
= $A_i/(F_L d)$.

where:

A_i = Activity released of ith radionuclide during the release period, μCi.

F_L = Total river flow at location L during period, mℓ.

L = Location of interest (For dose to the maximum individual the first down-river exposure point is used. For the population dose, various down-river locations are used to account for the total exposed population. Table 2.4a gives the river location of public water supplies; Tables 2.4b and 2.4c give the boundaries of the various reaches in which concentrations are calculated for the fish and recreation pathways).

d = fraction of river flow available for dilution (0.20 above Wheeler Dam, 1 below the dam).

V_k = average rate of water consumption for the kth age group, per Regulatory Guide 1.109

= for maximum individual:
adult - 2000 mℓ/d
child - 1400 mℓ/d

= for average individual (population):
adult - 1010 mℓ/d
child - 710 mℓ/d.

N = number of days during the release period, day.

B_i = bioaccumulation factor for the ith radionuclide in fish, μCi/g per μCi/mℓ, (Table 2.2).

M_k = amount of fish consumed during the period for the kth age group (fraction of year times the annual consumption rate per Regulatory Guide 1.109)

for maximum individual:
adult - 21 kg/yr
child - 6.9 kg/yr

for average individual (population):
adult - 6.9 kg/yr
child - 2.2 kg/yr.

$(RDCF)_{ijm}$ = recreation dose commitment factor for the jth organ from the ith radionuclide via the mth pathway; mrem/yr per concentration (ξ_{im}) in medium, (Table 2.3).

ξ_{im} = the concentration of the ith radionuclide in the environmental medium pertaining to mth pathway.

for above-water and in-water recreation pathways:

$$\xi_{im} = \xi_{i5} = C_i$$

For the shoreline recreation pathway:

$$\xi_{i3} = 100 \cdot RHL_i \cdot C_i \cdot W\,[1-\exp(-\lambda_i \cdot t)] \qquad (2.16)$$

where:

100 = transfer constant as defined in Regulatory Guide 1.109 equation A-4.
RHL_i = radiological half-life of the ith isotope, days, (Table 2.1).
W = shoreline width factor (0.3 for a lake shore, per Table A-2 of Regulatory Guide 1.109).
λ_i = decay constant of the ith radionuclide $0.693/RHL_i$.
t = buildup time in sediment, assumed 15 years, per Regulatory Guide 1.109.

T_m = assumed exposure time of maximum individual for the mth pathway

(3) shoreline 500 h/yr (~10 h/week)
(4) above-water 1800 h/yr (6 h/d, 300 d/yr)
(5) in-water 920 h/yr (6 h/d, for five summer months).

φ = Fraction of annual exposure for each quarter

1st Quarter	January-March	0.1
2nd Quarter	April-June	0.3
3rd Quarter	July-September	0.4
4th Quarter	October-December	0.2.

2.3.3.2 Population Doses

The total dose, Δ_j, from all 5 pathways to the jth organ of the population from n nuclides at p locations is described by:

$$\Delta_j = \sum_{l=1}^{p} \sum_{m=1}^{5} \sum_{i=1}^{n} \Delta_{ijml}, \quad \text{man-rem} \qquad (2.17)$$

$$\Delta_j = \sum_{l=1}^{p} \sum_{m=1}^{5} \sum_{i=1}^{n} D_{ijml} \cdot P_{ml}, \quad \text{man-rem} \qquad (2.18)$$

where:

Δ_{ijml} = Dose to the jth organ of the total population from the ith radionuclide via the mth pathway at location l.

D_{ijml} = Dose to individual (as described in Section 2.3.3.1) at location l.

P_l = Number of people at location l (Table 2.4a-c). The population is assumed to consist of 71-percent adults and 29-percent children (from Appendix D, Regulatory Guide 1.109, the value for children includes teenagers).

2.4 Operability of Liquid Radwaste Equipment

The Radiological Effluent Manual (REM) requires that the liquid radwaste system (Figure 2.3) shall be used to reduce the radioactive materials in liquid wastes prior to their discharge when the projected dose due to liquid effluent releases* to unrestricted areas (see Figure 2.1) when averaged over 31 days would exceed 0.06 mrem to the total body or 0.21 mrem to any organ. Doses will be projected monthly to assure compliance.

2.5 Dose Projections

In accordance with the REM, dose projections will be performed. This will be done by averaging the calculated dose for the most recent month and the calculated dose for the previous month and assigning that average dose as the projection for the current month.

*Per operating reactor unit.

3.0 Radiological Environmental Monitoring

3.1 Monitoring Program

An environmental radiological monitoring program as described in Tables 3.1 and 3.2 and in Figures 3.1, 3.2, 3.3, and 3.4 shall be conducted. Results of this program shall be reported in accordance with Section F-1 of the REM.

The atmospheric environmental radiological monitoring program shall consist of 10 monitoring stations from which samples of air particulates and radioiodine shall be collected.

The terrestrial monitoring program shall consist of the collection of vegetation, milk, soil, drinking water, and food crops. In addition, direct gamma radiation levels will be measured at 40 or more locations in the vicinity of the plant.

The reservoir sampling program shall consist of the collection of samples of surface water, sediment, and fish.

Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, sample unavilability, or malfunction of sampling equipment. If the latter, every effort shall be made to complete corrective action prior to the end of the next sampling period.

3.2 Detection Capabilities

Analytical techniques shall be such that the detection capabilities listed in Table 3.3 are achieved.

3.3 Nonroutine Reports

Nonroutine reports shall be submitted pursuant to Section F-3 of the REM.

4.0 Annual Maximum Individual Doses - Total

To determine compliance with 40 CFR 190, the annual dose contributions to the maximum individual from BFN radioactive effluents and all other nearby uranium fuel cycle sources will be considered. The annual dose to the maximum individual will be conservatively estimated by: first, summing the total body air submersion dose, and the critical organ dose from gaseous effluents; the total body dose, and critical organ dose from liquid effluents for each quarter in accordance with sections 1.3 and 2.3.3 Then to this sum for each quarter is added any identifiable increase in direct radiation dose levels attributable to the plant as determined by the environmental monitoring program outlined in section 3.0. These quarterly sums are then conservatively summed for the four calendar quarters to estimate the maximum individual dose for the year.

TABLE 1.1

Expected Annual Routine Atmospheric Releases
from One Unit at BFN

Isotope	Nuclear Plant (Ci/yr/Unit) Reactor Complex Vent	Radwaste Building Vent	Turbine Building Vent	Stack (Ci/yr/Unit) Gland Seal and Offgas	MVP
Kr-85m	6E+0	< 1	2E+0	1.66E+4	0.0E+0
Kr-85	-	-	-	6.3E+2	-
Kr-87	6E+0	< 1	9.5E+1	7.47E+2	0.0E+0
Kr-88	9E+0	< 1	1.02E+2	1.35E+4	0.0E+0
Kr-89	1E+0	3.4E+1	5.03E+2	4.10E+3	0.0E+0
Xe-131m	-	-	-	3.09E+2	0.0E+0
Xe-133m	0E+0	6.0E+1	0E+0	8.51E+2	0.0E+0
Xe-133	1.03E+2	2.94E+2	5.81E+2	9.47E+4	3.0E+2
Xe-135m	1.11E+2	6.67E+2	4.64E+2	9.17E+2	0.0E+0
Xe-135	1.73E+2	3.28E+2	6.72E+2	5.99E+2	2.0E+2
Xe-137	7.8E+1	1.13E+2	3.86E+2	5.04E+3	0.0E+0
Xe-138	1.2E+1	2E+0	1.18E+3	3.15E+3	0.0E+0
I-131 I	5.94E-2	5.0E-3	1.56E-2	4.1E-3	8.5E-3
I-132 I	5.94E-1	5.0E-2	1.79E-1	4.69E-2	9.73E-2
I-133 I	2.97E-1	2.5E-2	1.23E-1	3.23E-2	6.71E-2
I-134 I	1.49E+0	1.25E-1	2.67E-2	7.0E-3	1.45E-2
I-135 I	5.94E-1	5.0E-2	1.23E-1	3.23E-2	6.71E-2
I-131 O	3.16E-2	2.9E-2	6.5E-3	3.32E-2	2.74E-1
I-132 O	3.16E-1	2.9E-1	7.44E-2	3.80E-1	3.14E+0
I-133 O	1.58E-1	1.45E-1	5.13E-2	2.62E-1	2.16E+0
I-134 O	7.90E-1	7.25E-1	1.11E-2	5.68E-2	4.69E-1
I-135 O	3.16E-1	2.90E-1	5.13E-2	2.61E-1	2.16E+0
Cr-51	3E-3	9E-4	1E-3	1E-4	0.0E+0
Mn-54	3E-3	5E-3	2E-3	4E-5	0.0E+0
Co-58	2E-3	4E-4	9E-5	2E-5	0.0E+0
Fe-59	1E-4	8E-4	4E-4	2E-4	0.0E+0
Co-60	3E-2	6E-3	3E-3	1E-5	0.0E+0
Zn-65	3E-3	2E-4	4E-4	9E-5	0.0E+0
Sr-89	1E-2	3E-1	*	*	0.0E+0
Sr-90	2E-3	4E-3	*	*	0.0E+0
Nb-95	3E-4	2E-4	9E-6	8E-5	0.0E+0
Sr-95	1E-4	1E-4	8E-6	8E-5	0.0E+0
Ru-103	3E-5	1E-4	2E-4	1E-4	0.0E+0
Ag-110m	7E-6	*	*	*	0.0E+0
Sb-124	3E-5	3E-4	6E-5	8E-5	0.0E+0
Cs-134	5E-3	3E-4	5E-4	2E-5	0.0E+0
Cs-136	2E-3	5E-5	1E-4	9E-8	0.0E+0
Cs-137	7E-3	4E-4	2E-3	7E-4	0.0E+0
Ba-140	4E-3	5E-4	2E-2	8E-3	0.0E+0
Ce-141	4E-4	2E-4	2E-3	2E-5	0.0E+0
Ce-144	5E-6	*	*	4E-6	0.0E+0
Ar-41	2.5E+1	0E+0	0E+0	0E+0	0.0E+0
C-14	0E+0	0E+0	0E+0	9.5E+0	0.0E+0
H-3	0E+0	9.5E+0	0E+0	0E+0	0.0E+0

* Not available.
I denotes nonorganic iodine (elemental, particulate, HIO).
O denotes organic iodine.

TABLE 1.3
(Sheet 1 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS A (DELTA-T≤ -1.9°C/100 M)
BROWNS FERRY NUCLEAR PLANT
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.0	0.04	0.12	0.05	0.0	0.0	0.21
NNE	0.0	0.0	0.0	0.05	0.19	0.10	0.0	0.0	0.34
NE	0.0	0.0	0.0	0.04	0.06	0.0	0.0	0.0	0.10
ENE	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.01
E	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.01
ESE	0.0	0.01	0.11	0.17	0.02	0.0	0.0	0.0	0.31
SE	0.0	0.03	1.11	0.40	0.02	0.0	0.0	0.0	1.56
SSE	0.0	0.04	0.52	0.10	0.02	0.0	0.0	0.0	0.68
S	0.0	0.01	0.38	0.11	0.04	0.0	0.0	0.0	0.54
SSW	0.0	0.0	0.04	0.05	0.01	0.0	0.0	0.0	0.10
SW	0.0	0.0	0.05	0.04	0.0	0.0	0.0	0.0	0.09
WSW	0.0	0.0	0.04	0.07	0.04	0.0	0.0	0.0	0.15
W	0.0	0.0	0.01	0.05	0.05	0.01	0.0	0.0	0.12
WNW	0.0	0.0	0.02	0.03	0.09	0.06	0.0	0.0	0.20
NW	0.0	0.0	0.0	0.02	0.17	0.11	0.0	0.0	0.30
NNW	0.0	0.0	0.01	0.01	0.06	0.09	0.02	0.0	0.19
SUBTOTAL	0.0	0.09	2.29	1.19	0.90	0.42	0.02	0.0	4.91

TOTAL HOURS OF VALID STABILITY OBSERVATIONS	25935
TOTAL HOURS OF STABILITY CLASS A	1262
TOTAL HOURS OF VALID WIND DIRECTION-WIND SPEED-STABILITY CLASS A	1259
TOTAL HOURS CALM	0

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF JOINT VALID OBSERVATIONS

METEOROLOGICAL FACILITY: LOCATED ABOUT 1.3 KM SW OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON LAPSE RATE MEASURED BETWEEN 10.03 AND 45.30 METERS
WIND SPEED AND DIRECTION MEASURED AT THE 10.42 METER LEVEL

MEAN WIND SPEED = 6.8 MPH

TABLE 1.3
(Sheet 2 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS B (-1.9 < DELTA-T≤ -1.7°C/100 M)
BROWNS FERRY NUCLEAR PLANT
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
NN	0.0	0.0	0.05	0.09	0.30	0.04	0.01	0.0	0.49
NNE	0.0	0.0	0.05	0.07	0.27	0.05	0.0	0.0	0.44
NE	0.0	0.0	0.04	0.02	0.09	0.01	0.0	0.0	0.16
ENE	0.0	0.01	0.01	0.01	0.01	0.0	0.0	0.0	0.04
E	0.0	0.0	0.02	0.01	0.0	0.0	0.0	0.0	0.03
ESE	0.0	0.02	0.10	0.04	0.0	0.0	0.0	0.0	0.16
SE	0.0	0.13	0.64	0.09	0.02	0.0	0.0	0.0	0.88
SSE	0.0	0.09	0.31	0.02	0.01	0.0	0.0	0.0	0.43
S	0.0	0.05	0.42	0.07	0.02	0.0	0.0	0.0	0.56
SSW	0.0	0.02	0.07	0.01	0.0	0.0	0.0	0.0	0.10
SW	0.0	0.0	0.17	0.02	0.0	0.0	0.0	0.0	0.19
WSW	0.0	0.0	0.11	0.13	0.05	0.01	0.0	0.0	0.30
W	0.0	0.02	0.04	0.17	0.17	0.03	0.0	0.0	0.43
WNW	0.0	0.0	0.07	0.11	0.23	0.08	0.04	0.0	0.53
NW	0.0	0.0	0.01	0.07	0.27	0.13	0.01	0.0	0.49
NNW	0.0	0.0	0.0	0.07	0.19	0.12	0.0	0.0	0.38
SUBTOTAL	0.0	0.34	2.11	1.00	1.63	0.47	0.06	0.0	5.61

TOTAL HOURS OF VALID STABILITY OBSERVATIONS 25935
TOTAL HOURS OF STABILITY CLASS B 1445
TOTAL HOURS OF VALID WIND DIRECTION-WIND SPEED-STABILITY CLASS B 1440
TOTAL HOURS CALM 0

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF JOINT VALID OBSERVATIONS

METEOROLOGICAL FACILITY;METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON LAPSE RATE MEASURED BETWEEN 10.03 AND 45.30 METERS
WIND SPEED AND DIRECTION MEASURED AT THE 10.42 METER LEVEL

MEAN WIND SPEED = 7.2 MPH

TABLE 1.3
(Sheet 3 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS C (-1.7 < DELTA-T≤ -1.5°C/100 M)
BROWNS FERRY NUCLEAR PLANT
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.01	0.08	0.11	0.21	0.02	0.0	0.0	0.43
NNE	0.0	0.01	0.07	0.09	0.17	0.20	0.0	0.0	0.36
NE	0.0	0.0	0.03	0.08	0.05	0.0	0.0	0.0	0.16
ENE	0.0	0.0	0.02	0.02	0.0	0.0	0.0	0.0	0.04
E	0.0	0.0	0.03	0.02	0.0	0.0	0.0	0.0	0.05
ESE	0.0	0.01	0.05	0.02	0.0	0.0	0.0	0.0	0.08
SE	0.0	0.17	0.29	0.09	0.01	0.0	0.0	0.0	0.56
SSE	0.0	0.12	0.17	0.04	0.01	0.0	0.0	0.0	0.34
S	0.0	0.11	0.25	0.04	0.02	0.0	0.0	0.0	0.42
SSW	0.0	0.03	0.06	0.01	0.0	0.0	0.0	0.0	0.10
SW	0.0	0.03	0.12	0.03	0.01	0.0	0.0	0.0	0.19
WSW	0.0	0.0	0.11	0.07	0.07	0.0	0.0	0.0	0.25
W	0.0	0.0	0.05	0.12	0.10	0.02	0.01	0.0	0.30
WNW	0.0	0.01	0.12	0.13	0.17	0.07	0.04	0.0	0.54
NW	0.0	0.0	0.05	0.09	0.22	0.10	0.01	0.0	0.47
NNW	0.0	0.0	0.02	0.08	0.18	0.10	0.0	0.0	0.38
SUBTOTAL	0.0	0.50	1.52	1.04	1.22	0.33	0.06	0.0	4.67

TOTAL HOURS OF VALID STABILITY OBSERVATIONS	25935
TOTAL HOURS OF STABILITY CLASS C	1202
TOTAL HOURS OF VALID WIND DIRECTION-WIND SPEED-STABILITY CLASS C	1197
TOTAL HOURS CALM	0

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF JOINT VALID OBSERVATIONS

METEOROLOGICAL FACILITY:METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON LAPSE RATE MEASURED BETWEEN 10.03 AND 45.30 METERS
WIND SPEED AND DIRECTION MEASURED AT THE 10.42 METER LEVEL

MEAN WIND SPEED = 7.0 MPH

TABLE 1.3
(Sheet 4 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS D (-1.5 < DELTA-T≤ -0.5°C/100 M)
BROWNS FERRY NUCLEAR PLANT
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.19	0.41	0.53	1.00	0.37	0.01	0.0	2.51
NNE	0.01	0.20	0.56	0.58	1.18	0.18	0.01	0.0	2.72
NE	0.01	0.12	0.38	0.43	0.52	0.01	0.0	0.0	1.47
ENE	0.0	0.26	0.23	0.15	0.05	0.01	0.0	0.0	0.70
E	0.0	0.20	0.31	0.17	0.05	0.0	0.0	0.0	0.73
ESE	0.0	0.24	0.51	0.30	0.08	0.0	0.0	0.0	1.13
SE	0.02	1.16	1.31	0.83	0.26	0.0	0.0	0.0	3.58
SSE	0.01	0.99	0.99	0.26	0.11	0.02	0.0	0.0	2.38
S	0.0	0.92	1.17	0.34	0.17	0.0	0.0	0.0	2.60
SSW	0.0	0.45	0.29	0.08	0.04	0.0	0.0	0.0	0.86
SW	0.0	0.24	0.29	0.09	0.02	0.01	0.0	0.0	0.65
WSW	0.0	0.32	0.70	0.29	0.33	0.11	0.0	0.0	1.75
W	0.0	0.18	0.55	0.62	0.63	0.22	0.03	0.0	2.23
WNW	0.0	0.13	0.39	0.42	1.10	0.82	0.22	0.01	3.09
NW	0.0	0.04	0.28	0.38	1.01	0.87	0.14	0.02	2.74
NNW	0.0	0.13	0.40	0.55	1.54	0.74	0.05	0.0	3.41
SUBTOTAL	0.05	5.77	8.77	6.02	8.09	3.36	0.46	0.03	32.55

TOTAL HOURS OF VALID STABILITY OBSERVATIONS 25935
TOTAL HOURS OF STABILITY CLASS D 8438
TOTAL HOURS OF VALID WIND DIRECTION-WIND SPEED-STABILITY CLASS D 8341
TOTAL HOURS CALM 1

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF JOINT VALID OBSERVATIONS

METEOROLOGICAL FACILITY:METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON LAPSE RATE MEASURED BETWEEN 10.03 AND 45.30 METERS
WIND SPEED AND DIRECTION MEASURED AT THE 10.42 METER LEVEL

MEAN WIND SPEED = 7.1 MPH

TABLE 1.3
(Sheet 5 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS E (-0.5 < DELTA-T≤ 1.5°C/100 M)
BROWNS FERRY NUCLEAR PLANT
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.04	0.47	0.54	0.43	0.41	0.05	0.01	0.0	1.95
NNE	0.05	0.61	0.74	0.55	0.47	0.04	0.0	0.0	2.46
NE	0.05	0.57	0.63	0.42	0.27	0.02	0.0	0.0	1.96
ENE	0.05	0.71	0.45	0.17	0.08	0.02	0.0	0.0	1.48
E	0.04	0.61	0.74	0.16	0.07	0.0	0.0	0.0	1.62
ESE	0.03	0.76	1.01	0.53	0.16	0.01	0.0	0.0	2.50
SE	0.11	2.04	1.75	0.92	0.55	0.02	0.0	0.0	5.39
SSE	0.07	1.16	0.78	0.48	0.33	0.04	0.0	0.0	2.86
S	0.05	1.03	0.74	0.44	0.63	0.14	0.01	0.0	3.04
SSW	0.02	0.52	0.14	0.08	0.06	0.01	0.0	0.0	0.83
SW	0.04	0.30	0.07	0.02	0.03	0.0	0.0	0.0	0.46
WSW	0.01	0.53	0.60	0.14	0.11	0.04	0.0	0.0	1.43
W	0.02	0.37	0.77	0.42	0.27	0.04	0.0	0.0	1.89
WNW	0.03	0.15	0.13	0.11	0.22	0.09	0.02	0.0	0.75
NW	0.02	0.17	0.20	0.14	0.25	0.09	0.02	0.0	0.89
NNW	0.05	0.41	0.48	0.54	0.59	0.09	0.01	0.0	2.17
SUBTOTAL	0.68	10.41	9.77	5.55	4.50	0.70	0.07	0.0	31.68

TOTAL HOURS OF VALID STABILITY OBSERVATIONS 25935
TOTAL HOURS OF STABILITY CLASS E 8264
TOTAL HOURS OF VALID WIND DIRECTION-WIND SPEED-STABILITY CLASS E 8098
TOTAL HOURS CALM 3

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF JOINT VALID OBSERVATIONS

METEOROLOGICAL FACILITY:METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON LAPSE RATE MEASURED BETWEEN 10.03 AND 45.30 METERS
WIND SPEED AND DIRECTION MEASURED AT THE 10.42 METER LEVEL

MEAN WIND SPEED = 5.0 MPH

TABLE 1.3
(Sheet 6 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS F (1.5 < DELTA-T≤ 4.0°C/100 M)
BROWNS FERRY NUCLEAR PLANT
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.05	0.36	0.52	0.28	0.06	0.0	0.0	0.0	1.27
NNE	0.05	0.51	0.66	0.34	0.11	0.0	0.0	0.0	1.67
NE	0.07	0.34	0.27	0.18	0.01	0.0	0.0	0.0	0.87
ENE	0.03	0.53	0.33	0.05	0.0	0.0	0.0	0.0	0.94
E	0.01	0.59	0.52	0.03	0.0	0.0	0.0	0.0	1.15
ESE	0.0	0.52	0.22	0.0	0.0	0.0	0.0	0.0	0.74
SE	0.09	0.97	0.48	0.17	0.13	0.01	0.0	0.0	1.85
SSE	0.05	0.54	0.34	0.17	0.25	0.02	0.01	0.0	1.38
S	0.03	0.29	0.18	0.20	0.27	0.01	0.0	0.0	0.98
SSW	0.03	0.13	0.03	0.0	0.01	0.0	0.0	0.0	0.20
SW	0.0	0.09	0.03	0.0	0.0	0.0	0.0	0.0	0.12
WSW	0.0	0.09	0.07	0.0	0.0	0.0	0.0	0.0	0.16
W	0.02	0.09	0.06	0.0	0.01	0.0	0.0	0.0	0.18
WNW	0.01	0.08	0.01	0.0	0.0	0.0	0.0	0.0	0.10
NW	0.01	0.08	0.04	0.01	0.0	0.0	0.0	0.0	0.14
NNW	0.05	0.27	0.27	0.16	0.05	0.0	0.0	0.0	0.80
SUBTOTAL	0.50	5.48	4.03	1.59	0.90	0.04	0.01	0.0	12.55

TOTAL HOURS OF VALID STABILITY OBSERVATIONS	25935
TOTAL HOURS OF STABILITY CLASS F	3268
TOTAL HOURS OF VALID WIND DIRECTION-WIND SPEED-STABILITY CLASS F	3223
TOTAL HOURS CALM	2

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF JOINT VALID OBSERVATIONS

METEOROLOGICAL FACILITY:METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON LAPSE RATE MEASURED BETWEEN 10.03 AND 45.30 METERS
WIND SPEED AND DIRECTION MEASURED AT THE 10.42 METER LEVEL

MEAN WIND SPEED = 4.0 MPH

TABLE 1.3
(Sheet 7 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS G (DELTA-T> 4.0°C/100 M)
BROWNS FERRY NUCLEAR PLANT
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.07	0.76	0.32	0.02	0.0	0.0	0.0	0.0	1.17
NNE	0.05	0.83	0.51	0.18	0.02	0.0	0.0	0.0	1.59
NE	0.04	0.34	0.12	0.02	0.0	0.0	0.0	0.0	0.52
ENE	0.04	0.48	0.18	0.02	0.0	0.0	0.0	0.0	0.72
E	0.02	0.52	0.34	0.0	0.0	0.0	0.0	0.0	0.88
ESE	0.01	0.18	0.01	0.0	0.0	0.0	0.0	0.0	0.20
SE	0.08	0.43	0.09	0.04	0.03	0.0	0.0	0.0	0.67
SSE	0.03	0.44	0.31	0.16	0.08	0.0	0.0	0.0	1.02
S	0.05	0.09	0.12	0.10	0.04	0.0	0.0	0.0	0.40
SSW	0.05	0.05	0.01	0.0	0.0	0.0	0.0	0.0	0.11
SW	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.01
WSW	0.02	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.04
W	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.02
WNW	0.01	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.03
NW	0.04	0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.08
NNW	0.05	0.23	0.12	0.03	0.0	0.0	0.0	0.0	0.43
SUBTOTAL	0.57	4.45	2.13	0.57	0.17	0.0	0.0	0.0	7.89

TOTAL HOURS OF VALID STABILITY OBSERVATIONS 25935
TOTAL HOURS OF STABILITY CLASS G 2056
TOTAL HOURS OF VALID WIND DIRECTION-WIND SPEED-STABILITY CLASS G 2019
TOTAL HOURS CALM 4

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF JOINT VALID OBSERVATIONS

METEOROLOGICAL FACILITY:METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON LAPSE RATE MEASURED BETWEEN 10.03 AND 45.30 METERS
WIND SPEED AND DIRECTION MEASURED AT THE 10.42 METER LEVEL

MEAN WIND SPEED = 3.2 MPH

TABLE 1.3
(Sheet 8 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION

DISREGARDING STABILITY CLASS
BROWNS FERRY NUCLEAR PLANT
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.02	0.19	0.38	0.64	2.07	2.47	0.61	0.06	6.44
NNE	0.0	0.13	0.33	0.60	2.46	2.69	0.50	0.04	6.75
NE	0.0	0.12	0.35	0.64	2.16	1.85	0.58	0.02	5.72
ENE	0.02	0.14	0.32	0.36	1.15	0.95	0.34	0.04	3.32
E	0.0	0.22	0.47	0.45	0.99	0.43	0.08	0.01	2.65
ESE	0.01	0.23	0.53	0.66	1.79	1.63	0.42	0.09	5.36
SE	0.02	0.36	1.26	1.36	3.25	3.20	1.54	0.69	11.68
SSE	0.01	0.38	1.20	1.22	2.97	2.59	1.16	0.59	10.12
S	0.02	0.40	0.90	1.05	2.53	2.40	1.03	0.43	8.76
SSW	0.0	0.31	0.65	0.69	1.73	1.77	0.73	0.19	6.07
SW	0.02	0.38	0.66	0.69	1.55	1.62	0.50	0.14	5.56
WSW	0.01	0.26	0.69	0.68	1.15	1.05	0.36	0.17	4.37
W	0.02	0.20	0.66	0.81	1.76	1.04	0.42	0.35	5.26
WNW	0.01	0.17	0.46	0.69	2.03	1.54	0.76	0.30	5.96
NW	0.02	0.19	0.49	0.70	1.80	2.01	0.96	0.28	6.45
NNW	0.01	0.22	0.28	0.41	1.66	2.13	0.70	0.13	5.54
SUBTOTAL	0.19	3.90	9.63	11.65	31.05	29.37	10.69	3.53	100.01

TOTAL HOURS OF VALID WIND OBSERVATIONS 25784
TOTAL HOURS OF OBSERVATIONS 26280
RECOVERABILITY PERCENTAGE 98.1
TOTAL HOURS CALM 2

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF JOINT VALID OBSERVATIONS

METEOROLOGICAL FACILITY:METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
WIND SPEED AND DIRECTION MEASURED AT THE 92.63 METER LEVEL

MEAN WIND SPEED = 12.0 MPH

TABLE 1.3
(Sheet 9 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS A (DELTA-T≤ -1.9°C/100 M)
BROWNS FERRY NUCLEAR PLANT
PART 1 OF 2 GROUND LEVEL RELEASE MODE
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24:5	TOTAL
N	0.0	0.0	0.0	0.0	0.0	0.02	0.01	0.0	0.0	0.03
NNE	0.0	0.0	0.0	0.0	0.0	0.03	0.02	0.0	0.0	0.05
NE	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.01
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESE	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.02
SE	0.0	0.0	0.0	0.05	0.04	0.01	0.0	0.0	0.0	0.10
SSE	0.0	0.0	0.0	0.03	0.02	0.01	0.0	0.0	0.0	0.06
S	0.0	0.0	0.0	0.02	0.02	0.01	0.0	0.0	0.0	0.05
SSW	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.01
SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WSW	0.0	0.0	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.02
W	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.01
WNW	0.0	0.0	0.0	0.0	0.0	0.01	0.01	0.0	0.0	0.02
NW	0.0	0.0	0.0	0.0	0.0	0.02	0.02	0.0	0.0	0.04
NNW	0.0	0.0	0.0	0.0	0.0	0.01	0.02	0.02	0.0	0.05
SUBTOTAL	0.0	0.0	0.0	0.10	0.12	0.15	0.08	0.02	0.0	0.47

TOTAL HOURS OF VALID OBSERVATIONS 25482.0
TOTAL HOURS OF GROUND LEVEL RELEASE 2832.4
TOTAL HOURS OF STABILITY CLASS A 133.1
TOTAL HOURS OF GROUND LEVEL STABILITY CLASS A 127.5

METEOROLOGICAL FACILITY: METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON DELTA-T BETWEEN 10.03 AND 45.30 METERS
WIND DIRECTION MEASURED AT 10.42 METER LEVEL
WIND SPEED MEASURED AT 10.42 METER LEVEL
EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.3
(Sheet 10 of 22)

SPLIT JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS B (-1.9 < Delta T ≤ -1.7° C/100M)
BROWNS FERRY NUCLEAR PLANT
PART 1 OF 2 GROUND LEVEL RELEASE MODE
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24:5	TOTAL
N	0.0	0.0	0.0	0.0	0.01	0.05	0.01	0.01	0.0	0.08
NNE	0.0	0.0	0.0	0.0	0.01	0.05	0.01	0.0	0.0	0.07
NE	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.01
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESE	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.01
SE	0.0	0.0	0.0	0.02	0.02	0.01	0.0	0.0	0.0	0.05
SSE	0.0	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.0	0.02
S	0.0	0.0	0.0	0.02	0.01	0.01	0.0	0.0	0.0	0.04
SSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WSW	0.0	0.0	0.0	0.0	0.02	0.01	0.0	0.0	0.0	0.03
W	0.0	0.0	0.0	0.0	0.01	0.02	0.02	0.01	0.0	0.06
WNW	0.0	0.0	0.0	0.0	0.01	0.03	0.02	0.03	0.0	0.09
NW	0.0	0.0	0.0	0.0	0.01	0.04	0.03	0.0	0.0	0.08
NNW	0.0	0.0	0.0	0.0	0.0	0.03	0.04	0.0	0.0	0.07
SUBTOTAL	0.0	0.0	0.0	0.05	0.12	0.26	0.13	0.05	0.0	0.61

TOTAL HOURS OF VALID OBSERVATIONS	25482.0
TOTAL HOURS OF GROUND LEVEL RELEASE	2832.4
TOTAL HOURS OF STABILITY CLASS B	185.1
TOTAL HOURS OF GROUND LEVEL STABILITY CLASS B	163.4

METEOROLOGICAL FACILITY:METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON DELTA-T BETWEEN 10.03 AND 45.30 METERS
WIND DIRECTION MEASURED AT 10.42 METER LEVEL
WIND SPEED MEASURED AT 10.42 METER LEVEL
EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.3
(Sheet 11 of 22)

SPLIT JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS C (-1.7 < DELTA-T≤ -1.5°C/100 M)
BROWNS FERRY NUCLEAR PLANT
PART 1 OF 2 GROUND LEVEL RELEASE MODE
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.0	0.0	0.01	0.03	0.0	0.0	0.0	0.04
NNE	0.0	0.0	0.0	0.0	0.01	0.02	0.0	0.0	0.0	0.03
NE	0.0	0.0	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.02
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SE	0.0	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.0	0.02
SSE	0.0	0.0	0.0	0.01	0.01	0.01	0.0	0.0	0.0	0.03
S	0.0	0.0	0.0	0.01	0.01	0.01	0.0	0.0	0.0	0.03
SSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WSW	0.0	0.0	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.02
W	0.0	0.0	0.0	0.0	0.01	0.01	0.01	0.01	0.0	0.04
WNW	0.0	0.0	0.0	0.0	0.01	0.02	0.02	0.03	0.0	0.08
NW	0.0	0.0	0.0	0.0	0.01	0.03	0.02	0.01	0.0	0.07
NNW	0.0	0.0	0.0	0.0	0.01	0.02	0.03	0.0	0.0	0.06
SUBTOTAL	0.0	0.0	0.0	0.03	0.11	0.17	0.08	0.05	0.0	0.44

TOTAL HOURS OF VALID OBSERVATIONS 25482.0
TOTAL HOURS OF GROUND LEVEL RELEASE 2832.4
TOTAL HOURS OF STABILITY CLASS C 259.0
TOTAL HOURS OF GROUND LEVEL STABILITY CLASS C 106.3

METEOROLOGICAL FACILITY:METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON DELTA-T BETWEEN 10.03 AND 45.30 METERS
WIND DIRECTION MEASURED AT 10.42 METER LEVEL
EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.3
(Sheet 12 of 22)

SPLIT JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS D (-1.5 < DELTA-T≤ -0.5°C/100 M)
BROWNS FERRY NUCLEAR PLANT
PART 1 OF 2 GROUND LEVEL RELEASE MODE
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.0	0.01	0.04	0.15	0.10	0.01	0.0	0.31
NNE	0.0	0.0	0.0	0.01	0.05	0.18	0.05	0.01	0.0	0.30
NE	0.0	0.0	0.0	0.01	0.04	0.08	0.0	0.0	0.0	0.13
ENE	0.0	0.0	0.0	0.01	0.01	0.01	0.0	0.0	0.0	0.03
E	0.0	0.0	0.0	0.01	0.02	0.01	0.0	0.0	0.0	0.04
ESE	0.0	0.0	0.0	0.03	0.04	0.01	0.0	0.0	0.0	0.08
SE	0.0	0.0	0.01	0.11	0.13	0.06	0.0	0.0	0.0	0.31
SSE	0.0	0.0	0.02	0.09	0.06	0.05	0.02	0.0	0.0	0.24
S	0.0	0.0	0.02	0.09	0.06	0.06	0.0	0.0	0.0	0.23
SSW	0.0	0.0	0.01	0.02	0.01	0.01	0.0	0.0	0.0	0.05
SW	0.0	0.0	0.0	0.01	0.01	0.0	0.01	0.0	0.0	0.03
WSW	0.0	0.0	0.0	0.03	0.03	0.06	0.04	0.0	0.0	0.16
W	0.0	0.0	0.0	0.02	0.06	0.10	0.09	0.02	0.0	0.29
WNW	0.0	0.0	0.0	0.0	0.03	0.16	0.19	0.14	0.01	0.53
NW	0.0	0.0	0.0	0.0	0.03	0.15	0.23	0.10	0.02	0.53
NNW	0.0	0.0	0.0	0.01	0.05	0.25	0.19	0.04	0.0	0.54
SUBTOTAL	0.0	0.0	0.6	0.46	0.67	1.34	0.92	0.32	0.03	3.80

TOTAL HOURS OF VALID OBSERVATIONS	25482.0
TOTAL HOURS OF GROUND LEVEL RELEASE	2832.4
TOTAL HOURS OF STABILITY CLASS D	13904.1
TOTAL HOURS OF GROUND LEVEL STABILITY CLASS D	968.6

METEOROLOGICAL FACILITY:METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON DELTA-T BETWEEN 10.03 AND 45.30 METERS
WIND DIRECTION MEASURED AT 10.42 METER LEVEL
EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.3
(Sheet 13 of 22)

SPLIT JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS E (-0.5<DELTA-T≤ 1.5°C/100 M)
BROWNS FERRY NUCLEAR PLANT
PART 1 OF 2 GROUND LEVEL RELEASE MODE
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.0	0.04	0.06	0.07	0.02	0.01	0.0	0.20
NNE	0.0	0.0	0.01	0.06	0.07	0.08	0.02	0.0	0.0	0.24
NE	0.0	0.0	0.01	0.06	0.06	0.05	0.01	0.0	0.0	0.19
ENE	0.0	0.0	0.02	0.04	0.03	0.01	0.01	0.0	0.0	0.11
E	0.0	0.0	0.02	0.07	0.02	0.01	0.0	0.0	0.0	0.12
ESE	0.0	0.0	0.02	0.08	0.07	0.03	0.0	0.0	0.0	0.20
SE	0.0	0.0	0.08	0.22	0.16	0.18	0.02	0.0	0.0	0.66
SSE	0.0	0.0	0.05	0.12	0.12	0.19	0.04	0.0	0.0	0.52
S	0.0	0.0	0.06	0.10	0.09	0.27	0.13	0.01	0.0	0.66
SSW	0.0	0.0	0.02	0.02	0.02	0.02	0.01	0.0	0.0	0.09
SW	0.0	0.0	0.01	0.0	0.0	0.01	0.0	0.0	0.0	0.02
WSW	0.0	0.0	0.01	0.05	0.02	0.03	0.02	0.0	0.0	0.13
W	0.0	0.0	0.01	0.06	0.05	0.05	0.01	0.0	0.0	0.18
WNW	0.0	0.0	0.0	0.01	0.01	0.04	0.02	0.01	0.0	0.09
NW	0.0	0.0	0.0	0.01	0.02	0.04	0.03	0.01	0.0	0.11
NNW	0.0	0.0	0.0	0.03	0.07	0.10	0.02	0.01	0.0	0.23
SUBTOTAL	0.0	0.0	0.32	0.97	0.87	1.18	0.36	0.05	0.0	3.75

TOTAL HOURS OF VALID OBSERVATIONS 25482.0
TOTAL HOURS OF GROUND LEVEL RELEASE 2832.4
TOTAL HOURS OF STABILITY CLASS E 7920.6
TOTAL HOURS OF GROUND LEVEL STABILITY CLASS E 957.9

METEOROLOGICAL FACILITY:METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON DELTA-TBETWEEN 10.03 AND 45.30 METERS
WIND DIRECTION MEASURED AT THE 10.42 METER LEVEL
WIND SPEED MEASURED AT 10.42 METER LEVEL
EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.3
(Sheet 14 of 22)

SPLIT JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS F (1.5 < DELTA-T≤ 4.0°C/100 M)
PART 1 OF 2 GROUND LEVEL RELEASE MODE
BROWNS FERRY NUCLEAR PLANT

JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.01	0.06	0.04	0.01	0.0	0.0	0.0	0.12
NNE	0.0	0.0	0.01	0.08	0.05	0.02	0.0	0.0	0.0	0.16
NE	0.0	0.0	0.01	0.03	0.03	0.0	0.0	0.0	0.0	0.07
ENE	0.0	0.0	0.02	0.03	0.01	0.0	0.0	0.0	0.0	0.06
E	0.0	0.0	0.01	0.04	0.0	0.0	0.0	0.0	0.0	0.05
ESE	0.0	0.0	0.02	0.02	0.0	0.0	0.0	0.0	0.0	0.04
SE	0.0	0.0	0.05	0.06	0.03	0.06	0.01	0.0	0.0	0.21
SSE	0.0	0.0	0.04	0.06	0.05	0.18	0.02	0.01	0.0	0.36
S	0.0	0.0	0.02	0.03	0.04	0.11	0.01	0.0	0.0	0.21
SSW	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.01
SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.01
WNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NNW	0.0	0.0	0.01	0.03	0.02	0.01	0.0	0.0	0.0	0.07
SUBTOTAL	0.0	0.0	0.21	0.45	0.27	0.39	0.04	0.01	0.0	1.37

TOTAL HOURS OF VALID OBSERVATIONS	25482.0
TOTAL HOURS OF GROUND LEVEL RELEASE	2832.4
TOTAL HOURS OF STABILITY CLASS F	2385.0
TOTAL HOURS OF GROUND LEVEL STABILITY CLASS F	357.0

METEOROLOGICAL FACILITY:METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON DELTA-T BETWEEN 10.03 AND 45.30 METERS
WIND SPEED MEASURED AT THE 10.42 METER LEVEL
EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.3
(Sheet 15 of 22)

SPLIT JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS G (DELTA-T> 4.0°C/100 M)
PART 1 OF 2 GROUND LEVEL RELEASE MODE
BROWNS FERRY NUCLEAR PLANT

JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.02	0.04	0.0	0.0	0.0	0.0	0.0	0.06
NNE	0.0	0.0	0.02	0.06	0.03	0.0	0.0	0.0	0.0	0.11
NE	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.02
ENE	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.02
E	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.02
ESE	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.01
SE	0.0	0.0	0.03	0.01	0.01	0.02	0.0	0.0	0.0	0.07
SSE	0.0	0.0	0.04	0.05	0.03	0.06	0.0	0.0	0.0	0.18
S	0.0	0.0	0.01	0.02	0.02	0.01	0.0	0.0	0.0	0.06
SSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NNW	0.0	0.0	0.01	0.01	0.08	0.0	0.0	0.0	0.0	0.02
SUBTOTAL	0.0	0.0	0.17	0.22	0.09	0.09	0.0	0.0	0.0	0.57

TOTAL HOURS OF VALID OBSERVATIONS	25482.0
TOTAL HOURS OF GROND LEVEL RELEASE	2832.4
TOTAL HOURS OF STABILITY CLASS G	694.7
TOTAL HOURS OF GROUD LEVEL STABILITY CLASS G	151.7

METEOROLOGICAL FACILITY:METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON LAPSE RATE MEASURED BETWEEN 10.03 AND 45.30 METERS
WIND SPEED AND DIRECTION MEASURED AT THE 10.42 METER LEVEL

EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.3
(Sheet 16 of 22)

SPLIT JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS A (DELTA-T≤ -1.9°C/100 M)
PART 2 OF 2 ELEVATED RELEASE MODE
BROWNS FERRY NUCLEAR PLANT
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH)									
	CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NNE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SSW	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.01
SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUBTOTAL	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.01

TOTAL HOURS OF VALID OBSERVATIONS	25482.0
TOTAL HOURS OF ELEVATED RELEASES	22649.6
TOTAL HOURS OF STABILITY CLASS A	133.1
TOTAL HOURS OF ELEVATED STABILITY CLASS A	5.6

METEOROLOGICAL FACILITY:METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON DELTA-T BETWEEN 45.30 AND 89.60 METERS
WIND DIRECTION MEASURED AT 45.67 METER LEVEL
WIND SPEED MEASURED AT 45.67 METER LEVEL
EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.3
(Sheet 17 of 22)

SPLIT JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS B (-1.9 < DELTA-T≤ -1.7°C/100 M)
BROWNS FERRY NUCLEAR PLANT
PART 2 OF 2 ELEVATED RELEASE MODE
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NNE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SE	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.02
SSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SSW	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.01
SW	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.01
WSW	0.0	0.0	0.0	0.0	0.0	0.02	0.0	0.0	0.0	0.02
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUBTOTAL	0.0	0.0	0.01	0.01	0.01	0.03	0.0	0.0	0.0	0.06

TOTAL HOURS OF VALID OBSERVATIONS	25482.0
TOTAL HOURS OF ELEVATED RELEASES	22649.6
TOTAL HOURS OF STABILITY CLASS B	185.1
TOTAL HOURS OF ELEVATED STABIITY CLASS B	21.8

METEOROLOGICAL FACILITY: METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON DELTA-T BETWEEN 45.30 AND 89.60 METERS
WIND DIRECTION MEASURED AT 45.67 METER LEVEL
WIND SPEED MEASURED AT 45.67 METER LEVEL
EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.3
(Sheet 18 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS C (-1.7 < DELTA-T≤ -1.5°C/100 M)
BROWNS FERRY NUCLEAR PLANT
PART 2 OF 2 ELEVATED RELEASE MODE
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NNE	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.01
NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESE	0.0	0.0	0.0	0.01	0.01	0.01	0.0	0.0	0.0	0.03
SE	0.0	0.0	0.02	0.05	0.01	0.0	0.0	0.0	0.0	0.08
SSE	0.0	0.0	0.0	0.04	0.0	0.0	0.0	0.0	0.0	0.04
S	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.02
SSW	0.0	0.0	0.0	0.02	0.02	0.01	0.0	0.0	0.0	0.05
SW	0.0	0.0	0.0	0.05	0.05	0.02	0.01	0.0	0.0	0.13
WSW	0.0	0.0	0.0	0.0	0.03	0.05	0.01	0.0	0.0	0.09
W	0.0	0.0	0.0	0.0	0.01	0.03	0.02	0.02	0.0	0.08
WNW	0.0	0.0	0.0	0.0	0.0	0.02	0.02	0.0	0.0	0.04
NW	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	0.0	0.01
NNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUBTOTAL	0.0	0.0	0.03	0.18	0.14	0.14	0.07	0.02	0.0	0.58

TOTAL HOURS OF VALID OBSERVATIONS	25482.0
TOTAL HOURS OF ELEVATED RELEASES	22649.6
TOTAL HOURS OF STABILITY CLASS C	259.0
TOTAL HOURS OF ELEVATED STABILITY CLASS C	152.7

METEOROLOGICAL FACILITY: METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON DELTA-T BETWEEN 45.30 AND 89.60 METERS
WIND SPEED AND DIRECTION MEASURED AT THE 45.67 METER LEVEL
EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.3
(Sheet 19 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS D (-1.5 < DELTA-T≤ -0.5°C/100 M)
BROWNS FERRY NUCLEAR PLANT
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH)									
	CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.12	0.40	0.62	1.49	0.87	0.12	0.0	3.62
NNE	0.0	0.01	0.13	0.46	0.72	1.88	0.91	0.05	0.0	4.16
NE	0.0	0.0	0.09	0.36	0.48	1.04	0.14	0.02	0.0	2.13
ENE	0.0	0.01	0.11	0.24	0.23	0.23	0.04	0.01	0.0	0.87
E	0.0	0.01	0.10	0.20	0.28	0.25	0.05	0.01	0.0	0.80
ESE	0.0	0.01	0.22	0.52	0.68	1.07	0.16	0.0	0.0	2.66
SE	0.0	0.01	0.67	1.66	0.89	1.75	0.84	0.16	0.01	5.99
SSE	0.0	0.01	0.48	0.90	0.63	1.49	1.08	0.26	0.02	4.87
S	0.0	0.0	0.34	0.99	0.67	0.99	0.93	0.33	0.02	4.27
SSW	0.0	0.01	0.20	0.52	0.37	0.69	0.34	0.11	0.0	2.24
SW	0.0	0.01	0.24	0.79	0.43	0.49	0.32	0.05	0.0	2.33
WSW	0.0	0.02	0.16	0.51	0.57	0.57	0.27	0.08	0.0	2.18
W	0.0	0.0	0.07	0.36	0.80	1.34	0.55	0.16	0.01	3.29
WNW	0.0	0.0	0.09	0.33	0.48	1.25	0.94	0.32	0.01	3.42
NW	0.0	0.0	0.07	0.36	0.55	1.40	1.44	0.37	0.01	4.20
NNW	0.0	0.0	0.09	0.29	0.53	1.36	1.15	0.19	0.0	3.61
SUBTOTAL	0.0	0.10	3.18	8.89	8.93	17.29	10.03	2.24	0.08	50.74

TOTAL HOURS OF VALID OBSERVATIONS 25482.0
TOTAL HOURS OF ELEVATED RELEASES 22649.6
TOTAL HOURS OF STABILITY CLASS D 13904.1
TOTAL HOURS OF ELEVATED STABILITY CLASS D 12935.5

METEOROLOGICAL FACILITY: METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON DELTA-T BETWEEN 45.30 AND 89.60 METERS
WIND SPEED AND DIRECTION MEASURED AT THE 45.67 METER LEVEL
EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.3
(Sheet 20 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS E (-0.5 < DELTA-T≤ 1.5°C/100 M)
BROWNS FERRY NUCLEAR PLANT
PART 2 of 2 ELEVATED RELEASE MODE
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH)									
	CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.13	0.22	0.31	0.80	0.15	0.0	0.0	1.61
NNE	0.0	0.0	0.15	0.24	0.39	1.04	0.28	0.0	0.0	2.10
NE	0.0	0.01	0.11	0.25	0.39	0.88	0.18	0.0	0.0	1.82
ENE	0.0	0.0	0.20	0.21	0.33	0.39	0.10	0.0	0.0	1.23
E	0.0	0.0	0.09	0.24	0.30	0.55	0.06	0.0	0.0	1.24
ESE	0.0	0.01	0.29	0.58	0.86	1.10	0.09	0.01	0.0	2.94
SE	0.0	0.02	0.41	1.04	1.02	1.37	0.55	0.08	0.01	4.50
SSE	0.0	0.01	0.23	0.60	0.54	0.87	0.59	0.14	0.01	2.99
S	0.0	0.01	0.14	0.49	0.32	0.70	0.34	0.05	0.0	2.05
SSW	0.0	0.0	0.11	0.28	0.30	0.48	0.19	0.01	0.0	1.37
SW	0.0	0.01	0.17	0.27	0.28	0.29	0.09	0.0	0.0	1.11
WSW	0.0	0.01	0.12	0.25	0.24	0.28	0.06	0.0	0.0	0.96
W	0.0	0.0	0.09	0.19	0.26	0.34	0.05	0.0	0.0	0.93
WNW	0.0	0.0	0.06	0.13	0.11	0.20	0.04	0.01	0.0	0.55
NW	0.0	0.0	0.09	0.14	0.13	0.31	0.08	0.0	0.0	0.75
NNW	0.0	0.0	0.12	0.21	0.16	0.52	0.16	0.0	0.0	1.17
SUBTOTAL	0.0	0.08	2.51	5.34	5.94	10.12	3.01	0.30	0.02	27.32

TOTAL HOURS OF VALID OBSERVATIONS 25482.0
TOTAL HOURS OF ELEVATED RELEASES 22649.6
TOTAL HOURS OF STABILITY CLASS E 7920.9
TOTAL HOURS OF ELEVATED STABILITY CLASS E 6962.9

METEOROLOGICAL FACILITY: METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON DELTA-T BETWEEN 45.30 AND 89.60 METERS
WIND SPEED AND DIRECTION MEASURED AT THE 45.67 METER LEVEL
EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.3
(Sheet 21 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS F (1.5 < DELTA-T≤ 4.0°C/100 M)
BROWNS FERRY NUCLEAR PLANT
PART 2 of 2 ELEVATED RELEASE MODE
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.03	0.08	0.06	0.34	0.05	0.0	0.0	0.56
NNE	0.0	0.0	0.04	0.06	0.11	0.42	0.21	0.0	0.0	0.54
NE	0.0	0.0	0.04	0.10	0.15	0.40	0.12	0.0	0.0	0.81
ENE	0.0	0.0	0.04	0.11	0.11	0.29	0.07	0.0	0.0	0.62
E	0.0	0.0	0.03	0.07	0.11	0.32	0.02	0.0	0.0	0.55
ESE	0.0	0.0	0.13	0.26	0.24	0.24	0.0	0.0	0.0	0.87
SE	0.0	0.0	0.13	0.38	0.30	0.19	0.0	0.0	0.0	1.00
SSE	0.0	0.0	0.09	0.11	0.12	0.14	0.03	0.0	0.0	0.49
S	0.0	0.0	0.08	0.11	0.13	0.21	0.03	0.0	0.0	0.56
SSW	0.0	0.0	0.04	0.12	0.14	0.24	0.01	0.0	0.0	0.55
SW	0.0	0.0	0.04	0.09	0.10	0.06	0.0	0.0	0.0	0.29
WSW	0.0	0.0	0.03	0.07	0.06	0.05	0.0	0.0	0.0	0.21
W	0.0	0.01	0.04	0.04	0.05	0.04	0.0	0.0	0.0	0.18
WNW	0.0	0.0	0.02	0.04	0.01	0.01	0.0	0.0	0.0	0.08
NW	0.0	0.0	0.03	0.04	0.03	0.02	0.0	0.0	0.0	0.12
NNW	0.0	0.0	0.02	0.02	0.04	0.10	0.0	0.0	0.0	0.18
SUBTOTAL	0.0	0.01	0.83	1.70	1.76	3.07	0.54	0.0	0.0	7.91

TOTAL HOURS OF VALID OBSERVATIONS	25482.0
TOTAL HOURS OF ELEVATED RELEASES	22649.6
TOTAL HOURS OF STABILITY CLASS F	2385.0
TOTAL HOURS OF ELEVATED STABILITY CLASS F	2028.0

METEOROLOGICAL FACILITY: METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON DELTA-T BETWEEN 45.30 AND 89.60 METERS
WIND SPEED AND DIRECTION MEASURED AT THE 45.67 METER LEVEL
EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.3
(Sheet 22 of 22)

JOINT PERCENTAGE FREQUENCIES OF WIND SPEED BY WIND DIRECTION FOR
STABILITY CLASS G (DELTA-T> 4.0°C/100 M)
BROWNS FERRY NUCLEAR PLANT
PART 2 of 2 ELEVATED RELEASE MODE
JAN 1, 77 - DEC 31, 79

WIND DIRECTION	WIND SPEED (MPH) CALM	0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	>=24.5	TOTAL
N	0.0	0.0	0.0	0.0	0.02	0.06	0.01	0.0	0.0	0.09
NNE	0.0	0.0	0.01	0.02	0.04	0.11	0.04	0.0	0.0	0.22
NE	0.0	0.0	0.02	0.02	0.03	0.12	0.02	0.0	0.0	0.21
ENE	0.0	0.0	0.0	0.02	0.02	0.07	0.02	0.0	0.0	0.13
E	0.0	0.0	0.0	0.02	0.01	0.04	0.0	0.0	0.0	0.07
ESE	0.0	0.01	0.05	0.15	0.07	0.01	0.0	0.0	0.0	0.29
SE	0.0	0.0	0.12	0.20	0.13	0.04	0.0	0.0	0.0	0.49
SSE	0.0	0.0	0.03	0.06	0.06	0.02	0.0	0.0	0.0	0.17
S	0.0	0.0	0.02	0.07	0.06	0.01	0.0	0.0	0.0	0.16
SSW	0.0	0.0	0.0	0.02	0.02	0.06	0.0	0.0	0.0	0.10
SW	0.0	0.0	0.01	0.01	0.03	0.02	0.0	0.0	0.0	0.07
WSW	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.01
W	0.0	0.0	0.01	0.0	0.01	0.0	0.0	0.0	0.0	0.02
WNW	0.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.02
NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NNW	0.0	0.0	0.01	0.01	0.0	0.01	0.0	0.0	0.0	0.03
SUBTOTAL	0.0	0.01	0.31	0.60	0.50	0.57	0.09	0.0	0.0	2.08

TOTAL HOURS OF VALID OBSERVATIONS	25482.0
TOTAL HOURS OF ELEVATED RELEASES	22649.6
TOTAL HOURS OF STABILITY CLASS G	694.7
TOTAL HOURS OF ELEVATED STABILITY CLASS G	543.1

METEOROLOGICAL FACILITY: METEOROLOGICAL FACILITY LOCATED 1.3 KM ESE OF BROWNS FERRY NUCLEAR PLANT
STABILITY BASED ON DELTA-T BETWEEN 45.30 AND 89.60 METERS
WIND SPEED AND DIRECTION MEASURED AT THE 45.67 METER LEVEL
EFFLUENT VELOCITY = 12.60 M/S

TABLE 1.4

BFN - OFFSITE RECEPTOR LOCATION DATA

	POINT	SECTOR	DIST. (m)	ELEV. (m)	GROUND LEVEL χ/Q (s/m³)	GROUND LEVEL D/Q (1/m²)	ELEVATED χ/Q (s/m³)	ELEVATED D/Q (1/m²)
1	Site Boundary	N	1525.	7.	1.60E-06	5.64E-09	9.79E-11	8.57E-10
2	Site Boundary	NNE	1300.	4.	7.88E-07	1.97E-09	7.86E-12	5.24E-10
3	Site Boundary	NE	1250.	7.	4.52E-07	1.56E-09	5.91E-12	4.66E-10
4	Site Boundary	ENE	1450.	0.	7.30E-07	2.92E-09	1.37E-11	4.11E-10
5	Site Boundary	E	1375.	0.	8.24E-07	4.04E-09	8.84E-12	4.75E-10
6	Site Boundary	ESE	1575.	0.	4.56E-07	3.28E-09	4.98E-11	5.98E-10
7	Site Boundary	SE	5600.	-6.	7.61E-08	3.63E-10	7.24E-09	3.00E-10
8	Site Boundary	SSE	2875.	-6.	4.86E-07	1.77E-09	1.58E-09	5.59E-10
9	Site Boundary	S	2850.	-6.	8.27E-07	2.24E-09	1.12E-09	6.67E-10
10	Site Boundary	SSW	2425.	-6.	1.08E-06	2.92E-09	9.27E-10	7.07E-10
11	Site Boundary	SW	2300.	-6.	6.87E-07	1.75E-09	5.94E-10	6.06E-10
12	Site Boundary	WSW	2500.	-6.	6.38E-07	1.14E-09	5.34E-10	3.45E-10
13	Site Boundary	W	2550.	-6	6.70E-07	1.25E-09	5.06E-10	2.74E-10
14	Site Boundary	WNW	3325.	-6.	3.69E-07	9.07E-10	2.69E-09	4.75E-10
15	Site Boundary	NW	2275.	-6.	1.69E-06	4.92E-09	1.10E-09	1.24E-09
16	Site Boundary	NNW	1650.	0.	1.84E-06	5.29E-09	1.31E-10	1.05E-09
17	Air Dose Point	NW	5100.	16.	5.42E-07	1.22E-09	2.01E-08	6.30E-10
18	Air Dose Point	NW	5500	16.	4.89E-07	1.06E-09	2.05E-08	5.59E-10
19	Air Dose Point	NW	6100	16.	4.25E-07	8.82E-10	2.08E-08	4.75E-10
20	Air Dose Point	NW	6500.	16.	3.89E-07	7.87E-10	2.08E-08	4.29E-10
21	Air Dose Point	NW	6800.	16.	3.66E-07	7.25E-10	2.07E-08	4.00E-10
22	Air Dose Point	NW	7100.	16.	3.45E-07	6.71E-10	2.05E-08	3.73E-10
23	Resident,Garden	N	1620.	13.	1.46E-06	5.11E-09	2.89E-10	8.98E-10
24	Resident	NNE	2845.	13.	2.46E-07	5.34E-10	3.91E-09	6.14E-10
25	Resident	NE	4075.	13.	7.68E-08	2.13E-10	7.85E-09	3.92E-10
26	Resident,Garden	ENE	1960.	13.	4.61E-07	1.78E-09	5.62E-10	4.79E-10
27	Resident,Garden	E	4437.	19.	1.43E-07	5.54E-10	9.50E-09	3.37E-10
28	Resident	ESE	4655.	-12.	8.82E-08	5.17E-10	5.01E-09	3.62E-10
29	Resident	SE	8100.	0.	4.55E-08	1.87E-10	8.54E-09	1.67E-10
30	Resident,Garden	SSE	7155.	0.	1.39E-07	3.54E-10	7.23E-09	1.75E-10
31	Resident,Garden	S	4460.	0.	3.91E-07	8.54E-10	6.74E-09	4.10E-10
32	Resident,Garden	SSW	4155.	0.	5.24E-07	1.15E-09	6.32E-09	4.66E-10
33	Resident	SW	4896.	7.	2.43E-07	4.74E-10	7.92E-09	3.28E-10
34	Resident,Garden	WSW	4131.	0.	3.24E-07	4.77E-10	3.27E-09	2.31E-10
35	Resident	W	2550.	-24.	6.70E-07	1.25E-09	1.91E-10	2.74E-10
36	Resident,Garden	WNW	4425.	10.	2.48E-07	5.52E-10	7.61E-09	3.45E-10
37	Resident,Garden	NW	3500.	-9.	9.17E-07	2.35E-09	5.87E-09	9.76E-10
38	Resident,Garden	NNW	1650.	-9.	1.84E-06	5.29E-09	5.91E-11	1.05E-09
39	Garden	NE	4475.	13.	6.70E-08	1.81E-10	8.80E-09	3.53E-10
40	Garden	NNE	2980.	0	2.30E-07	4.93E-10	2.68E-09	6.07E-10
41	Garden	SW	5430.	0.	2.12E-07	3.93E-10	7.28E-09	2.79E-10
42	Garden	W	2675	0.	6.27E-07	1.15E-09	8.56E-10	2.72E-10
43	Milk Cow Child	N	8045.	0.	1.47E-07	3.16E-10	1.25E-08	2.30E-10
44	Milk Cow Infant	ENE	9450	21.	4.71E-08	1.14E-10	8.42E-09	8.94E-11
45	Milk Cow Child	NNW	10975	30.	1.32E-07	1.97E-10	1.69E-08	1.65E-10
46	Goat Child	NE	10975	0.	1.86E-08	3.70E-11	7.77E-09	9.04E-11

TABLE 1.5

DOSE FACTORS FOR SUBMERSION IN NOBLE GASES

	DFB^a	DF^b_λ	DFS^a	DF^b_β
Kr-85m	1.17E+03[c]	1.21E+03	1.46E+03	3.86E+03
Kr-85	1.61E+01	1.69E+01	1.34E+03	3.83E+03
Kr-87	5.92E+03	6.05E+03	9.73E+03	2.01E+04
Kr-88	1.47E+04	1.50E+04	2.37E+03	5.72E+03
Kr-88+D	---	2.02E+04	---	3.72E+04
Kr-89	1.66E+04	1.59E+04	1.01E+04	1.88E+04
Xe-131m	9.15E+01	1.53E+02	4.76E+02	2.18E+03
Xe-133m	2.51E+02	3.17E+02	9.94E+02	2.90E+03
Xe-133	2.94E+02	3.46E+02	3.06E+02	2.06E+03
Xe-135m	3.12E+03	3.30E+03	7.11E+02	1.45E+03
Xe-135	1.81E+03	1.88E+03	1.86E+03	4.84E+03
Xe-137	1.42E+03	1.48E+03	1.22E+04	2.50E+04
Xe-138	8.83E+03	9.00E+03	4.13E+03	9.25E+03
Xe-138+D	---	2.65E+04	---	2.81E+04
Ar-41	8.84E+03	9.76E+03	2.69E+03	5.54E+03

---

a mrem/yr per $\mu Ci/m^3$
b mrad/yr per $\mu Ci/m^3$
c 1.17E+03 = 1.17 X 10^3.

TABLE 1.6

NUCLIDE SPECIFIC TRANSFER DATA*
(Sheet 1 of 2)

	NUCLIDE	RETENTION*	$B_{iv}(\frac{veg.}{soil})$**	$FM_i(\frac{d}{L})$***
1	Tritium	4.70E-01	4.80E+00	1.30E-02
2	C-14	4.70E-01	5.50E+00	1.20E-02
3	N-13	4.70E-01	7.50E+00	2.20E-02
4	O-19	4.70E-01	1.60E+00	2.00E-02
5	F-18	4.70E-01	6.50E-04	1.40E-02
6	Na-24	4.70E-01	5.20E-02	4.00E-02
7	P-32	4.70E-01	1.10E+00	2.50E-02
8	Ar-41	4.70E-01	6.00E-01	2.00E-02
9	Cr-51	4.70E-01	2.50E-04	2.20E-03
10	Mn-54	4.70E-01	2.90E-02	2.50E-04
11	Mn-56	4.70E-01	2.90E-02	2.50E-04
12	Fe-59	4.70E-01	6.60E-04	1.20E-03
13	Co-58	4.70E-01	9.40E-03	1.00E-03
14	Co-60	4.70E-01	9.40E-03	1.00E-03
15	Zn-69m	4.70E-01	4.00E-01	3.90E-02
16	Zn-69	4.70E-01	4.00E-01	3.90E-02
17	Br-84	4.70E-01	7.60E-01	5.00E-02
18	Br-85	4.70E-01	7.60E-01	5.00E-02
19	Kr-85m	4.70E-01	3.00E+00	2.00E-02
20	Kr-85	4.70E-01	3.00E-00	2.00E-02
21	Kr-87	4.70E-01	3.00E-00	2.00E-02
22	Kr-88	4.70E-01	3.00E-00	2.00E-02
23	Kr-89	4.70E-01	3.00E-00	2.00E-02
24	Rb-88	4.70E-01	1.30E-01	3.00E-02
25	Rb-89	4.70E-01	1.30E-01	3.00E-02
26	Sr-89	4.70E-01	1.70E-02	1.40E-03
27	Sr-90	4.70E-01	1.70E-02	1.40E-03
28	Sr-91	4.70E-01	1.70E-02	1.40E-03
29	Sr-92	4.70E-01	1.70E-02	1.40E-03
30	Sr-93	4.70E-01	1.70E-02	1.40E-03
31	Y-90	4.70E-01	2.60E-03	1.00E-05
32	Y-91m	4.70E-01	2.60E-03	1.00E-05
33	Y-91	4.70E-01	2.60E-03	1.00E-05
34	Y-92	4.70E-01	2.60E-03	1.00E-05
35	Y-93	4.70E-01	2.60E-03	1.00E-05
36	Zr-95	4.70E-01	1.70E-04	5.00E-06
37	Nb-95m	4.70E-01	9.40E-03	2.50E-03
38	Nb-95	4.70E-01	9.40E-03	2.50E-03
39	Mo-99	4.70E-01	1.20E-01	7.50E-03
40	Tc-99m	4.70E-01	2.50E-01	2.50E-02
41	Tc-99	4.70E-01	2.50E-01	2.50E-02
42	Tc-104	4.70E-01	2.50E-01	2.50E-02
43	Ru-106	4.70E-01	5.00E-02	1.00E-06
44	Te-132	4.70E-01	1.30E+00	1.00E-03
45	I-129	4.70E-01	2.00E-02	1.20E-02
46	I-131	4.70E-01	2.00E-02	1.20E-02
47	MI-131	4.70E-01	2.00E-02	1.20E-02

TABLE 1.6

NUCLIDE SPECIFIC TRANSFER DATA*
(Sheet 2 of 2)

	NUCLIDE	RETENTION*	$B_{iv}(\frac{veg.}{soil})$ **	$FM_i(\frac{d}{L})$ ***
48	I-132	4.70E-01	2.00E-02	1.20E-02
49	MI-132	4.70E-01	2.00E-02	1.20E-02
50	I-133	4.70E-01	2.00E-02	1.20E-02
51	MI-133	4.70E-01	2.00E-02	1.20E-02
52	I-134	4.70E-01	2.00E-02	1.20E-02
53	MI-134	4.70E-01	2.00E-02	1.20E-02
54	I-135	4.70E-01	2.00E-02	1.20E-02
55	MI-135	4.70E-01	2.00E-02	1.20E-02
56	Xe-131m	4.70E-01	1.00E+01	2.00E-02
57	Xe-133m	4.70E-01	1.00E+01	2.00E-02
58	Xe-133	4.70E-01	1.00E+01	2.00E-02
59	Xe-135m	4.70E-01	1.00E+01	2.00E-02
60	Xe-135	4.70E-01	1.00E+01	2.00E-02
61	Xe-137	4.70E-01	1.00E+01	2.00E-02
62	Xe-138	4.70E-01	1.00E+01	2.00E-02
63	Cs-134	4.70E-01	1.00E-02	8.00E-03
64	Cs-135	4.70E-01	1.00E-02	8.00E-03
65	Cs-136	4.70E-01	1.00E-02	8.00E-03
66	Cs-137	4.70E-01	1.00E-02	8.00E-03
67	Cs-138	4.70E-01	1.00E-02	8.00E-03
68	Ba-139	4.70E-01	5.00E-03	4.00E-04
69	Ba-140	4.70E-01	5.00E-03	4.00E-04
70	La-140	4.70E-01	2.50E-03	5.00E-06
71	Ce-144	4.70E-01	2.50E-03	1.00E-04
72	Pr-143	4.70E-01	2.50E-03	5.00E-06
73	Pr-144	4.70E-01	2.50E-03	5.00E-06
74	Np-239	4.70E-01	2.50E-03	5.00E-06

*Reference: NUREG/CR-1004
**Reference: Regulatory Guide 1.109
***Reference: NUREG/CR-1004 for Iodine, Strontium, and Cesium; R.G. 1.109 for all other nuclides.

TABLE 1.7

EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND
(mrem/h per pCi/m²)
(Sheet 1 of 2)

Element	Total Body (DFG_i)	Skin
H-3	0.0	0.0
C-14	0.0	0.0
Na-24	2.50E-08	2.90E-08
P-32	0.0	0.0
Cr-51	2.20E-10	2.60E-10
Mn-54	5.80E-09	6.80E-09
Mn-56	1.10E-08	1.30E-08
Fe-55	0.0	0.0
Fe-59	8.00E-09	9.40E-09
Co-58	7.00E-09	8.20E-09
Co-60	1.70E-08	2.00E-08
Ni-63	0.0	0.0
Ni-65	3.70E-09	4.30E-09
Cu-64	1.50E-09	1.70E-09
Zn-65	4.00E-09	4.60E-09
Zn-69	0.0	0.0
Br-83	6.40E-11	9.30E-11
Br-84	1.20E-08	1.40E-08
Br-85	0.0	0.0
Rb-86	6.30E-10	7.20E-10
Rb-88	3.50E-09	4.00E-09
Rb-89	1.50E-08	1.80E-08
Sr-89	5.60E-13	6.50E-13
Sr-91	7.10E-09	8.30E-09
Sr-92	9.00E-09	1.00E-08
Y-90	2.20E-12	2.60E-12
Y-91M	3.80E-09	4.40E-09
Y-91	2.40E-11	2.70E-11
Y-92	1.60E-09	1.90E-09
Y-93	5.70E-10	7.80E-10
Zr-95	5.00E-09	5.80E-09
Zr-97	5.50E-09	6.40E-09
Nb-95	5.10E-09	6.00E-09
Mo-99	1.90E-09	2.20E-09
Tc-99M	9.60E-10	1.10E-09
Tc-101	2.70E-09	3.00E-09
Ru-103	3.60E-09	4.20E-09
Ru-105	4.50E-09	5.10E-09
Ru-106	1.50E-09	1.80E-09
Ag-110M	1.80E-08	2.10E-08
Te-125M	3.50E-11	4.80E-11
Te-127M	1.10E-12	1.30E-12
Te-127	1.00E-11	1.10E-11
Te-129M	7.70E-10	9.00E-10
Te-129	7.10E-10	8.40E-10
Te-131M	8.40E-09	9.90E-09
Te-131	2.20E-09	2.60E-06

TABLE 1.7

EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND
(mrem/h per pCi/m²)
(Sheet 2 of 2)

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

TABLE 2.1

DOSE COMMITMENT FACTORS—(REM/MICROCI)

(Sheet 1 of 4)

NUCLIDE	HALF-LIFE (DAYS)	ADULT					CHILD				
		BONE	GI TRACT	THYROID	TOTAL BODY	LIVER	BONE	GI TRACT	THYROID	TOTAL BODY	LIVER
H-3	4.50E+03	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.05E-04	2.03E-04	2.03E-04	2.03E-04	2.03E-04	2.03E-04
C-14	2.08E+06	2.84E-03	5.68E-04	5.68E-04	5.68E-04	5.68E-04	1.21E-02	2.42E-03	2.42E-03	2.42E-03	2.42E-03
Na-22	9.49E+02	2.50E-02	1.35E-02	1.21E-02	1.36E-02	1.40E-02	2.50E-02	1.35E-02	1.21E-02	1.36E-02	1.40E-02
Na-24	6.26E-01	1.70E-03	1.70E-03	1.70E-03	1.70E-03	1.70E-03	5.80E-03	5.80E-03	5.80E-03	5.80E-03	5.80E-03
P-32	1.43E+01	1.93E-01	2.17E-02	7.46E-03	7.46E-03	1.20E-02	8.25E-01	2.28E-02	3.18E-02	3.18E-02	3.86E-02
Cr-51	2.77E+01	2.66E-06	6.68E-04	1.59E-16	2.66E-06	2.66E-06	8.90E-06	4.72E-04	4.94E-06	8.90E-06	8.90E-06
Mn-54	3.12E+02	8.72E-04	1.40E-02	8.72E-04	8.72E-04	4.57E-03	2.85E-03	8.98E-03	2.85E-03	2.85E-03	1.07E-02
Mn-56	1.08E-01	2.04E-05	3.67E-03	2.04E-05	2.04E-05	1.15E-04	7.54E-05	4.84E-02	7.54E-05	7.54E-05	3.34E-04
Fe-55	9.86E+02	2.75E-03	1.09E-03	4.43E-04	4.43E-04	1.90E-03	1.15E-02	1.13E-03	1.89E-03	1.89E-03	6.10E-03
Fe-59	4.46E+01	4.34E-03	3.40E-02	3.91E-03	3.91E-03	1.02E-02	1.65E-02	2.78E-02	1.33E-02	1.33E-02	2.67E-02
Co-57	2.71E+02	3.57E-04	4.56E-03	1.10E-04	1.84E-04	2.53E-04	3.57E-04	4.56E-03	1.10E-04	1.84E-04	2.53E-04
Co-58	7.08E+01	1.67E-03	1.51E-02	1.67E-03	1.67E-03	7.45E-04	5.51E-03	1.05E-02	5.51E-03	5.51E-03	1.80E-03
Co-60	1.92E+03	4.72E-03	4.02E-02	4.72E-03	4.72E-03	2.14E-03	1.56E-02	2.93E-02	1.56E-02	1.56E-02	5.29E-03
Ni-63	3.65E+04	1.30E-01	1.88E-03	4.36E-03	4.36E-03	9.01E-03	5.38E-01	1.94E-03	1.83E-02	1.83E-02	2.88E-02
Ni-65	1.05E-01	5.28E-04	1.74E-03	3.13E-05	3.13E-05	6.86E-05	2.22E-03	2.56E-02	1.22E-04	1.22E-04	2.09E-04
Cu-64	5.30E-01	3.91E-05	7.10E-03	3.91E-05	3.91E-05	8.33E-05	1.48E-04	1.15E-02	1.48E-04	1.48E-04	2.45E-04
Zn-65	2.44E+02	4.84E-03	9.70E-03	6.86E-03	6.96E-03	1.54E-02	1.37E-02	6.41E-03	2.27E-03	2.27E-03	3.65E-02
Zn-69	3.96E-02	1.03E-05	2.96E-06	1.37E-06	1.37E-06	1.97E-05	4.38E-05	3.99E-03	5.85E-06	5.85E-06	6.33E-05
As-74	1.78E+01	2.90E-04	3.88E-02	2.90E-04	2.90E-04	2.51E-04	2.90E-04	3.88E-02	2.90E-04	2.90E-04	2.51E-04
As-76	1.10E+00	4.49E-05	9.70E-02	4.49E-05	4.49E-05	4.70E-05	4.49E-05	9.70E-02	4.49E-05	4.49E-05	4.70E-05
Br-83	1.00E-01	4.02E-05	5.79E-05	4.02E-05	4.02E-05	4.02E-05	1.71E-04	0.00E+00	1.71E-04	1.71E-04	1.71E-04
Br-84	2.21E-02	5.21E-05	4.09E-10	5.21E-05	5.21E-05	5.21E-05	1.98E-04	0.00E+00	1.98E-04	1.98E-04	1.98E-04
Br-85	1.99E-03	2.14E-06	1.00E-21	2.14E-06	2.14E-06	2.14E-06	9.12E-06	0.00E+00	9.12E-06	9.12E-06	9.12E-06
Kr-839	7.75E-02	0.00E+00	1.46E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E-04	0.00E+00	0.00E+00	0.00E+00
Kr-85m	1.87E-01	0.00E+00	3.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.30E-03	0.00E+00	0.00E+00	0.00E+00
Kr-85	3.91E+03	0.00E+00	4.62E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.62E-02	0.00E+00	0.00E+00	0.00E+00
Rb-86	1.87E+01	9.83E-03	4.16E-03	9.83E-03	9.83E-03	2.11E-02	4.12E-02	4.31E-03	4.12E-02	4.12E-02	6.70E-02
Rb-88	1.23E-02	3.21E-05	8.36E-16	3.21E-05	3.21E-05	6.05E-05	1.32E-04	9.32E-06	1.32E-04	1.32E-04	1.90E-04
Rb-89	1.07E-02	2.82E-05	2.33E-18	2.82E-05	2.82E-05	4.01E-05	1.04E-04	1.02E-06	1.04E-04	1.04E-04	1.17E-04
Sr-89	5.05E+01	3.08E-01	4.94E-02	8.84E-03	8.84E-03	8.84E-03	1.32E+00	5.11E-02	3.77E-02	3.77E-02	3.77E-02
Sr-90	1.06E+04	7.58E+00	2.19E-01	1.86E+00	1.86E+00	1.86E+00	1.70E+01	2.29E-01	4.31E+00	4.31E+00	4.31E+00
Sr-91	3.97E-01	5.67E-03	2.70E-02	2.29E-04	2.29E-04	2.29E-04	2.40E-02	5.30E-02	9.06E-04	9.06E-04	9.06E-04
Sr-92	1.13E-01	2.15E-03	4.26E-02	9.30E-05	9.30E-05	4.30E-05	9.03E-03	1.71E-01	3.62E-04	3.62E-04	3.62E-04
Y-90	2.67E+00	9.62E-06	1.02E-01	2.58E-07	2.58E-07	2.58E-07	4.11E-05	1.17E-01	1.10E-06	1.10E-06	1.10E-06
Y-91	5.86E+01	1.41E-04	7.76E-02	3.77E-06	3.77E-06	3.77E-06	6.02E-04	8.02E-02	1.61E-05	1.61E-05	1.61E-05

TABLE 2.1

DOSE COMMITMENT FACTORS--(REM|MICROCI)

(Sheet 2 of 4)

NUCLIDE	HALF-LIFE (DAYS)	ADULT					CHILD				
		BONE	GI TRACT	THYROID	TOTAL BODY	LIVER	BONE	GI TRACT	THYROID	TOTAL BODY	LIVER
Y-91M	3.45E-02	9.09E-08	2.67E-07	3.52E-09	3.52E-09	3.52E-09	3.82E-07	7.48E-04	1.39E-08	1.39E-08	1.39E-08
Y-92	1.48E-01	1.48E-02	2.47E-08	2.47E-08	2.47E-08	2.47E-08	3.60E-06	1.04E-01	1.03E-07	1.03E-07	1.03E-07
Y-93	4.21E-01	2.68E-06	8.50E-02	7.40E-08	7.40E-08	7.40E-08	1.14E-05	1.70E-01	3.13E-07	3.13E-07	3.13E-07
Zr-95	6.40E+01	3.04E-05	3.09E-02	6.60E-06	6.60E-06	9.75E-06	1.16E-04	2.66E-02	2.27E-05	2.27E-05	2.55E-05
Zr-97	7.00E-01	1.68E-06	1.05E-01	1.55E-07	1.55E-07	3.39E-07	6.99E-06	1.53E-01	5.96E-07	5.96E-07	1.01E-06
Nb-95	3.50E+00	6.22E-06	2.10E-02	1.86E-06	1.86E-06	3.46E-06	2.25E-05	1.62E-02	6.26E-06	6.26E-06	8.76E-06
Nb-95m	3.61E+00	5.95E-07	2.43E-02	2.54E-07	2.54E-07	4.63E-07	5.95E-07	2.43E-02	2.54E-07	2.54E-07	4.63E-07
Nb-97	5.11E-02	1.56E-05	1.43E-03	7.85E-07	2.90E-05	1.62E-05	1.56E-05	1.43E-03	7.85E-07	2.90E-05	1.62E-05
Nb-97m	6.25E-04	3.48E-07	2.71E-05	3.12E-08	6.28E-07	4.73E-07	3.48E-07	2.71E-05	3.12E-08	6.28E-07	4.73E-07
Mo-99	2.75E+00	8.20E-04	9.99E-03	8.20E-04	8.20E-04	4.31E-03	3.29E-03	1.10E-02	3.29E-03	3.29E-03	1.33E-02
Tc-99	7.77E+07	4.10E-04	3.20E-03	1.41E-02	2.14E-04	6.28E-04	4.10E-04	3.20E-03	1.41E-02	2.14E-04	6.28E-04
Tc-99m	2.51E-01	2.47E-07	4.13E-04	8.89E-06	8.89E-06	6.98E-07	9.23E-07	1.03E-03	3.00E-05	3.00E-05	1.81E-06
Ru-103	3.94E+01	1.85E-04	2.16E-02	7.97E-05	7.97E-05	7.97E-05	7.31E-04	1.89E-02	2.81E-04	2.81E-04	2.81E-04
Ru-105	1.85E-01	1.54E-05	9.42E-03	6.08E-06	6.08E-06	6.08E-06	6.45E-05	4.21E-02	2.34E-05	2.34E-05	2.34E-05
Ru-106	3.68E+02	2.75E-03	1.78E-01	3.48E-04	3.48E-04	3.48E-04	1.17E-02	1.82E-01	1.46E-03	1.46E-03	1.46E-03
Rh103m	3.89E-02	4.05E-08	9.27E-05	1.58E-08	8.96E-07	2.21E-08	4.05E-08	9.27E-05	1.58E-08	8.96E-07	2.21E-08
Rh-105	1.48E+00	5.68E-05	1.41E-02	1.30E-05	1.02E-04	3.35E-05	5.68E-05	1.41E-02	1.30E-05	1.02E-04	3.35E-05
Rh105m	4.40E-04	2.72E-08	7.78E-06	4.91E-09	6.34E-08	2.00E-08	2.72E-08	7.78E-06	4.91E-09	6.34E-08	2.00E-08
Rh-106	3.46E-04	1.86E-08	7.20E-05	2.80E-09	1.89E-07	3.57E-08	1.86E-08	7.20E-05	2.80E-09	1.89E-07	3.57E-08
Ag110m	2.52E+02	1.60E-04	6.04E-02	8.79E-05	8.79E-05	1.48E-04	5.39E-04	4.33E-02	2.91E-04	2.91E-04	3.64E-04
Ag-111	7.47E+00	5.65E-05	4.85E-02	1.26E-05	1.26E-05	2.46E-05	5.65E-05	4.85E-02	1.26E-05	1.26E-05	2.46E-05
Sb-122	2.72E+00	2.29E-04	6.47E-02	3.11E-06	6.70E-05	4.51E-06	2.29E-04	6.47E-02	3.11E-06	6.70E-05	4.51E-06
Sb-124	6.02E+01	2.75E-03	9.70E-02	7.14E-06	1.16E-03	5.47E-07	2.75E-03	9.70E-02	7.14E-06	1.16E-03	5.47E-07
Sb-127	3.80E+00	5.45E-04	7.00E-02	1.19E-04	6.13E-04	2.95E-04	5.45E-04	7.00E-02	1.19E-04	6.13E-04	2.95E-04
Te125m	5.80E+01	2.69E-03	1.07E-02	8.06E-04	3.59E-04	8.71E-04	1.14E-02	1.10E-02	3.20E-03	1.52E-03	3.09E-03
Te-127	3.92E-01	1.10E-04	8.68E-03	8.15E-05	2.38E-05	3.95E-05	4.71E-04	1.84E-02	3.26E-04	1.01E-04	1.27E-04
Te127m	1.09E+02	6.77E-03	2.27E-02	1.73E-03	8.25E-04	2.42E-03	2.89E-02	2.34E-02	6.91E-03	3.43E-03	7.78E-03
Te-129	4.86E-02	3.14E-05	2.37E-05	2.41E-05	7.65E-06	1.18E-05	1.34E-03	8.34E-03	9.56E-05	3.18E-05	3.74E-05
Te129m	3.34E+01	1.15E-02	5.79E-02	3.95E-03	1.82E-03	4.29E-03	4.87E-02	5.94E-02	1.57E-02	7.56E-03	1.36E-02
Te-131m	1.25E+00	1.73E-03	8.40E-02	1.34E-03	7.05E-04	8.46E-04	7.20E-03	1.01E-01	5.12E-03	2.65E-03	2.49E-03
Te-131	1.74E-02	1.97E-05	2.79E-06	1.62E-05	6.22E-06	8.23E-06	8.30E-05	4.36E-04	6.35E-05	2.47E-05	2.53E-05
Te-132	3.25E+00	2.52E-03	7.71E-02	1.80E-03	1.53E-03	1.63E-03	1.01E-02	4.50E-02	6.51E-03	5.40E-03	4.47E-03
I-129	5.80E+09	9.42E-04	7.84E-05	7.80E+00	3.18E-03	7.24E-04	9.42E-04	7.84E-05	7.80E+00	3.18E-03	7.24E-04
I-130	5.15E-01	7.56E-04	1.92E-03	1.89E-01	8.80E-04	2.23E-03	2.92E-03	2.76E-03	6.50E-01	3.04E-04	5.90E-03
I-131	8.04E+00	4.16E-03	1.57E-03	1.95E+00	3.41E-03	5.95E-03	1.72E-02	1.54E-03	5.72E+00	9.83E-03	1.73E-02

TABLE 2.1

DOSE COMMITMENT FACTORS—(REM/MICROCI)

(Sheet 3 of 4)

NUCLIDE	HALF-LIFE (DAYS)	ADULT					CHILD				
		BONE	GI TRACT	THYROID	TOTAL BODY	LIVER	BONE	GI TRACT	THYROID	TOTAL BODY	LIVER
I-132	9.54E-02	2.03E-04	1.02E-04	1.90E-02	1.90E-04	5.43E-04	8.00E-04	1.73E-03	6.82E-02	6.76E-04	1.47E-03
I-133	8.67E-01	1.42E-03	2.22E-03	3.63E-01	7.53E-04	2.47E-03	5.92E-03	2.95E-03	1.36E+00	2.77E-03	7.32E-03
I-134	3.65E-02	1.06E-04	2.51E-07	4.99E-03	1.03E-04	2.88E-04	4.19E-04	5.16E-04	1.79E-02	3.58E-04	7.78E-04
I-135	2.74E-01	4.43E-04	1.31E-03	7.65E-02	4.28E-04	1.16E-03	1.75E-03	2.40E-03	2.79E-01	1.49E-03	3.15E-03
Xe133m	2.19E+00	0.00E+00	2.45E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.45E-02	0.00E+00	0.00E+00	0.00E+00
Xe-133	5.25E+00	0.00E+00	2.58E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.58E-02	0.00E+00	0.00E+00	0.00E+00
Xe135m	1.06E-02	0.00E+00	3.29E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.29E-04	0.00E+00	0.00E+00	0.00E+00
Xe-135	3.79E-01	0.00E+00	1.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-02	0.00E+00	0.00E+00	0.00E+00
Cs-134	7.53E+02	6.22E-02	2.59E-03	1.21E-01	1.21E-01	1.48E-01	2.34E-01	2.07E-03	8.10E-02	8.10E-02	3.84E-01
Cs-135	8.40E+08	1.30E-02	5.35E-04	1.13E-02	6.61E-03	1.12E-02	1.30E-02	5.35E-04	1.13E-02	6.61E-03	1.12E-02
Cs-136	1.31E+01	6.51E-03	2.92E-03	1.85E-02	1.85E-02	2.57E-02	2.35E-02	2.27E-03	4.18E-02	4.18E-02	6.46E-02
Cs-137	1.10E+04	7.97E-02	2.11E-03	7.14E-02	7.14E-02	1.09E-01	3.27E-01	1.96E-03	4.62E-02	4.62E-02	3.13E-01
Cs-138	2.24E-02	5.52E-02	4.65E-10	5.40E-05	5.40E-05	1.09E-04	2.28E-04	1.46E-04	2.01E-04	2.01E-04	3.17E-04
Ba137m	1.77E-03	2.93E-07	2.87E-05	4.07E-08	5.12E-07	5.29E-07	2.93E-07	2.87E-05	4.07E-08	5.12E-07	5.29E-07
Ba-139	5.78E-02	9.70E-05	1.72E-04	2.84E-06	2.84E-06	6.91E-08	4.14E-04	2.39E-02	1.20E-05	1.20E-05	2.21E-07
Ba-140	1.28E+01	2.03E-02	4.18E-02	1.33E-03	1.33E-03	2.55E-05	8.31E-02	4.21E-02	4.85E-03	4.85E-03	7.28E-05
Ba-141	1.26E-02	4.71E-05	2.22E-14	1.59E-06	1.59E-06	3.56E-08	2.00E-04	1.14E-04	6.51E-06	6.51E-06	1.12E-07
Ba-142	7.43E-03	2.13E-05	3.00E-23	1.34E-06	1.34E-06	2.19E-08	8.74E-05	1.14E-06	4.88E-06	4.88E-06	6.29E-08
La-140	1.68E+00	2.50E-06	9.25E-02	3.33E-07	3.33E-07	1.26E-06	1.01E-05	9.84E-02	1.19E-06	1.19E-06	3.53E-06
La-142	6.42E-02	1.28E-07	4.25E-04	1.45E-08	1.45E-08	5.82E-08	5.24E-07	3.31E-02	5.23E-08	5.23E-08	1.67E-07
Ce-141	3.25E+01	9.36E-06	2.42E-02	7.18E-07	7.18E-07	6.33E-06	3.97E-05	2.47E-02	2.94E-06	2.94E-06	1.98E-05
Ce-143	1.38E+00	1.65E-06	4.56E-02	1.35E-07	1.35E-07	1.22E-03	6.99E-06	5.55E-02	5.49E-07	5.49E-07	3.79E-03
Ce-144	2.84E+02	4.88E-04	1.65E-01	2.62E-05	2.62E-05	2.04E-04	2.08E-03	1.70E-01	1.11E-04	1.11E-04	6.52E-04
Pr-143	1.36E+01	9.20E-06	4.03E-02	4.56E-07	4.56E-07	3.69E-06	3.93E-05	4.24E-02	1.95E-06	1.95E-06	1.18E-05
Pr-144	1.20E-02	3.01E-08	4.33E-15	1.53E-09	1.53E-09	1.25E-08	1.29E-07	8.59E-05	6.49E-09	6.49E-09	3.99E-08
Pr144m	5.00E-03	8.86E-08	5.69E-04	5.14E-09	3.29E-06	9.58E-08	8.86E-08	5.69E-04	5.14E-09	3.29E-06	9.58E-08
Nd-147	1.10E+01	6.29E-06	3.49E-02	4.35E-07	4.35E-07	7.27E-06	2.79E-05	3.58E-02	1.75E-06	1.75E-06	2.26E-05
Pm-147	9.57E+02	2.87E-05	1.17E-02	5.38E-07	5.02E-05	1.02E-04	2.87E-05	1.17E-02	5.38E-07	5.02E-05	1.02E-04
Pm-149	2.21E+00	1.53E-06	4.85E-02	1.24E-07	1.24E-07	2.50E-07	1.53E-06	4.85E-02	1.24E-07	1.24E-07	2.50E-07
Sm-147	3.94E+13	3.20E-01	4.26E-02	1.18E-03	2.98E-02	2.20E-01	3.20E-01	4.26E-02	1.18E-03	2.98E-02	2.20E-01
Sm-151	3.37E+04	6.87E-05	4.85E-03	2.84E-06	2.84E-06	1.18E-05	6.87E-05	4.85E-03	2.84E-06	2.84E-06	1.18E-05
Sm-153	1.95E+00	7.90E-07	2.43E-02	6.13E-08	6.13E-08	7.61E-07	7.90E-07	2.43E-02	6.13E-08	6.13E-08	7.61E-07
Eu-155	1.74E+03	4.63E-05	9.70E-03	5.26E-06	5.26E-06	1.08-05	4.63E-05	9.70E-03	5.26E-06	5.26E-06	1.08E-05
Ta-182	1.15E+02	1.72E-05	4.85E-02	8.75E-06	8.75E-06	6.37E-05	1.72E-05	4.85E-02	8.75E-06	8.75E-06	6.37E-05

TABLE 2.1

DOSE COMMITMENT FACTORS—(REM/MICROCI)

(Sheet 4 of 4)

NUCLIDE	HALF-LIFE (DAYS)	ADULT					CHILD				
		BONE	GI TRACT	THYROID	TOTAL BODY	LIVER	BONE	GI TRACT	THYROID	TOTAL BODY	LIVER
W-187	9.96E-01	1.03E-04	2.82E-02	3.01E-05	3.01E-05	8.61E-05	4.29E-04	3.57E-02	1.14E-04	1.14E-04	2.54E-04
Pb-210	8.14E+03	2.10E+01	2.03E-02	3.00E-01	1.70E+00	1.40E+00	2.10E+01	2.03E-02	3.00E-01	1.70E+00	1.40E+00
Pb-212	4.43E-01	1.20E-01	7.57E-02	5.22E-04	2.57E-03	5.85E-03	1.20E-01	7.57E-02	5.22E-04	2.57E-03	5.85E-03
Pb-214	1.86E-02	3.03E-04	3.14E-03	1.18E-05	5.64E-05	2.97E-05	3.03E-04	3.14E-03	1.18E-05	5.64E-05	2.97E-05
Bi-212	4.21E-02	3.03E-04	5.90E-03	4.97E-05	1.26E-04	7.24E-05	3.03E-04	5.90E-03	4.97E-05	1.26E-04	7.24E-05
Bi-214	1.38E-02	4.16E-05	3.18E-03	5.11E-06	2.97E-05	1.58E-05	4.16E-05	3.18E-03	5.11E-06	2.97E-05	1.58E-05
Po-212	3.50E-12	1.50E-33	9.17E-13	3.48E-34	1.96E-15	1.08E-33	1.50E-33	9.17E-13	3.48E-34	1.96E-15	1.08E-33
Po-214	1.89E-09	4.80E-12	4.28E-10	7.01E-14	1.30E-12	3.35E-13	4.80E-12	4.28E-10	7.01E-14	1.30E-12	3.35E-13
Po-216	1.74E-06	9.35E-07	3.68E-07	3.11E-09	1.85E-08	7.39E-08	9.35E-07	3.68E-07	3.11E-09	1.85E-08	7.39E-08
Po-218	2.12E-03	9.60E-05	6.84E-04	1.64E-06	8.62E-06	1.11E-05	9.60E-05	6.84E-04	1.64E-06	8.62E-06	1.11E-09
Ra-224	3.66E+00	3.30E+00	6.60E-01	8.32E-02	7.47E-02	8.90E-02	3.30E+00	6.60E-01	8.32E-02	7.47E-02	8.90E-02
Ra-226	5.84E+05	4.30E+01	3.30E-01	5.90E-01	3.40E+00	5.90E-01	4.30E+01	3.30E-01	5.90E-01	3.40E+00	5.90E-01
Ra-228	2.10E+03	2.10E+01	7.14E-02	4.00E-01	1.70E+00	4.00E-01	2.10E+01	7.14E-02	4.00E-01	1.70E+00	4.00E-01
Ac-228	2.55E-01	3.48E-03	8.07E-03	6.13E-06	1.99E-04	3.54E-04	3.48E-03	8.07E-03	6.13E-06	1.99E-04	3.54E-04
Th-228	6.98E+02	4.10E+00	4.70E-01	7.42E-03	3.80E-02	2.34E-02	4.10E+00	4.70E-01	7.42E-03	3.80E-02	2.34E-02
Th-230	2.81E+07	1.60E+01	1.80E-01	4.56E-03	9.24E-02	2.18E-02	1.60E+01	1.80E-01	4.56E-03	9.24E-02	2.18E-02
Th-232	5.11E+12	1.80E+01	1.50E-01	3.94E-03	9.63E-02	1.88E-02	1.80E+01	1.50E-01	3.94E-03	9.63E-02	1.88E-02
Th-234	2.41E+01	4.91E-05	1.60E-01	1.60E-06	6.39E-04	1.46E-05	4.91E-05	1.60E-01	1.60E-06	6.39E-04	1.46E-05
Pa-234	2.79E-01	3.00E-04	1.11E-02	7.20E-06	3.12E-04	2.28E-04	3.00E-04	1.11E-02	7.20E-06	3.12E-04	2.28E-04
U-234	8.91E+07	3.10E+01	1.80E-01	6.32E-02	2.30E+00	6.32E-02	3.10E+01	1.80E-01	6.32E-02	2.30E+00	6.32E-02
U-238	1.63E+12	2.80E+01	1.70E-01	5.63E-02	2.00E+00	5.35E-02	2.80E+01	1.70E-01	5.63E-02	2.00E+00	5.35E-02
Np-238	2.12E+00	4.42E-03	3.21E-02	1.22E-05	4.03E-04	1.08E-03	4.42E-03	3.21E-02	1.22E-05	4.03E-04	1.08E-03
Np-239	2.35E+00	1.19E-06	2.40E-02	6.45E-08	6.45E-08	1.17E-07	5.25E-06	2.79E-02	2.65E-07	2.65E-07	3.77E-07
Pu-238	3.20E+04	2.10E+00	2.10E-01	3.23E-03	2.83E-02	4.40E-01	2.10E+00	2.10E-01	3.23E-03	2.83E-02	4.40E-01
Pu-239	8.80E+06	2.60E+00	2.00E-01	3.63E-03	3.13E-02	4.90E-01	2.60E+00	2.00E-01	3.63E-03	3.13E-02	4.90E-01
Pu-240	2.39E+06	2.60E+00	2.00E-01	3.62E-03	3.13E-02	4.90E-01	2.60E+00	2.00E-01	3.62E-03	3.13E-02	4.90E-01
Pu-241	5.37E+03	4.83E-02	9.92E-04	7.49E-05	6.19E-04	9.50E-03	4.83E-02	9.92E-04	7.49E-05	6.19E-04	9.50E-03
Pu-242	1.37E+08	2.60E+00	1.90E-01	3.45E-03	2.98E-02	4.70E-01	2.60E+00	1.90E-01	3.45E-03	2.98E-02	4.70E-01
Am-241	1.58E+05	8.00E+01	2.10E-01	1.20E-01	1.00E+00	1.70E+01	8.00E+01	2.10E-01	1.20E-01	1.00E+00	1.70E+01
Am-242	6.68E-01	5.19E-03	9.26E-03	1.06E-05	1.44E-04	1.51E-03	5.19E-03	9.26E-03	1.06E-05	1.44E-04	1.51E-03
Am-243	2.69E+06	8.50E+01	2.20E-01	1.30E-01	1.00E+00	1.70E+01	8.50E+01	2.20E-01	1.30E-01	1.00E+00	1.70E+01
Cm-242	1.63E+02	1.50E+00	2.30E-01	2.72E-03	2.58E-02	4.40E-01	1.50E+00	2.30E-01	2.72E-03	2.58E-02	4.40E-01
Cm-243	1.04E+04	4.80E+01	2.50E-01	8.22E-02	7.10E-01	1.20E+01	6.00E+03	1.00E+03	1.01E+03	2.01E+03	1.00E+03
Cm-244	6.61E+03	3.80E+01	2.20E-01	6.40E-02	5.60E-01	9.30E+00	3.80E+01	2.20E-01	6.40E-02	5.60E-01	9.30E-00

Dose factors were taken from the following references in order of preference:

1. Regulatory Guide 1.109, USNRC, Obtober 1977
2. NUREG/CR-0150, D. E. Dunning; ORNL, October 1981
3. ORNL-4992, G. G. Killough and L. R. McKay, March 1976

TABLE 2.2

FISH CONCENTRATION FACTORS*
(Page 1 of 2)

NUCLIDE		NUCLIDE		NUCLIDE	
H-3	9.00E-01	Tc-99m	1.50E+01	Ce-144	1.00E+00
C-14	4.60E+03	Ru-103	1.00E+01	Pr-143	2.50E+01
Na-22	1.00E+02	Ru-105	1.00E+01	Pr-144	2.50E+01
Na-24	1.00E+02	Ru-106	1.00E+01	Pr144m	2.50E+01
P-32	3.00E+03	Rh103m	1.00E+01	Nd-147	2.50E+01
Cr-51	2.00E+02	Rh-105	1.00E+01	Pm-147	2.50E+01
Mn-54	4.00E+02	Rh105m	1.00E+01	Pm-149	2.50E+01
Mn-56	4.00E+02	Rh-106	1.00E+01	Sm-147	2.50E+01
Fe-55	1.00E+02	Ag110m	2.31E+00	Sm-151	2.50E+01
Fe-59	1.00E+02	Ag-111	2.31E+00	Sm-153	2.50E+01
Co-57	5.00E+01	Sb-122	1.00E+00	Eu-155	2.50E+01
Co-58	5.00E+01	Sb-124	1.00E+00	Ta-182	3.00E+04
Co-60	5.00E+01	Sb-127	1.00E+00	W-187	1.20E+03
Ni-63	1.00E+02	Te125m	4.00E+02	Pr-210	3.00E+02
Ni-65	1.00E+02	Te-127	4.00E+02	Pb-212	3.00E+02
Cu-64	5.00E+01	Te127m	4.00E+02	Pb-214	3.00E-02
Zn-65	2.00E+03	Te-129	4.00E+02	Bi-212	1.50E+01
Zn-69	2.00E+03	Te129m	4.00E+02	Bi-214	1.50E+01
As-74	1.00E+02	Te-131	4.00E+02	Po-212	5.00E+01
As-76	1.00E+02	Te131m	4.00E+02	Po-214	5.00E+01
Br-83	4.20E+02	Te-132	4.00E+02	Po-216	5.00E+01
Br-84	4.20E+02	I-129	1.50E+01	Po-218	5.00E+01
Br-85	4.20E+02	I-130	1.50E+01	Ra-224	5.00E+01
Kr-83m	1.00E+00	I-131	1.50E+01	Ra-226	5.00E+01
Kr-85m	1.00E+00	I-132	1.50E+01	Ra-228	5.00E+01
Kr-85	1.00E+00	I-133	1.50E+01	Ac-22A	2.50E+01
Rb-86	2.00E+03	I-134	1.50E+01	Th-228	3.00E+01
Rb-88	2.00E+03	I-135	1.50E+01	Th-230	3.00E+01
Rb-89	2.00E+03	Xe133m	1.00E+00	Th-232	3.00E+01
Sr-89	3.00E+01	Xe-133	1.00E+00	Th-234	3.00E+01
Sr-90	3.00E+01	Xe135m	1.00E+00	Pa-234	1.10E+01
Sr-91	3.00E+01	Xe-135	1.00E+00	U-234	1.00E+01
Sr-92	3.00E+01	Cs-134	2.00E+03	U-238	1.00E+01
Y-90	2.50E+01	Cs-135	2.00E+03	Np-238	1.00E+01
Y-91	2.50E+01	Cs-136	2.00E+03	Np-239	1.00E+01
Y-91m	2.50E+01	Cs-137	2.00E+03	Pu-238	3.50E+02
Y-92	2.50E+01	Cs-138	2.00E+03	Pu-239	3.50E+02
Y-93	2.50E+01	Ba137m	4.00E+00	Pu-240	3.50E+02
Zr-95	3.33E+00	Ba-139	4.00E+00	Pu-241	3.50E+02
Zr-97	3.33E+00	Ba-140	4.00E+00	Pu-242	3.50E+02
Nb-95	3.00E+04	Ba-141	4.00E+00	Am-241	2.50E+01
Nb-95m	3.00E+04	Ba-142	4.00E+00	Am-247	2.50E+01
Nb-97	3.00E+04	La-140	2.50E+01	Am-243	2.50E+01

TABLE 2.2

FISH CONCENTRATION FACTORS*
(Page 2 of 2)

NUCLIDE		NUCLIDE		NUCLIDE	
Nb-97m	3.00E+04	La-142	2.50E+01	Cm-242	2.50E+01
Mo-99	1.00E+01	Ce-141	1.00E+00	Cm-243	2.50E+01
Tc-99	1.50E+01	Ce-143	1.00E+00	Cm-244	2.50E+01

*The source for the fish concentration factors, given in order of preference is:

NUREG/CR-1336, "The Bioaccumulation Factor for Phosphorus-32 in Edible Fish Tissue," B. Kahn and K. S. Turgeon, Georgia Institute of Technology, March 1980.

Regulatory Guide 1.109, October 1977.

UCRL-50564, "Concentration Factors of Chemical Elements in Edible Aquatic Organisms," S. E. Thompson, et al.; Lawrence Livermore Laboratory, October 1972.

UCRL-50163, "Prediction of the Maximum Dosage to Man from the Fallout of Nuclear Devices: IV. Handbook for Estimating the Maximum Internal Dose from Radionuclides Released to the Biosphere," Y. C. Ng, et al.; Lawrence Livermore Laboratory, May 1968.

Regulatory Guide 1.109, Draft, Marcy 1976.

TVA generated numbers for noble gases.

TABLE 2.3

RECREATION DOSE FACTORS

(Sheet 1 of 4)

NUCLIDE	SWIMMING (MREM/YEAR PER UCI/ML)						SHORELINE (MREM/YEAR PER UCI/SQUARE CENTIMETER)					
	BONE	GI TRACT	THYROID	TB	LIVER	SKIN	BONE	GI TRACT	THYROID	TB	LIVER	SKIN
H-3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
C-14	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Na-22	3.14E+07	2.49E+07	2.30E+07	2.67E+07	2.27E+07	3.16E+07	2.76E+06	2.19E+06	2.01E+06	2.33E+06	1.99E+06	2.76E+06
Na-24	5.66E+07	5.92E+07	6.22E+07	5.39E+07	4.80E+07	6.16E+07	3.96E+06	4.10E+06	4.28E+06	3.76E+06	3.33E+06	4.29E+06
P-32	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cr-51	5.43E+05	3.07E+05	3.38E+05	3.79E+05	3.09E+05	4.56E+05	5.45E+04	3.08E+04	3.39E+04	3.81E+04	3.10E+04	4.69E+04
Mn-54	1.16E+07	8.57E+06	7.35E+06	9.68E+06	8.26E+07	1.24E+06	1.04E+05	7.69E+05	6.60E+05	8.69E+05	7.42E+05	1.11E+06
Mn-56	2.33E+07	2.14E+07	1.82E+07	2.07E+07	1.81E+07	2.54E+07	1.88E+06	1.69E+06	1.44E+06	1.66E+06	1.45E+06	2.05E+06
Fe-55	3.16E+01	3.47E+01	6.94E+00	1.60E+02	1.47E-01	3.16E+03	2.71E+01	2.98E+01	5.96E+00	1.44E+02	1.26E-01	2.71E+03
Fe-59	1.64E+07	1.38E+07	1.23E+07	1.45E+07	1.23E+07	1.76E+07	1.36E+06	1.15E+06	1.02E+06	1.20E+06	1.02E+06	1.46E+06
Co-57	2.71E+06	9.80E+05	1.69E+06	1.48E+06	1.13E+06	1.75E+06	2.82E+05	1.02E+05	1.76E+05	1.55E+05	1.17E+05	1.94E+05
Co-58	1.38E+07	1.03E+07	8.78E+06	1.13E+07	9.68E+06	1.43E+07	1.25E+06	9.36E+05	8.00E+05	1.03E+06	8.82E+05	1.30E+06
Co-60	3.46E+07	3.02E+07	2.73E+07	3.11E+07	2.62E+07	3.67E+07	2.83E+06	2.46E+06	2.23E+06	2.54E+06	2.14E+06	3.00E+06
Ni-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ni-65	7.65E+06	6.86E+06	6.50E+06	6.94E+06	5.84E+06	7.93E+06	6.18E+05	5.52E+05	5.22E+05	5.60E+05	4.71E+05	6.41E+05
Cu-64	2.83E+06	2.20E+06	1.85E+06	2.23E+06	1.92E+06	2.67E+06	2.71E+05	2.11E+05	1.78E+05	2.14E+05	1.84E+05	2.59E+05
Zn-65	7.99E+06	6.49E+06	5.58E+06	6.96E+06	5.90E+06	8.67E+06	6.75E+05	5.48E+05	4.71E+05	5.88E+05	4.98E+05	7.40E+05
Zn-69	9.55E+01	6.49E+01	6.09E+01	7.12E+01	6.00E+01	8.51E+01	9.40E+00	6.39E+00	6.00E+00	7.01E+00	5.90E+00	8.38E+00
As-74	1.70E+05	1.30E+05	1.40E+05	1.40E+05	1.10E+05	1.60E+05	1.36E+06	1.10E+06	1.16E+06	1.12E+06	9.40E+05	1.33E+06
As-76	8.31E+04	6.68E+04	7.04E+04	6.83E+04	5.73E+04	8.12E+04	6.82E+05	5.48E+05	5.78E+03	5.60E+05	4.70E+05	6.66E+05
Br-83	1.12E+05	8.64E+04	7.24E+04	8.81E+04	7.59E+04	1.06E+05	1.07E+04	8.29E+03	6.95E+03	8.45E+03	7.28E+03	1.02E+04
Br-84	2.46E+07	2.42E+07	2.59E+07	2.28E+07	2.03E+07	2.69E+07	1.80E+06	1.73E+06	1.79E+06	1.65E+06	1.46E+06	1.96E+06
Br-85	2.86E+05	2.11E+05	1.81E+05	2.39E+05	2.04E+05	3.07E+05	2.55E+04	1.88E+04	1.61E+04	2.13E+04	1.82E+04	2.74E+04
Kr-83m	5.24E+02	1.22E+02	1.22E+02	9.46E+02	3.71E+01	1.13E+04	4.33E+02	1.18E+02	5.97E+01	9.66E+02	1.12E+01	1.23E+04
Kr-85m	3.21E+06	1.36E+06	1.97E+06	1.93E+06	1.50E+06	2.30E+06	3.30E+05	1.39E+05	2.02E+05	1.99E+05	1.54E+05	2.39E+05
Kr-85	3.34E+04	2.59E+04	2.17E+04	2.62E+04	2.26E+04	3.14E+04	3.22E+03	2.49E+03	2.09E+03	2.53E+03	2.18E+03	3.03E+03
Rb-86	1.29E+06	1.04E+06	8.73E+05	1.12E+06	9.50E+05	1.42E+06	1.10E+05	8.79E+04	7.40E+04	9.50E+04	8.06E+04	1.20E+05
Rb-88	8.99E+06	9.16E+06	8.10E+06	8.32E+06	7.33E+06	9.90E+06	6.77E+05	6.82E+05	5.97E+05	6.24E+05	5.49E+05	7.46E+05
Rb-89	2.89E+07	2.67E+07	2.41E+07	2.61E+07	2.27E+07	3.17E+07	2.27E+06	2.06E+06	1.85E+06	2.04E+06	1.77E+06	2.49E+06
Br-89	1.88E+03	1.41E+03	1.18E+03	1.58E+03	1.35E+03	2.05E+03	1.66E+02	1.24E+02	1.04E+02	1.40E+02	1.19E+02	1.81E+02
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-91	9.71E+06	7.32E+06	6.32E+06	8.17E+06	6.96E+06	1.04E+07	8.56E+05	6.43E+05	5.56E+05	7.19E+05	6.13E+05	9.13E+05
Sr-92	1.86E+07	1.68E+07	1.59E+07	1.70E+07	1.43E+07	1.93E+07	1.50E+05	1.35E+06	1.28E+06	1.37E+06	1.15E+06	1.55E+06
Y-90	1.10E+00	2.90E-01	1.11E-01	1.32E+00	2.77E-02	1.06E+01	7.97E-01	2.17E-01	7.68E-02	9.65E-01	1.91E-02	7.87E+00
Y-91	4.99E+04	4.25E+04	3.77E+04	4.43E+04	3.75E+04	5.33E+04	4.12E+03	3.51E+03	3.11E+03	3.66E+03	3.10E+03	4.41E+03

TABLE 2.3

RECREATION DOSE FACTORS

(Sheet 2 of 4)

NUCLIDE	SWIMMING (MREM/YEAR PER UCI/ML)						SHORELINE (MREM/YEAR PER UCI/SQUARE CENTIMETER)					
	BONE	GI TRACT	THYROID	TB	LIVER	SKIN	BONE	GI TRACT	THYROID	TB	LIVER	SKIN
Y-91M	7.83E+06	6.02E+06	5.06E+06	6.21E+06	5.34E+06	7.53E+06	7.40E+05	5.74E+05	4.83E+05	5.93E+05	5.10E+05	7.20E+05
Y-92	3.51E+06	2.80E+06	2.49E+06	3.02E+06	2.57E+06	3.72E+06	3.02E+05	2.39E+05	2.12E+05	2.59E+05	2.20E+05	3.19E+05
Y-93	1.30E+06	1.10E+06	9.91E+05	1.10E+06	9.42E+05	1.33E+06	1.10E+05	8.91E+04	8.17E+04	9.13E+04	7.77E+04	1.10E+05
Zr-95	1.04E+07	7.78E+06	6.64E+06	8.56E+06	7.32E+06	1.08E+07	9.56E+05	7.13E+05	6.08E+05	7.84E+05	6.71E+05	9.88E+05
Zr-97	2.57E+06	2.04E+06	1.87E+06	2.18E+06	1.86E+06	2.62E+06	2.23E+05	1.74E+03	1.60E+05	1.88E+05	1.60E+05	2.27E+05
Nb-95	1.08E+07	8.01E+06	6.84E+06	8.87E+06	7.59E+06	1.12E+07	9.82E+05	7.31E+05	6.24E+05	8.09E+05	6.92E+05	1.02E+06
Nb-95m	1.17E+06	5.59E+05	7.04E+05	7.59E+05	5.90E+05	9.51E+05	1.22E+05	5.66E+04	7.17E+04	8.05E+04	5.98E+04	1.23E+05
Nb-97	9.40E+06	7.11E+06	6.03E+06	7.61E+06	6.52E+06	9.43E+06	8.77E+05	6.63E+05	5.62E+05	7.10E+05	6.08E+05	8.79E+05
Nb-97m	1.03E+07	7.67E+06	6.54E+06	8.44E+06	7.22E+06	1.06E+07	9.42E+05	7.03E+05	5.99E+05	7.73E+05	6.61E+05	9.74E+05
Mo-99	2.41E+06	1.63E+06	1.52E+06	1.87E+06	1.57E+06	2.34E+06	2.27E+05	1.51E+05	1.43E+05	1.75E+05	1.47E+05	2.21E+05
Tc-99	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m	2.74E+06	1.03E+06	1.69E+06	1.55E+06	1.18E+06	1.83E+06	2.83E+05	1.07E+05	1.74E+05	1.60E+05	1.21E+05	1.93E+05
Ru-103	7.05E+06	5.44E+06	4.57E+06	5.51E+06	4.75E+06	6.60E+06	6.81E+05	5.25E+05	4.41E+05	5.32E+05	4.58E+05	6.37E+05
Tc-99	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tc-99m	2.74E+06	1.03E+06	1.69E+06	1.55E+06	1.18E+06	1.83E+06	2.83E+05	1.07E+05	1.74E+05	1.60E+06	1.21E+05	1.93E+05
Ru-103	7.05E+06	5.44E+06	4.57E+06	5.51E+06	4.75E+06	6.60E+06	6.81E+05	5.25E+05	4.41E+05	5.32E+05	4.58E+05	6.37E+05
Ru-105	1.15E+07	8.32E+06	7.34E+06	9.16E+06	7.79E+06	1.14E+07	1.08E+06	7.78E+05	6.88E+05	8.57E+05	7.29E+05	1.06E+06
Ru-106	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Rh103m	3.73E+03	4.88E+02	1.27E+03	2.82E+03	3.92E+02	1.27E+04	1.74E+03	2.10E+02	5.66E+02	1.36E+03	1.63E+02	6.42E+03
Rh-105	1.35E+06	7.56E+05	8.38E+05	9.39E+05	7.64E+05	1.12E+06	1.36E+05	7.59E+04	8.41E+04	9.43E+04	7.67E+04	1.13E+05
Rh105m	6.12E+05	2.18E+05	3.75E+05	3.42E+05	2.51E+05	4.51E+05	7.05E+04	2.30E+04	4.10E+04	4.11E+04	2.66E+04	7.39E+04
Rh-106	2.99E+06	2.30E+06	1.96E+06	2.41E+06	2.07E+06	2.93E+06	2.81E+05	2.16E+05	1.84E+05	2.25E+05	1.94E+05	2.74E+05
Ag110m	3.87E+07	2.97E+07	2.68E+07	3.28E+07	2.79E+07	4.03E+07	3.41E+06	2.61E+06	2.35E+06	2.88E+06	2.45E+06	3.55E+06
Ag-111	4.03E+05	2.32E+05	2.51E+05	2.63E+05	2.31E+05	3.39E+05	4.03E+04	2.32E+04	2.51E+04	2.83E+04	2.31E+04	3.39E+04
Sb-122	8.06E+04	6.27E+04	6.58E+04	6.31E+04	5.26E+04	7.73E+04	6.83E+05	5.31E+05	5.57E+05	5.35E+05	4.46E+05	6.54E+05
Sb-124	2.61E+07	2.28E+07	2.07E+07	2.29E+07	1.98E+07	2.71E+07	2.18E+06	1.86E+06	1.69E+06	1.90E+06	1.64E+06	2.25E+06
Sb-127	1.01E+07	7.39E+06	6.47E+06	8.03E+06	6.85E+06	9.91E+06	9.52E+05	6.94E+05	6.09E+05	7.55E+05	6.43E+05	9.31E+05
Te125m	2.47E+05	2.93E+04	1.24E+05	1.35E+05	4.71E+04	3.39E+05	4.60E+04	9.08E+03	2.32E+04	2.50E+04	8.75E+03	6.29E+04
Te-127	7.84E+04	5.17E+04	4.98E+04	5.77E+04	4.83E+04	6.89E+04	7.74E+03	5.10E+03	4.92E+03	5.69E+03	4.77E+03	6.80E+03
Te127m	6.91E+04	1.33E+04	3.45E+04	3.82E+04	1.28E+04	9.89E+04	1.31E+04	2.54E+03	6.60E+03	7.21E+03	2.44E+03	1.86E+04
Te-129	8.68E+05	6.12E+05	5.58E+05	6.69E+05	5.60E+05	8.33E+05	8.52E+04	5.87E+04	5.43E+04	6.50E+04	5.37E+04	8.28E+04
Te129m	4.73E+05	3.23E+05	2.94E+05	3.71E+05	3.02E+05	5.03E+05	4.89E+04	3.09E+04	2.98E+04	3.71E+04	2.88E+04	5.38E+04
Te-131	6.79E+06	4.21E+06	4.37E+06	4.99E+06	4.13E+06	6.11E+06	6.49E+05	3.94E+05	4.16E+05	4.71E+05	3.88E+05	5.78E+05
Te131m	2.06E+07	1.53E+07	1.39E+07	1.70E+07	1.45E+07	2.12E+07	1.84E+06	1.35E+06	1.23E+06	1.51E+05	1.28E+06	1.89E+06
Te-132	4.27E+06	1.92E+06	2.54E+06	2.68E+06	2.04E+06	3.32E+06	4.55E+05	1.98E+05	2.68E+05	2.83E+05	2.12E+05	3.60E+05
I-129	2.25E+05	4.84E+04	1.19E+05	1.15E+05	4.75E+04	2.49E+05	5.02E+04	1.07E+04	2.67E+04	2.57E+04	1.05E+04	5.70E+04

TABLE 2.3
RECREATION DOSE FACTORS
(Sheet 3 of 4)

NUCLIDE	SWIMMING (MREM/YEAR PER UCI/ML)						SHORELINE (MREM/YEAR PER UCI/SQUARE CENTIMETER)					
	BONE	GI TRACT	THYROID	TB	LIVER	SKIN	BONE	GI TRACT	THYROID	TB	LIVER	SKIN
I-130	3.09E+07	2.33E+07	2.00E+07	2.50E+07	2.14E+07	3.08E+07	2.88E+06	2.17E+06	1.86E+06	2.32E+06	1.99E+06	2.86E+06
I-131	6.22E+06	3.93E+06	3.92E+06	4.54E+06	3.77E+06	5.47E+06	6.16E+05	3.87E+05	3.88E+05	4.49E+05	3.72E+05	5.41E+05
I-132	3.23E+07	2.45E+07	2.16E+07	2.68E+07	2.29E+07	3.32E+07	2.91E+06	2.20E+06	1.93E+06	2.41E+06	2.06E+06	2.99E+06
I-133	8.96E+06	6.90E+06	5.89E+06	7.18E+06	6.16E+06	8.69E+06	8.44E+05	6.49E+05	5.54E+05	6.75E+05	5.79E+05	8.17E+05
I-134	3.67E+07	2.84E+07	2.49E+07	3.11E+07	2.65E+07	3.89E+07	3.22E+06	2.46E+06	2.16E+06	2.71E+06	2.32E+06	3.40E+06
I-135	2.19E+07	1.95E+07	1.75E+07	1.96E+07	1.67E+07	2.33E+07	1.78E+06	1.57E+06	1.41E+06	1.58E+06	1.35E+06	1.89E+06
Xe133m	6.05E+05	2.38E+05	3.55E+05	3.71E+05	2.61E+05	5.27E+05	8.09E+04	2.81E+04	4.65E+04	4.77E+04	3.05E+04	7.71E+04
Xe-133	8.52E+05	2.53E+05	4.84E+05	4.24E+05	2.74E+05	5.73E+05	1.11E+05	3.17E+04	6.28E+04	5.57E+04	3.39E+04	8.27E+04
Xe135m	6.41E+06	4.94E+06	4.15E+06	5.04E+06	4.33E+06	6.08E+06	6.21E+05	4.75E+05	4.01E+05	4.87E+05	4.17E+05	5.90E+05
Xe135	4.54E+06	2.28E+06	2.76E+06	3.02E+06	2.40E+06	3.63E+06	4.59E+05	2.29E+05	2.79E+05	3.04E+05	2.41E+05	3.67E+05
Cs-134	2.22E+07	1.67E+07	1.43E+07	1.81E+07	1.55E+07	2.26E+07	2.04E+06	1.54E+06	1.32E+06	1.67E+06	1.43E+06	2.08E+06
Cs-135	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-136	3.10E+07	2.26E+07	2.03E+07	2.55E+07	2.15E+07	3.21E+07	2.77E+06	2.00E+06	1.81E+06	2.26E+06	1.91E+06	2.85E+06
Cs-137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cs-138	3.29E+07	3.03E+07	2.86E+07	2.98E+07	2.56E+07	3.46E+07	2.62E+06	2.37E+06	2.23E+06	2.35E+06	2.02E+06	2.74E+06
Ba137m	8.56E+06	6.45E+06	5.48E+06	6.92E+06	5.93E+06	8.59E+06	8.01E+05	6.02E+05	5.12E+05	6.47E+05	5.54E+05	8.04E+05
Ba-139	7.49E+05	3.44E+05	4.73E+05	4.66E+05	3.60E+05	5.55E+05	7.61E+04	3.38E+04	4.75E+04	4.67E+04	3.57E+04	5.62E+04
Ba-140	2.29E+06	1.60E+06	1.46E+06	1.73E+06	1.46E+06	2.10E+06	2.29E+05	1.56E+05	1.46E+05	1.71E+05	1.42E+05	2.13E+05
Ba-141	1.31E+07	8.90E+06	8.96E+06	1.02E+07	8.49E+06	1.22E+07	1.21E+06	7.97E+05	8.15E+05	9.26E+05	7.70E+05	1.12E+06
Ba-142	1.51E+07	1.11E+07	1.02E+07	1.24E+07	1.04E+07	1.54E+07	1.34E+06	9.30E+05	9.03E+05	1.10E+06	9.17E+05	1.36E+06
La-140	3.20E+07	2.91E+07	2.73E+07	2.88E+07	2.46E+07	3.31E+07	2.60E+06	2.32E+06	2.18E+06	2.32E+06	1.98E+06	2.67E+06
La-142	3.74E+07	3.80E+07	3.72E+07	3.47E+07	3.10E+07	4.10E+07	2.75E+06	2.73E+06	2.64E+06	2.53E+06	2.52E+06	3.00E+06
Ce-141	1.59E+06	5.94E+05	9.70E+05	9.01E+05	6.75E+05	1.09E+06	1.69E+05	6.20E+04	1.02E+05	9.52E+04	7.07E+04	1.16E+05
Ce-143	4.54E+05	2.64E+06	2.79E+06	3.22E+06	2.60E+06	4.00E+06	4.66E+05	2.61E+05	2.83E+05	3.24E+05	2.57E+05	4.07E+05
La-142	3.74E+07	3.80E+07	3.72E+07	3.47E+07	3.10E+07	4.10E+07	2.75E+06	2.73E+06	2.64E+06	2.53E+06	2.52E+06	3.00E+06
Ce-141	1.59E+06	5.94E+05	9.70E+05	9.01E+05	6.75E+05	1.07E+06	1.69E+05	6.20E+04	1.02E+05	9.52E+04	7.07E+04	1.16E+05
Ce-143	4.54E+05	2.64E+06	2.79E+06	3.22E+06	2.60E+06	4.00E+06	4.66E+05	2.61E+05	2.83E+05	3.24E+05	2.57E+05	4.07E+05
Ce-144	4.18E+05	1.42E+05	2.51E+05	2.26E+05	1.63E+05	2.81E+05	4.64E+04	1.55E+04	2.76E+04	2.50E+04	1.76E+04	3.18E+04
Pr-143	1.26E-01	9.38E-02	8.00E-02	1.03E-01	8.83E-02	1.30E-01	1.15E-02	8.60E-03	7.33E-03	9.45E-03	8.09E-03	1.19E-02
Pr-144	4.40E-05	4.24E+05	3.74E+05	3.97E+05	3.50E+05	4.75E+05	3.46E+04	3.24E+04	2.87E+04	3.10E+04	2.72E+04	3.71E+04
Pr144M	1.42E+05	3.32E+04	7.19E+04	6.95E+04	3.23E+04	1.25E+05	2.28E+04	5.33E+03	1.15E+04	1.12E+04	5.17E+03	2.06E+04
Nd-147	2.33E+06	1.34E+06	1.44E+06	1.57E+06	1.25E+06	1.93E+06	2.47E+05	1.35E+05	1.50E+05	1.62E+05	1.27E+05	2.03E+05
Pm-147	7.86E+01	2.76E+01	4.92E+01	4.26E+01	3.23E+01	4.93E+01	8.17E+00	2.92E+00	5.11E+00	4.43E+00	3.36E+00	5.17E+00
Pm-149	1.98E+05	1.12E+05	1.23E+05	1.39E+05	1.13E+05	1.69E+05	1.98E+04	1.11E+04	1.22E+04	1.38E+04	1.12E+04	1.67E+04
Sm-147	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sm-151	1.69E+01	2.20E+00	5.68E+00	1.33E+01	1.61E+00	6.78E+01	7.60E+00	1.04E+00	2.56E+00	6.24E+00	7.22E-01	3.55E+01

TABLE 2.3
RECREATION DOSE FACTORS
(Sheet 4 of 4)

NUCLIDE	SWIMMING (MREM/YEAR PER UCI/ML)						SHORELINE (MREM/YEAR PER UCI/SQUARE CENTIMETER)					
	BONE	GI TRACT	THYROID	TB	LIVER	SKIN	BONE	GI TRACT	THYROID	TB	LIVER	SKIN
Sm-153	1.25E+06	3.89E+05	7.21E+05	6.33E+05	4.25E+05	8.08E+05	1.57E+05	4.71E+04	8.79E+04	7.83E+04	5.07E+04	1.04E+05
Eu-155	1.35E+06	4.28E+05	7.98E+05	6.81E+05	4.78E+05	8.21E+05	1.54E+05	4.82E+04	8.98E+04	7.73E+04	5.35E+04	9.49E+04
Ta-182	2.42E+05	1.90E+05	1.80E+05	2.04E+06	1.68E+05	2.44E+05	1.94E+06	1.41E+06	1.45E+06	1.63E+06	1.35E+06	1.96E+06
W-187	7.25E+06	5.09E+06	4.57E+06	5.55E+06	4.68E+06	6.81E+06	6.99E+05	4.84E+05	4.39E+05	5.30E+05	4.45E+05	6.52E+05
Pb-210	3.69E+04	9.75E+03	1.71E+04	1.76E+04	9.16E+03	3.27E+04	5.31E+03	1.46E+03	2.42E+03	3.05E+03	1.28E+03	1.43E+04
Pb-212	2.89E+06	1.26E+06	1.72E+06	1.78E+06	1.36E+06	2.13E+06	2.99E+05	1.29E+05	1.78E+05	1.83E+05	1.40E+05	2.25E+05
Pb-214	4.29E+06	2.39E+06	2.65E+06	2.95E+06	2.39E+06	3.55E+06	4.32E+05	2.39E+05	2.66E+05	2.96E+05	2.39E+05	3.61E+05
Bi-212	2.59E+06	2.08E+06	1.89E+06	2.22E+06	1.90E+06	2.69E+06	2.25E+05	1.78E+05	1.61E+05	1.92E+05	1.63E+05	2.36E+05
Bi-214	2.10E+07	1.89E+07	1.69E+07	1.87E+07	1.62E+07	2.23E+07	1.71E+06	1.51E+06	1.35E+06	1.51E+06	1.31E+06	1.81E+06
Po-212	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-214	1.54E+03	1.14E+03	9.75E+02	1.27E+03	1.09E+03	1.62E+03	1.39E+02	1.03E+02	8.84E+01	1.15E+02	9.85E+01	1.46E+02
Po-216	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-218	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ra-224	1.87E+05	8.92E+04	1.13E+05	1.21E+05	9.45E+04	1.45E+05	1.90E+04	9.04E+03	1.15E+04	1.22E+04	9.58E+03	1.49E+04
Ra-226	1.37E+05	5.79E+04	8.19E+04	8.21E+04	6.26E+04	9.83E+04	1.41E+04	5.94E+03	8.41E+03	8.45E+03	6.41E+03	1.05E+04
Ra-228	8.53E-05	9.39E-05	1.88E-05	4.53E-04	3.98E-07	8.53E-03	7.89E-05	8.68E-05	1.74E-05	4.19E-04	3.68E-07	7.89E-03
Ac-228	1.32E+07	9.95E+06	8.99E+06	1.10E+07	9.30E+06	1.37E+07	1.17E+06	8.65E+05	7.86E+05	9.64E+05	8.14E+05	1.23E+06
Th-228	4.33E+04	1.54E+04	2.56E+04	2.41E+04	1.74E+04	3.33E+04	4.75E+03	1.67E+03	2.74E+03	2.95E+03	1.84E+03	8.88E+03
Th-230	8.79E+03	2.86E+03	4.78E+03	4.83E+03	3.07E+03	1.00E+04	1.11E+03	3.53E+02	5.44E+02	6.92E+02	3.39E+02	5.86E+03
Th-232	3.91E+03	1.20E+03	2.03E+03	2.21E+03	1.23E+03	6.81E+03	5.93E+02	1.78E+02	2.53E+02	6.10E+02	1.45E+02	5.44E+03
Th-234	1.90E+05	6.00E+04	1.10E+05	9.53E+04	6.63E+04	1.18E+05	2.14E+04	6.70E+03	1.23E+04	1.11E+04	7.33E+03	1.94E+04
Pa-234	2.89E+07	2.07E+07	1.92E+07	2.34E+07	1.98E+07	2.93E+07	2.61E+06	1.83E+06	1.72E+06	2.10E+06	1.77E+06	2.69E+06
U-234	2.77E+03	8.30E+02	1.38E+03	1.80E+03	8.36E+02	8.05E+03	5.71E+02	1.46E+02	1.85E+02	7.43E+02	1.00E+02	7.34E+03
U-238	9.69E+02	2.47E+02	3.66E+02	8.02E+02	1.97E+02	5.91E+03	3.32E+02	8.41E+01	7.05E+01	5.46E+02	2.97E+01	6.06E+03
Np-238	7.50E+06	5.78E+06	4.77E+06	6.38E+06	5.43E+06	8.32E+06	6.50E+05	4.99E+05	4.12E+05	5.54E+05	4.69E+05	7.45E+05
Np-239	3.44E+06	1.40E+06	2.14E+06	2.02E+06	1.57E+06	2.43E+06	3.59E+05	1.45E+05	2.22E+05	2.13E+05	1.62E+05	2.90E+05
Pu-238	9.79E+02	2.32E+02	3.16E+02	1.00E+03	1.67E+02	8.46E+03	4.77E+02	1.42E+02	7.02E+01	7.97E+02	2.54E+01	8.55E+03
Pu-239	1.39E+03	4.51E+02	7.98E+02	9.42E+02	5.05E+02	3.87E+03	2.83E+02	8.55E+01	9.52E+01	3.60E+02	5.44E+01	3.32E+03
Pu-240	1.01E+03	2.33E+02	3.34E+02	9.90E+02	1.78E+02	8.10E+03	4.65E+02	1.36E+02	7.17E+01	7.64E+02	2.69E+01	8.14E+03
Pu-241	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pu-242	8.25E+02	1.93E+02	2.83E+02	7.96E+02	1.52E+02	6.40E+03	3.68E+02	6.23E+01	5.81E+01	6.03E+02	2.22E+01	6.41E+03
Am-241	5.01E+05	1.43E+05	2.47E+05	2.37E+05	1.42E+05	3.12E+05	6.40E+04	1.81E+04	3.11E+04	3.16E+04	1.79E+04	5.77E+04
Am-242	3.08E+05	1.04E+05	1.95E+05	1.62E+05	1.21E+05	1.96E+05	3.32E+04	1.11E+04	2.07E+04	1.80E+04	1.29E+04	2.97E+04
Am-243	1.22E+06	3.71E+05	6.70E+05	5.97E+05	3.96E+05	7.28E+05	1.37E+05	4.16E+04	7.49E+04	6.79E+04	4.42E+04	9.30E+04
Cm-242	1.08E+03	2.95E+02	2.97E+02	1.14E+03	1.56E+02	9.49E+03	6.08E+02	2.02E+02	7.14E+01	9.05E+02	2.57E+01	9.00E+03
Cm-243	2.57E+06	1.06E+06	1.59E+06	1.53E+06	1.18E+06	1.85E+06	2.68E+05	1.09E+05	1.64E+05	1.62E+05	1.22E+05	2.33E+05
Cm-244	6.91E+02	2.00E+02	1.25E+02	9.01E+02	5.13E+01	8.47E+03	5.22E+02	1.76E+02	4.96E+01	8.07E+02	1.34E+01	8.15E+03

TABLE 2.4a
PUBLIC WATER SUPPLY INFORMATION*

TRM	2020 POPULATION	WATER SUPPLY
294.0		Browns Ferry Nuclear Plant
283.0	500	U. S. Plywood-Champion Paper
274.9	50	Wheeler Dam
259.6	14,100	Muscle Shoals
259.5	2,700	TVA-NFDC
254.3	21,100	Sheffield
245.0	520	Colbert Steam Plant
239.3	3,900	Cherokee
238.7	350	U.S. Steel Agri-Chemicals, Inc.
217.4	1	Yellow Creek Nuclear Plant
206.8	2,400	Hardin Co. Water District
193.5	1,900	Tri-County Utility District
158.0	1,100	Clifton
101.9	170	Foote Mineral Co.
100.5	6,100	New Johnsonville
100.4	13,300	Camden
100.0	375	Johnsonville Steam Plant
98.5	900	E. I. Dupont Company
95.5	700	Consolidated Aluminum Corporation
94.5	250	Inland Container Corporation
79.5	120	Bass Bay Resort
39.3	4,300	Jonathan Creek Water District
28.5	9,100	North Marshall Water District
23.6	650	Grand Rivers
17.8	600	B. F. Goodrich Chemical Co.
17.4	106	Airco Carbide
16.8	592	Airco Alloys
16.7	510	Air Products and Chemicals
1.1	69,800	Paducah

*From TVA Water Quality Branch, updated December 1979

TABLE 2.4b

FISH HARVEST DATA

RIVER SPAN (TRM)	NAME OF REACH	FISH HARVEST (LBS/YR) SPORT*	COMMERCIAL**
294.0 - 274.9	Wheeler Lake below BFN	1.5×10^6	5.7×10^5
274.9 - 259.4	Wilson Lake	5.9×10^5	2.2×19^5
259.4 - 217.4	Pickwick Lake above YCN	1.3×10^6	4.9×10^5
217.4 - 206.7	Pickwick Lake below YCN	3.3×10^5	1.2×10^5
206.7 - 165.0	Kentucky Lake (Part 1 of 4)	6.1×10^5	2.3×10^5
165.0 - 121.0	Kentucky Lake (Part 2 of 4)	6.1×10^5	2.3×10^5
121.0 - 76.0	Kentucky Lake (Part 3 of 4)	1.8×10^6	6.8×10^5
76.0 - 22.4	Kentucky Lake (Part 4 of 4)	3.1×10^6	1.1×10^6

*Derived from "Situation Assessment and Planning Assumptions," Division of Forestry, Fisheries, and Wildlife, TVA, December 1978.

**Derived from "Estimated Commercial Fish and Mussel Harvest from the Tennessee Valley," Fisheries and Aquatic Ecology Branch, TVA, 1980.

TABLE 2.4c

RECREATION USAGE DATA*

RIVER SPAN (TRM)	NAME OF REACH	HOURS OF USAGE PER YEAR		
		SHORELINE	ABOVE-WATER	IN-WATER
294.0 - 274.9	Wheeler Lake below BFN	5.2×10^6	1.0×10^6	4.7×10^4
274.9 - 259.4	Wilson Lake	3.9×10^6	7.4×10^5	3.5×10^6
259.4 - 217.4	Pickwick Lake above YCN	2.0×10^6	3.5×10^5	2.0×10^6
217.4 - 206.7	Pickwick Lake below YCN	2.0×10^6	4.0×10^5	1.8×10^6
206.7 - 165.0	Kentucky Lake (Part 1 of 4)	6.0×10^5	1.2×10^5	5.4×10^5
165.0 - 121.0	Kentucky Lake (Part 2 of 4)	1.2×10^6	2.3×10^5	1.1×10^6
121.0 - 76.0	Kentucky Lake (Part 3 of 4)	2.4×10^6	4.7×10^5	2.2×10^6
76.0 - 22.4	Kentucky Lake (Part 4 of 4)	2.6×10^7	4.9×10^6	2.3×10^7

*Based on "Extent of Recreation Development and Use of TVA Lake Frontage Property;" (unpublished data from 1974 Annual Recreation Survey); and Observations of Recreation Use of TVA Reservoirs, Division of Reservoir Properties, Recreation Resources Branch, TVA, 1975.

TABLE 3.1
(Sheet 1 of 4)

ENVIRONMENTAL RADIOLOGICAL MONITORING

Exposure Pathway and/or Sample	Number of Samples and Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
AIRBORNE			
Particulates	5 samples from locations (in different sectors) at or near the site boundary (LM-1, LM-2, LM-3, LM-4, and LM-6)	Continuous sampler operation with sample collection as required by dust loding but at least once per 7 days.	Particulate sampler. Analyze for gross beta radioactivity ≥24 hrs following filter change. Perform gamma isotopic analysis on each sample when gross beta activity is >10 times the average of control samples. Perform gamma isotopic analysis on composite (by location) sample at least once per 92 days.
	2 samples from control locations greater than 10 miles from the plant (RM-1 and RM-6)		
	3 samples from locations in communities approximately 10 miles from the plant (PM-1, PM-2 and PM-3)		
Radioiodine	Same locations as air particulates	Continuous sampler operation with charcoal canister collection at least once per 7 days	I-131 every 7 days
SOIL	Samples from same locations as air particulates	Once every year	Gamma scan, Sr-89, Sr-90 once per year
DIRECT	2 or more dosimeters placed at locations (in different sectors) at or near the site boundary in each of the 16 sectors	At least once per 92 days	Gamma dose once per 92 days

TABLE 3.1
(Sheet 2 of 4)

ENVIRONMENTAL RADIOLOGICAL MONITORING

Exposure Pathway and/or Sample	Number of Samples and Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
	2 or more dosimeters placed at stations located >5 miles from the plant in each of the 16 sectors	At least once per 92 days.	Gamma dose once per 92 days.
	2 or more dosimeters in at least 8 additional locations of special interest		
WATERBORNE			
Surface	1 sample upstream (TRM 305.0) 1 sample immediately downstream of discharge (TRM 293.5)	Collected by automatic sequential-type sampler with composite sample taken at least once per 31 days[a].	Gamma scan on 4-week composite. Composite for tritium at least once per 92 days
Drinking	1 sample at the first potable surface water supply downstream from the plant (TRM 282.6) 1 sample at control location[b] (TRM 305.0)	Collected by automatic sequential-type sampler with composite sample taken at least once per 31 days[a,c]	Gross beta and gamma scan on 4-week composite. Composite for tritium at least once per 92 days.
AQUATIC			
Sediment	1 sample upstream from discharge point (TRM 297.0)	At least once per 184 days	Gamma scan, Sr-89, and Sr-90 analyses

a Composite samples shall be collected by collecting an aliquot at intervals not exceeding 2 hours.
b The surface water control sample shall be considered a control for the drinking water sample.
c This assumes that the nearest drinking water intake is >3.0 mile downstream of the plant discharge. If a drinking water intake is constructed within 3.0 miles downstream of the plant discharge, sampling and analysis shall be every 2 weeks.

TABLE 3.1
(Sheet 3 of 4)

ENVIRONMENTAL RADIOLOGICAL MONITORING

Exposure Pathway and/or Sample	Number of Samples and Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
	1 sample in immediate downstream area of discharge point (TRM 293.7)	At least once per 184 days	Gamma scan, Sr-89 and Sr-90 analyses
INGESTION			
Milk	At least 3 samples from dairy farms in the immediate vicinity of the plant (Farms B, L and Bn)	At least once per 15 days when animals are on pasture; at least one per 31 days at other times.	I-131 on each sample. Gamma scan, Sr-89 and Sr-90 at least once per 31 days
	At least 1 sample from control locations (Farm O or C)		
Fish	3 samples representing commercial and game species in Guntersville Reservoir above the plant	At least once per 184 days	Gamma scan at least once per 184 days on edible portions,
	3 samples representing commercial and game species in Wheeler Reservoir near the plant		
Fruits & Vegetables	Samples of food crops such as corn, green beans, tomatoes, and potatoes grown at private gardens and/or farms in the immediate vicinity of the plant	At least once per year at time of harvest	Gamma scan on edible portion

TABLE 3.1
(Sheet 4 of 4)

ENVIRONMENTAL RADIOLOGICAL MONITORING

Exposure Pathway and/or Sample	Number of Samples and Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
	1 sample of each of the same foods grown at greater than 10 miles distance from the plant		
Vegetation (pasturage and	Samples from the nearby dairy farms and from the stations Control samples from 1 remote air monitor and 1 control dairy farm	Once per 31 days	I-131, gamma scan once per 31 days.

Table 3.2

Atmospheric and Terrestrial Monitoring Station Locations

Browns Ferry Nuclear Plant

	Location and Approximate Distance and Direction from Plant
LM-1 BF	1.0 mile N
LM-2 BF	0.9 mile NNE
LM-3 BF	1.0 mile NE
LM-4 BF	1.7 miles NNW
LM-6 BF	3 miles SSW
PM-1 BF (Rogersville, AL)	13.8 miles NW
PM-2 BF (Athens, AL)	10.9 miles NE
PM-3 BF (Decatur/Trinity, AL)	8.2 miles SSE
RM-1 BF (Muscle Shoals, AL)	32.0 miles W
RM-6 BF (Madison, AL area)	23.0 miles E
Farm B	7.0 miles NNW
Farm Bn	4.75 miles E
Farm L	5.8 miles ENE
Farm E (vegetation only)	6.1 miles NE
Farm W (vegetation only)	6.9 miles NE
Farm C (control)	32 miles N
Farm O (control)	26.2 miles E

TABLE 3.3

Maximum Values for the Lower Limit of Detection (LLD)[a,c]

(Sheet 1 of 2)

Analysis	Water (pCi/ℓ)	Airborne Particulate or Gases (pCi/m³)	Fish (pCi/kg, wet)	Milk (pCi/ℓ)	Food Products (pCi/kg, wet)	Sediment (pCi/kg, dry)
gross beta	4	0.01	N/A	N/A	N/A	N/A
H-3	2000	N/A	N/A	N/A	N/A	N/A
Mn-54	15	N/A	130	N/A	N/A	N/A
Fe-59	30	N/A	260	N/A	N/A	N/A
Co-58, 60	15	N/A	130	N/A	N/A	N/A
Zn-65	30	N/A	260	N/A	N/A	N/A
Zr-95	30	N/A	N/A	N/A	N/A	N/A
Nb-95	15	N/A	N/A	N/A	N/A	N/A
I-131	1[b]	0.07	N/A	1	60	N/A
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-140	60	N/A	N/A	60	N/A	N/A
La-140	15	N/A	N/A	15	N/A	N/A

TABLE 3.3

Maximum Values for the Lower Limit of Detection (LLD)[a,c]

(Sheet 2 of 2)

Table Notation

a The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95 percent probability with 5 percent probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66\ s_b}{E\ V\ 2.22\ Y\ \exp(-\lambda\Delta t)}$$

Where:

LLD is the "a priori" lower limit of detection as defined above, (as picocuries per unit mass or volume).

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, (as counts per minute).

E is the counting efficiency, (as counts per disintegration).

V is the sample size (in units of mass or volume).

2.22 is the number of disintegrations per minute per picocurie.

Y is the fractional radiochemical yield, (when applicable).

λ is the radioactive decay constant for the particular radionuclide, and

Δt for environmental samples is the elapsed time between sample collection, (or end of the sample collection period), and time of counting (for environmental samples, not plant effluent samples).

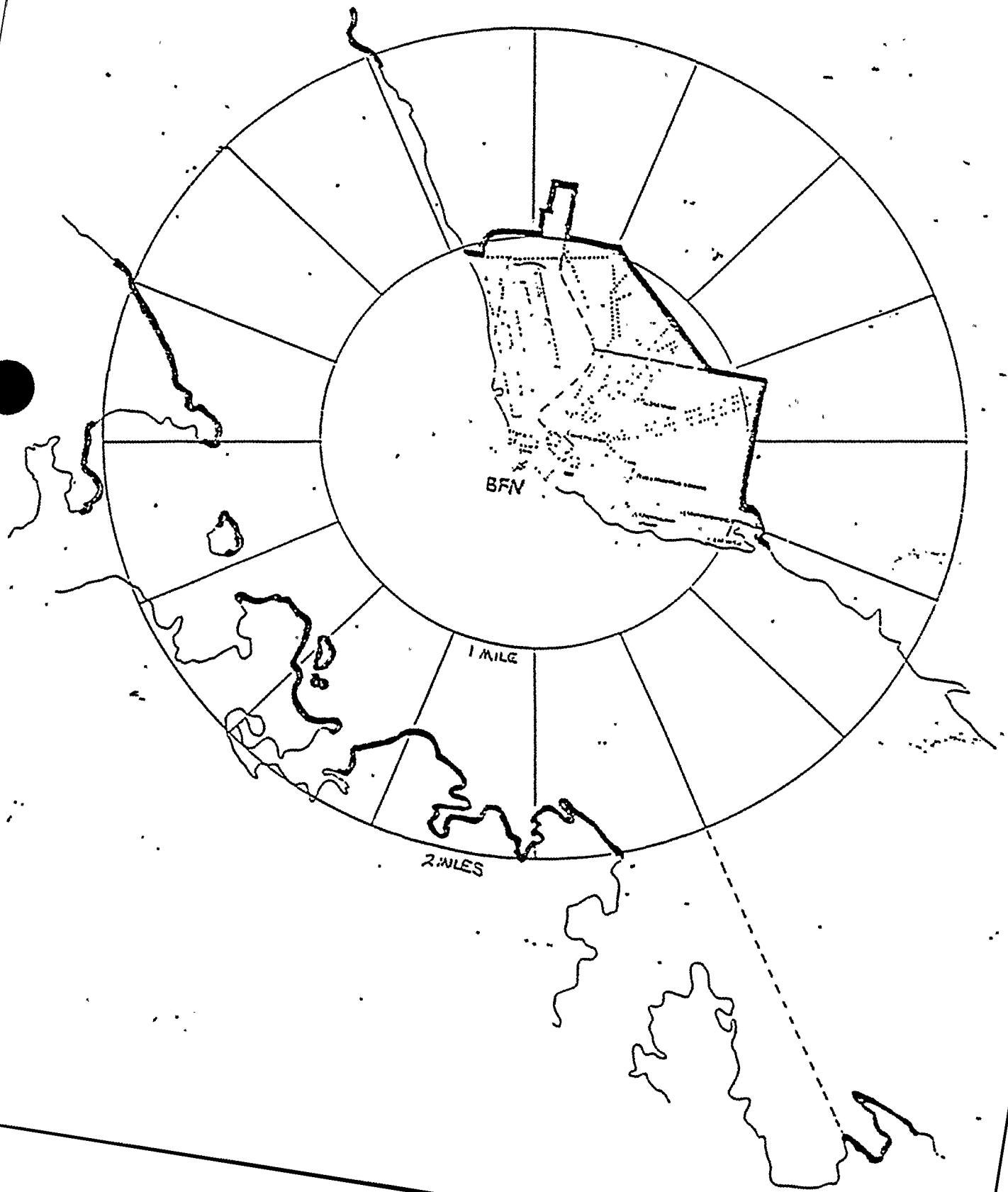
Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an a posteriori (after the fact) limit for a particular measurement.

b LLD for analysis of drinking water and surface water samples shall be performed by gamma spectroscopy at approximately 15 pCi/ℓ. If levels greater than 15 pCi/ℓ are identified in surface water samples fownstream from the plant, or in the event of an unanticipated release of I-131, drinking water samples will be analyzed at an LLD of 1.0 pCi/ℓ for I-131.

c Other peaks which are measurable and identifiable shall be identified and reported.

Figure 1.1
Land Site Boundary



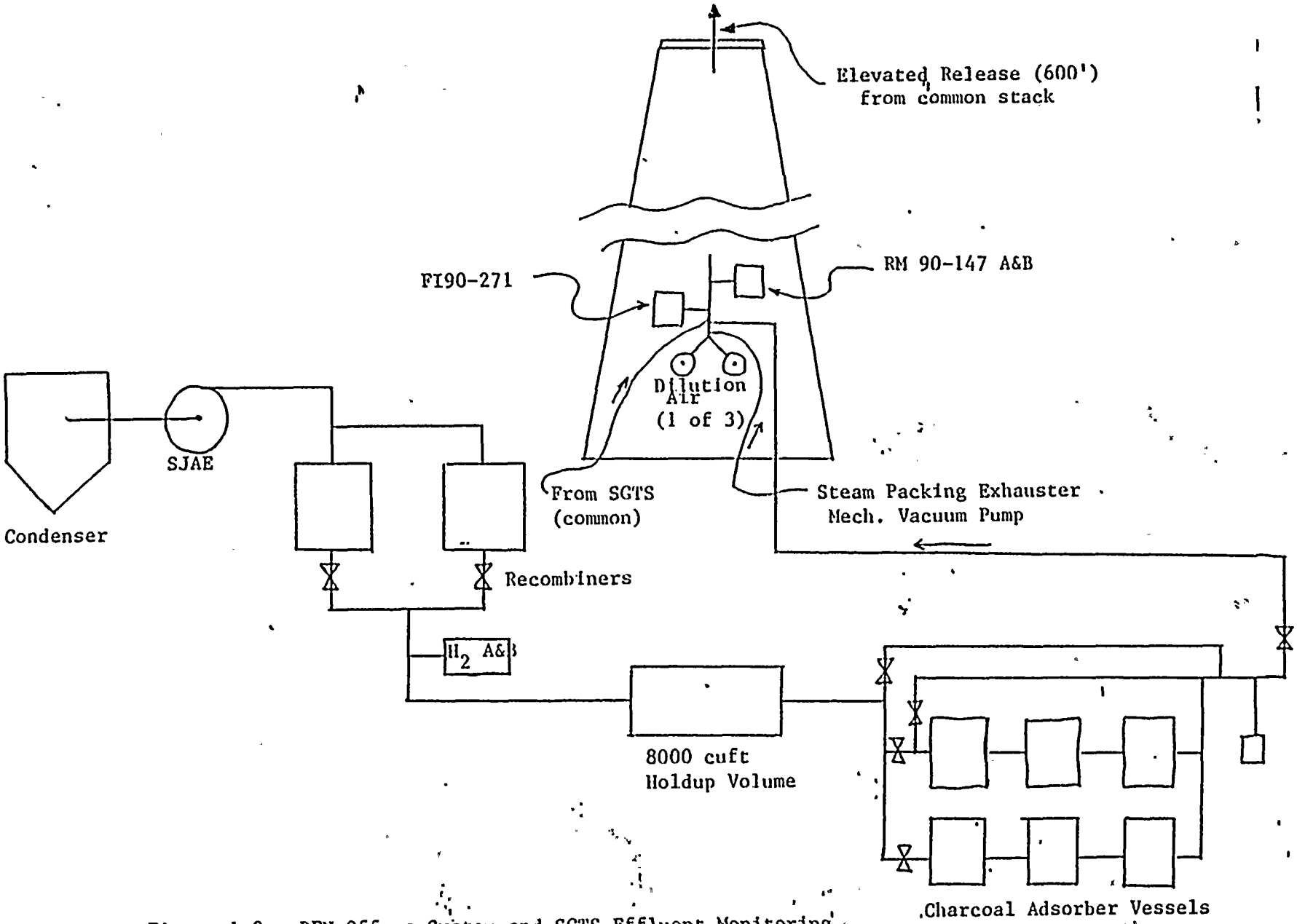
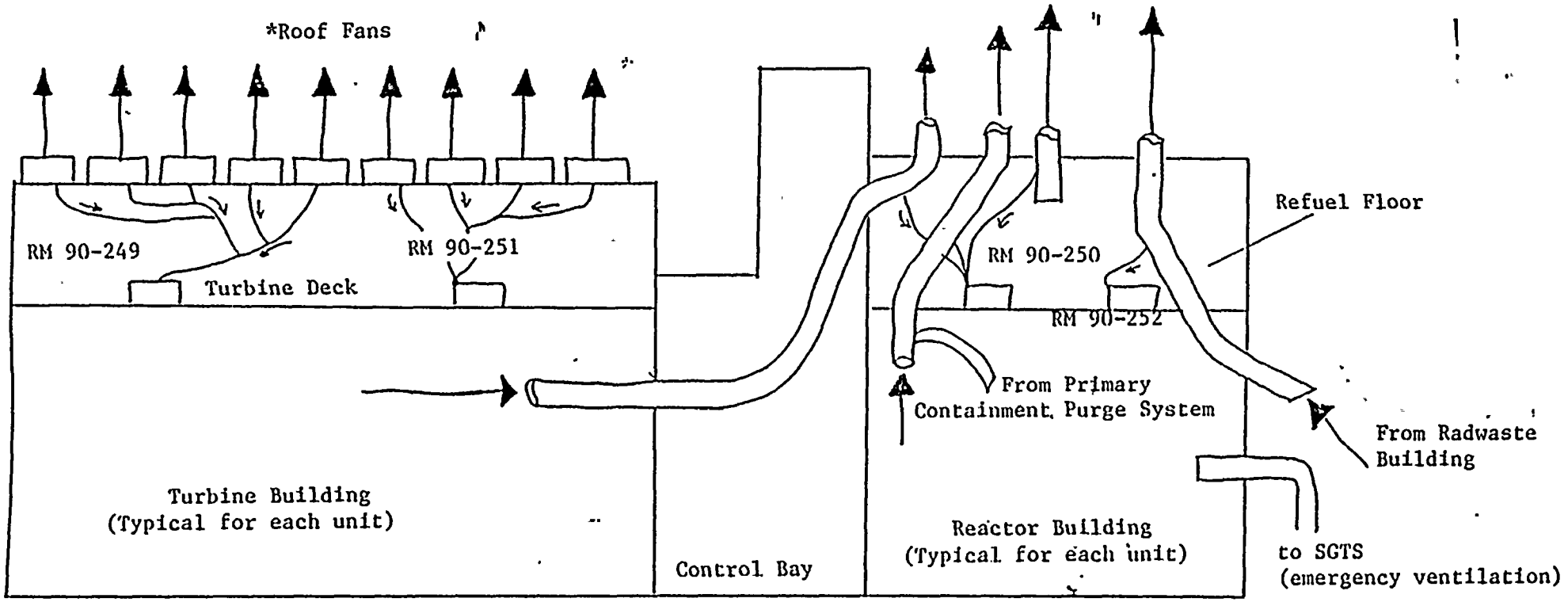


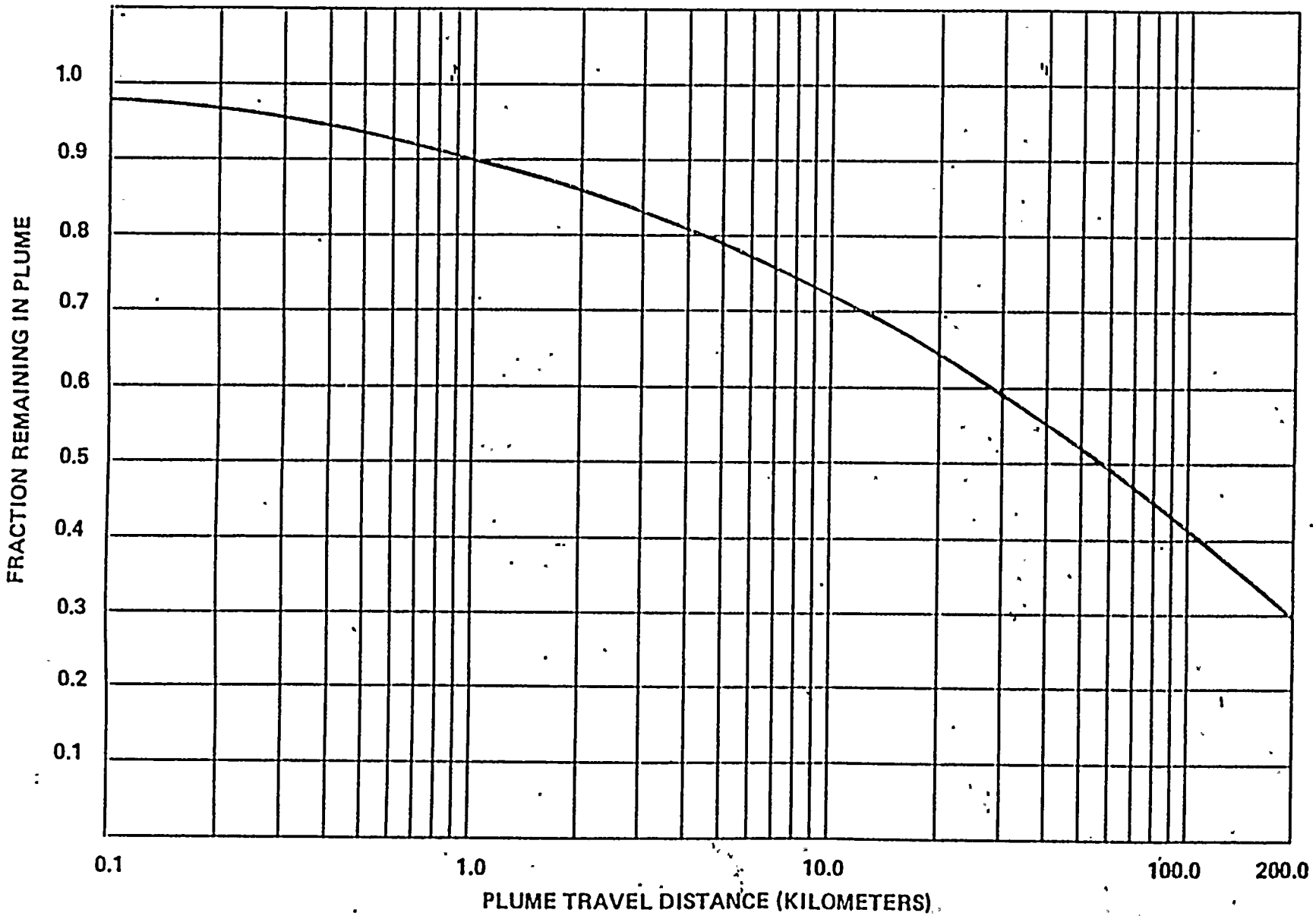
Figure 1.2 - BFN Offgas System and SGTS Effluent Monitoring



* Roof Fans used seasonally to control temperature

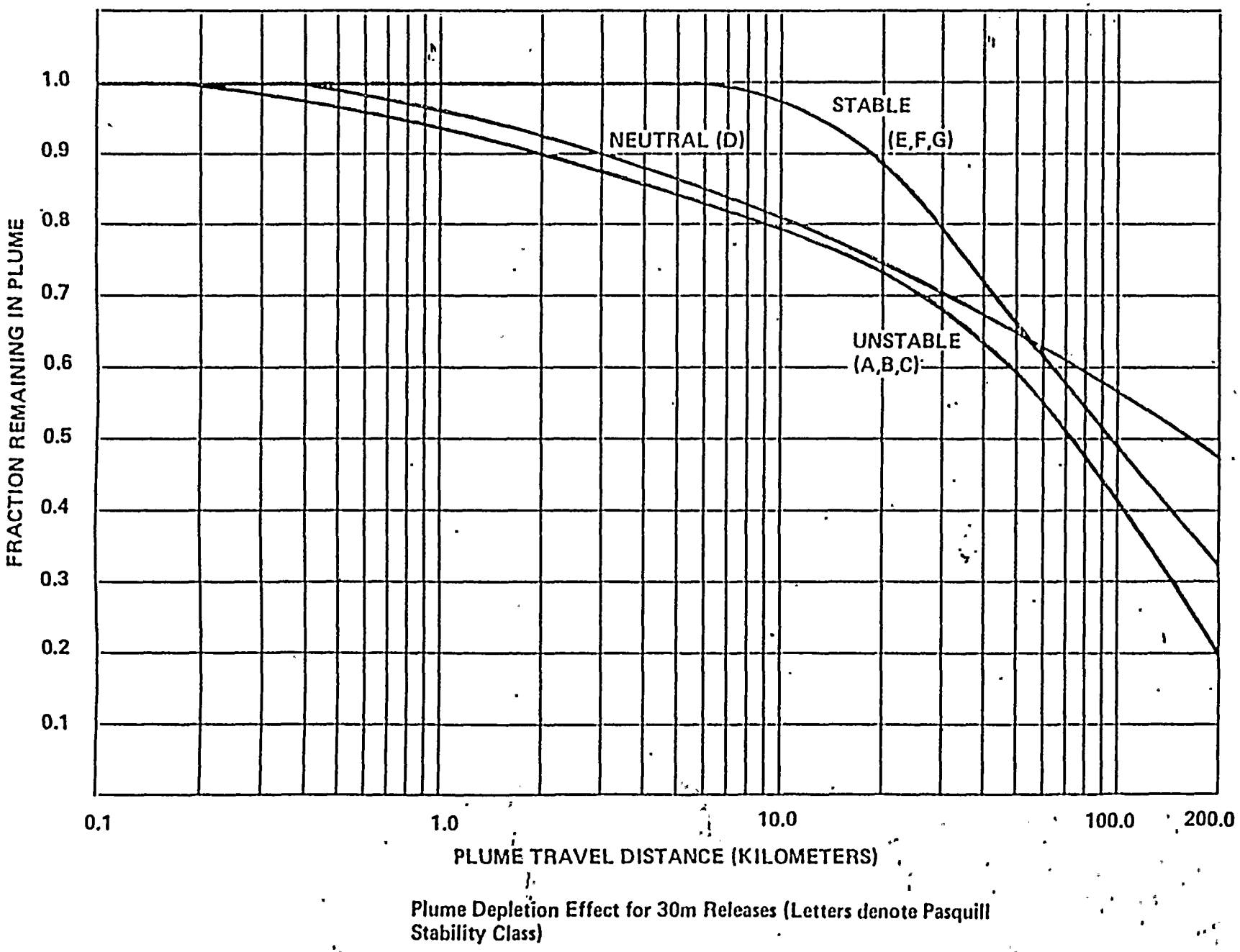
Figure 1.3 - BFN Normal Building Ventilation

Figure 1.4
(Sheet 1 of 4)



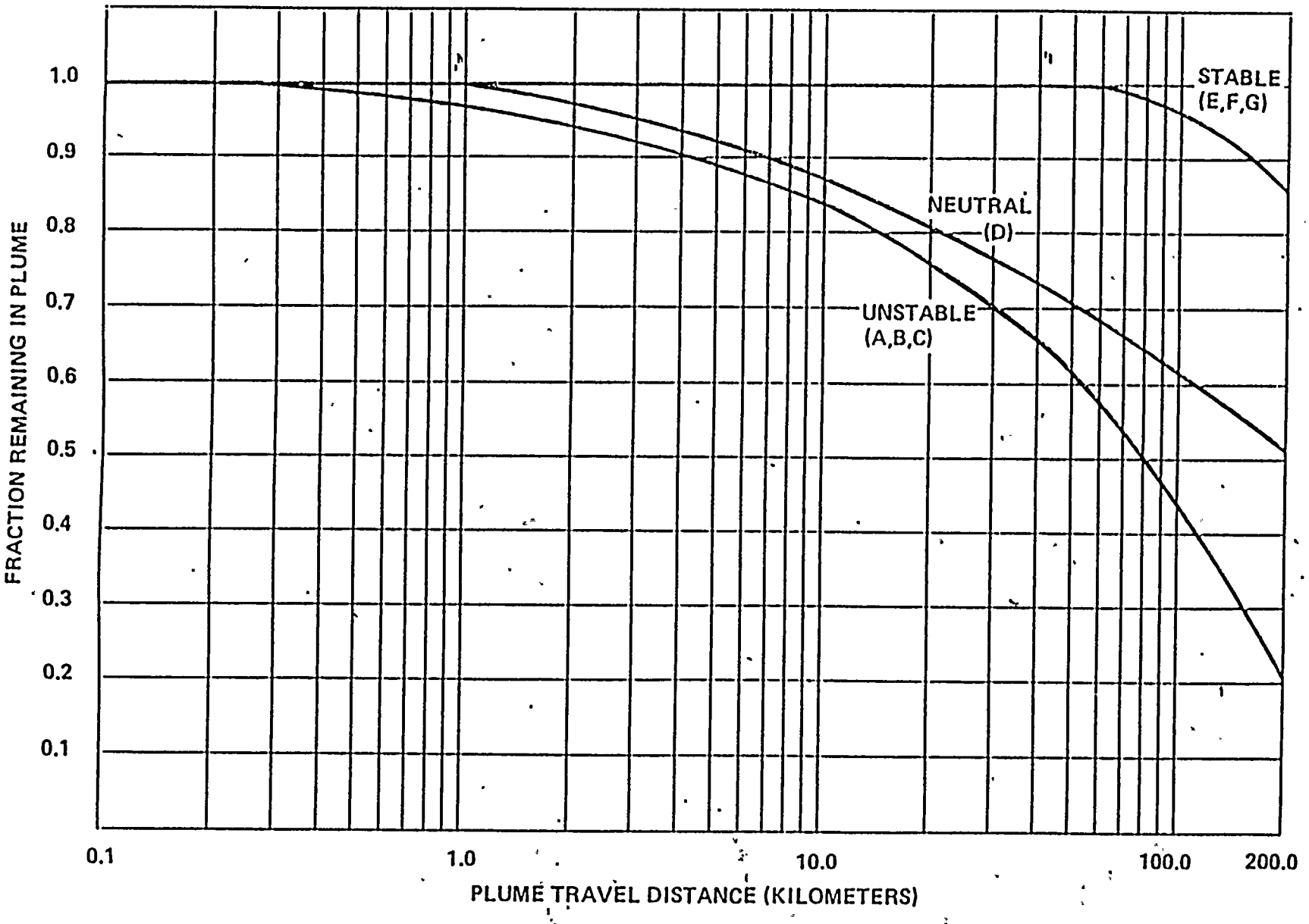
Plume Depletion Effect for Ground Level Releases (All Atmospheric Stability Classes)

Figure 1.4
(Sheet 2 of 4)



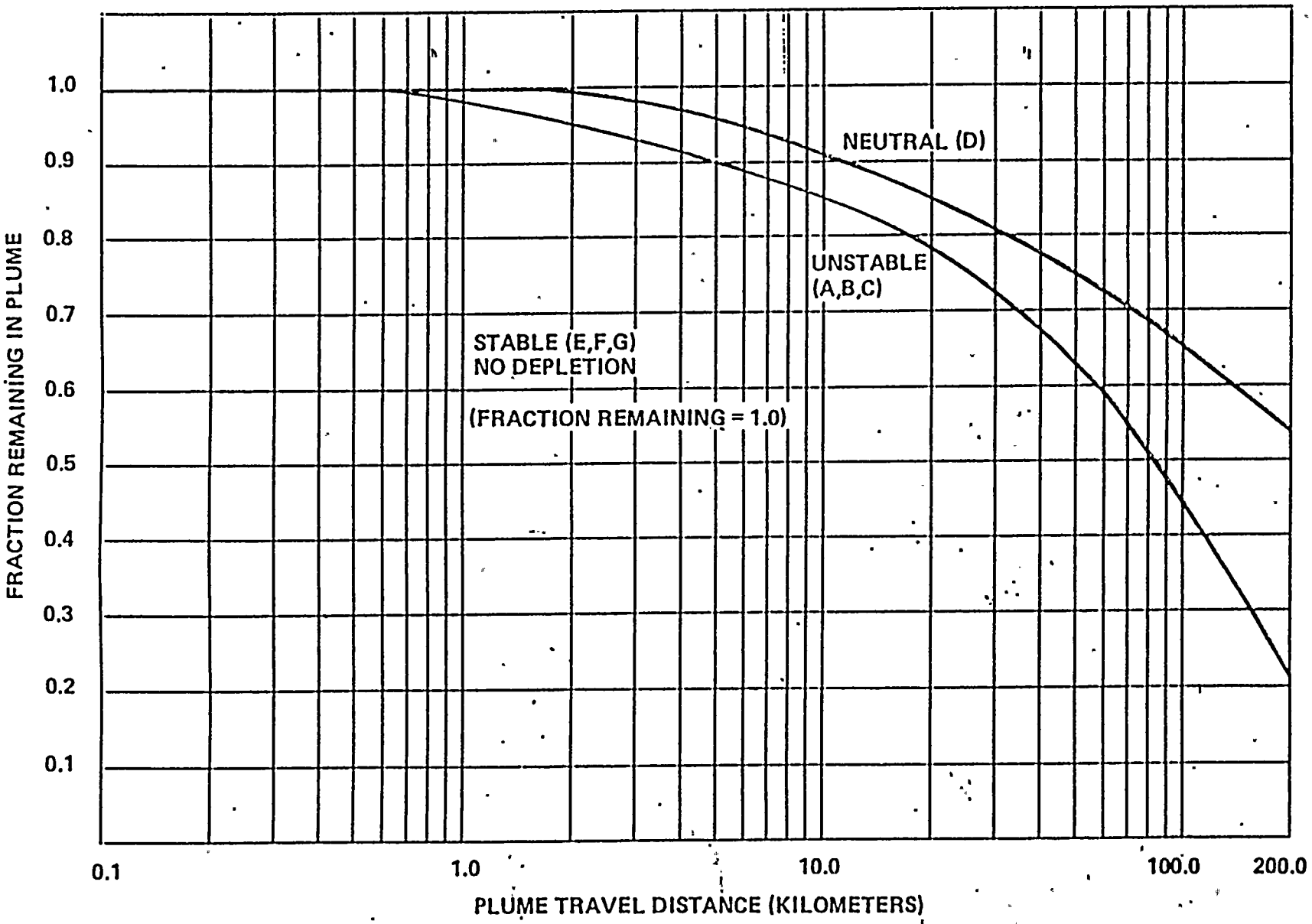
Plume Depletion Effect for 30m Releases (Letters denote Pasquill Stability Class)

Figure 1.4
(Sheet 3 of 4)



Plume Depletion Effect for 60m Releases (Letters denote Pasquill Stability Class)

Figure 1.4
(Sheet 4 of 4)



Plume Depletion Effect for 100m Releases (Letters denote Pasquill Stability Class)

Figure 1.5

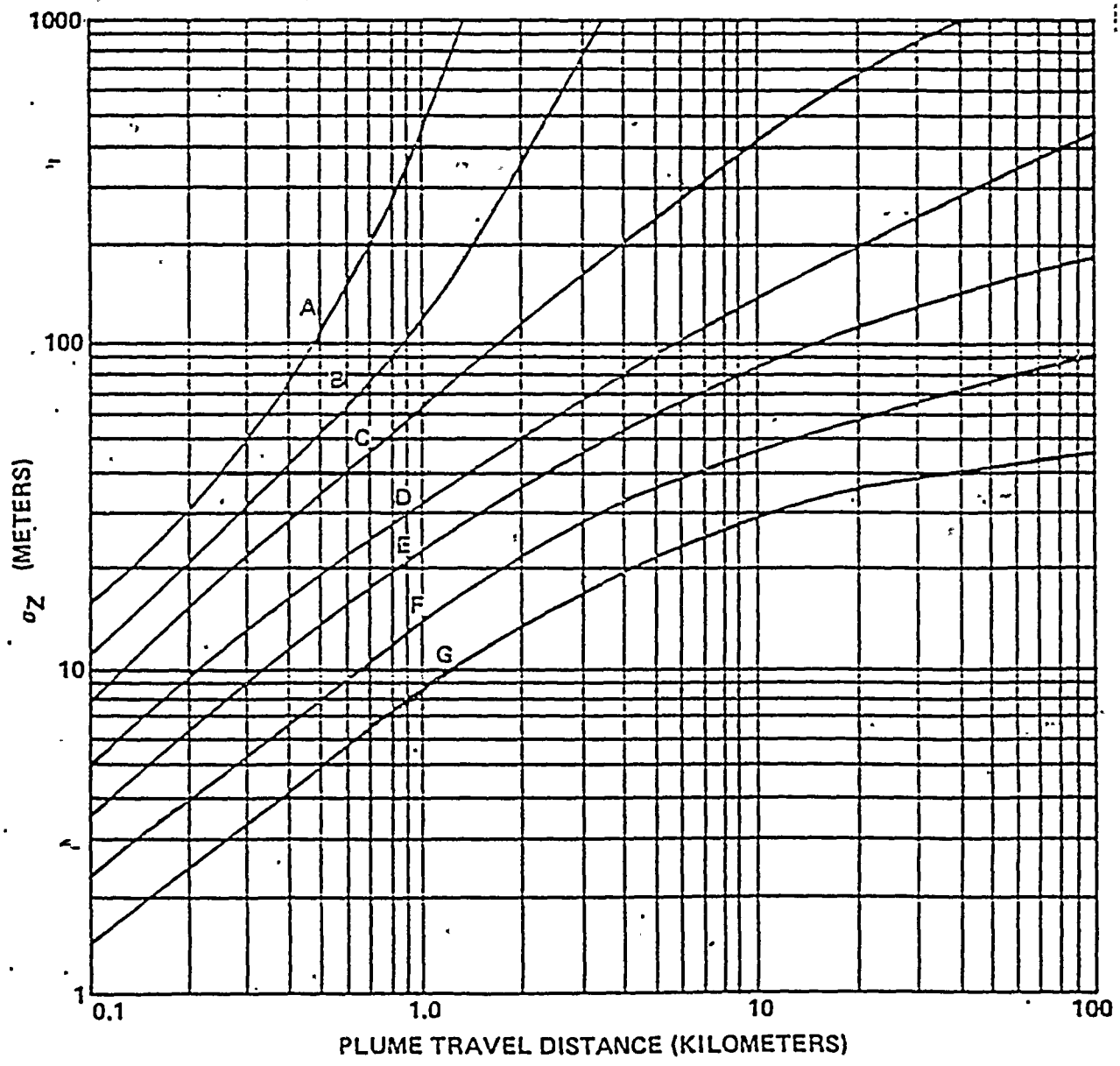
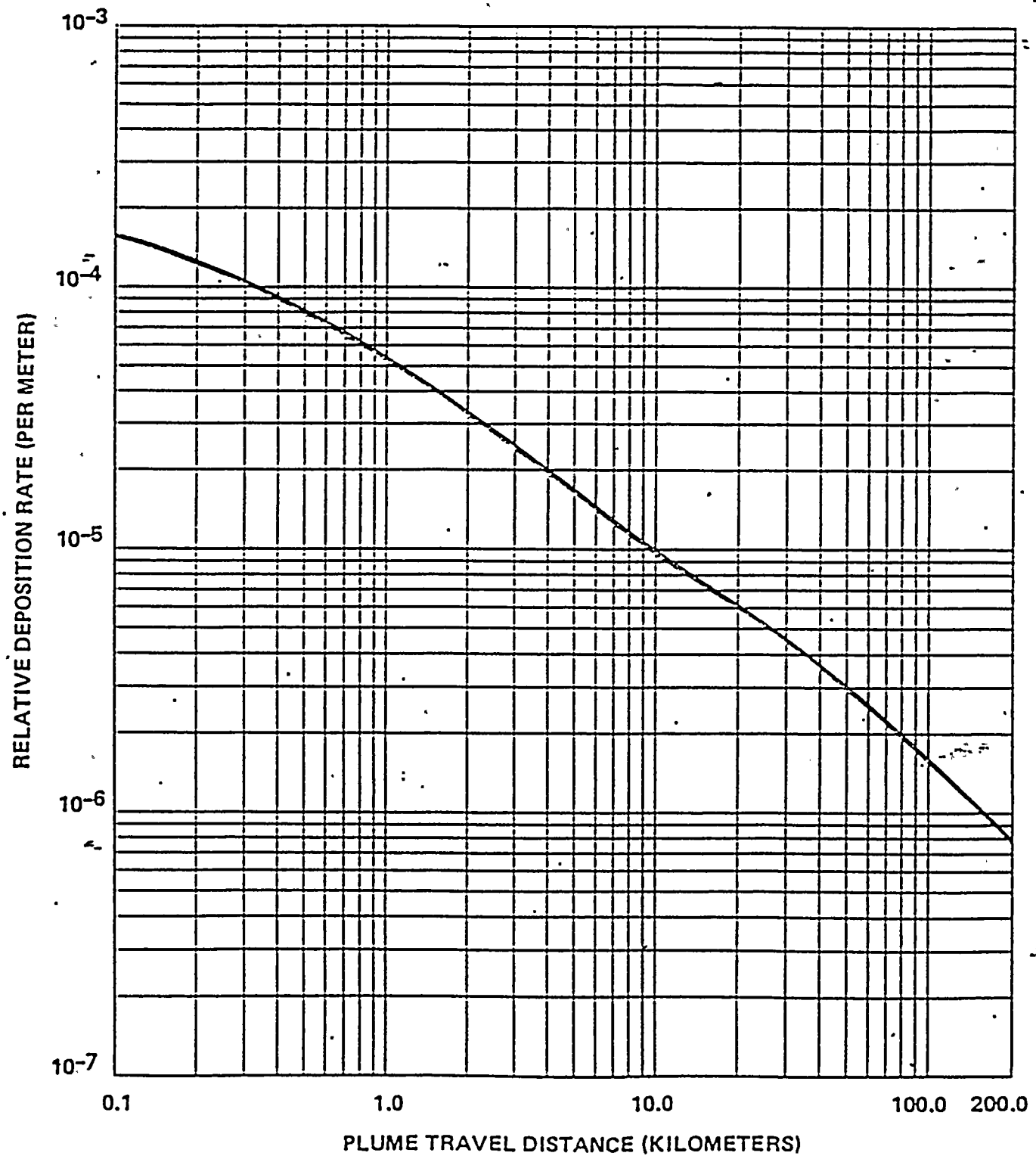


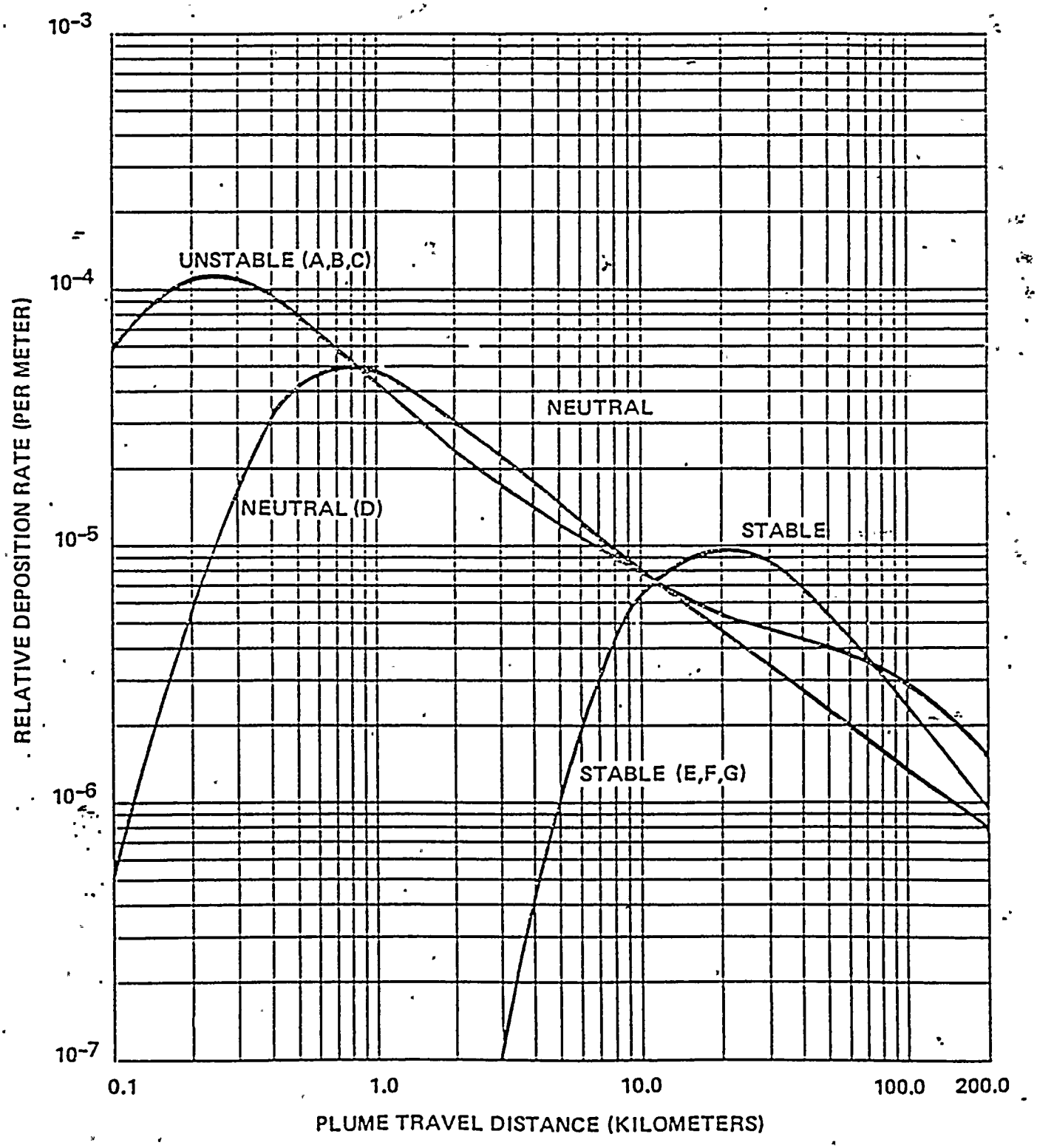
Figure 1. Vertical Standard Deviation of Material in a Plume (Letters denote Pasquill Stability Class)

Figure 1.6
(Sheet 1 of 4)



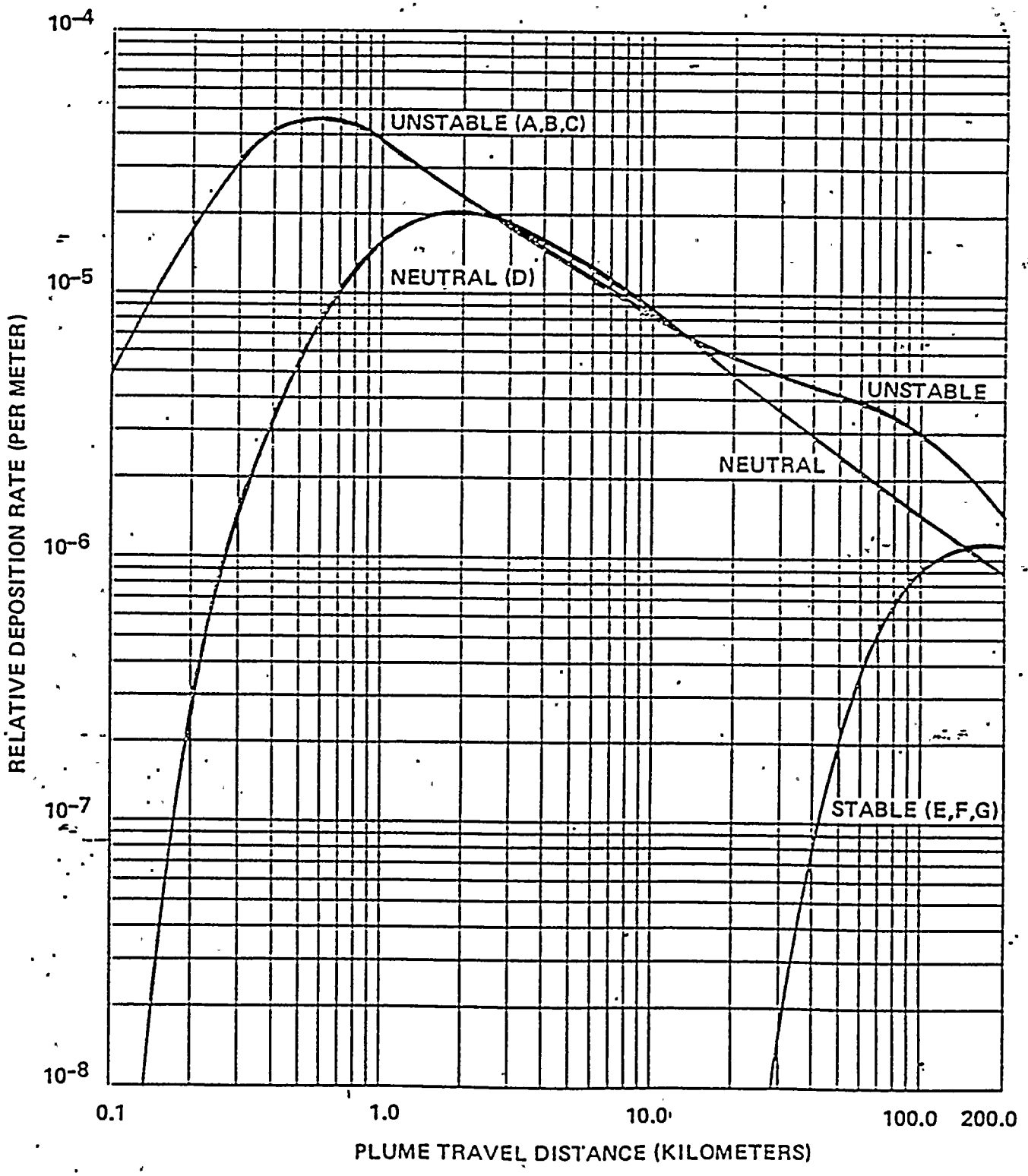
Relative Deposition for Ground Level Releases (All Atmospheric Stability Classes)

Figure 1.6
(Sheet 2 of 4)



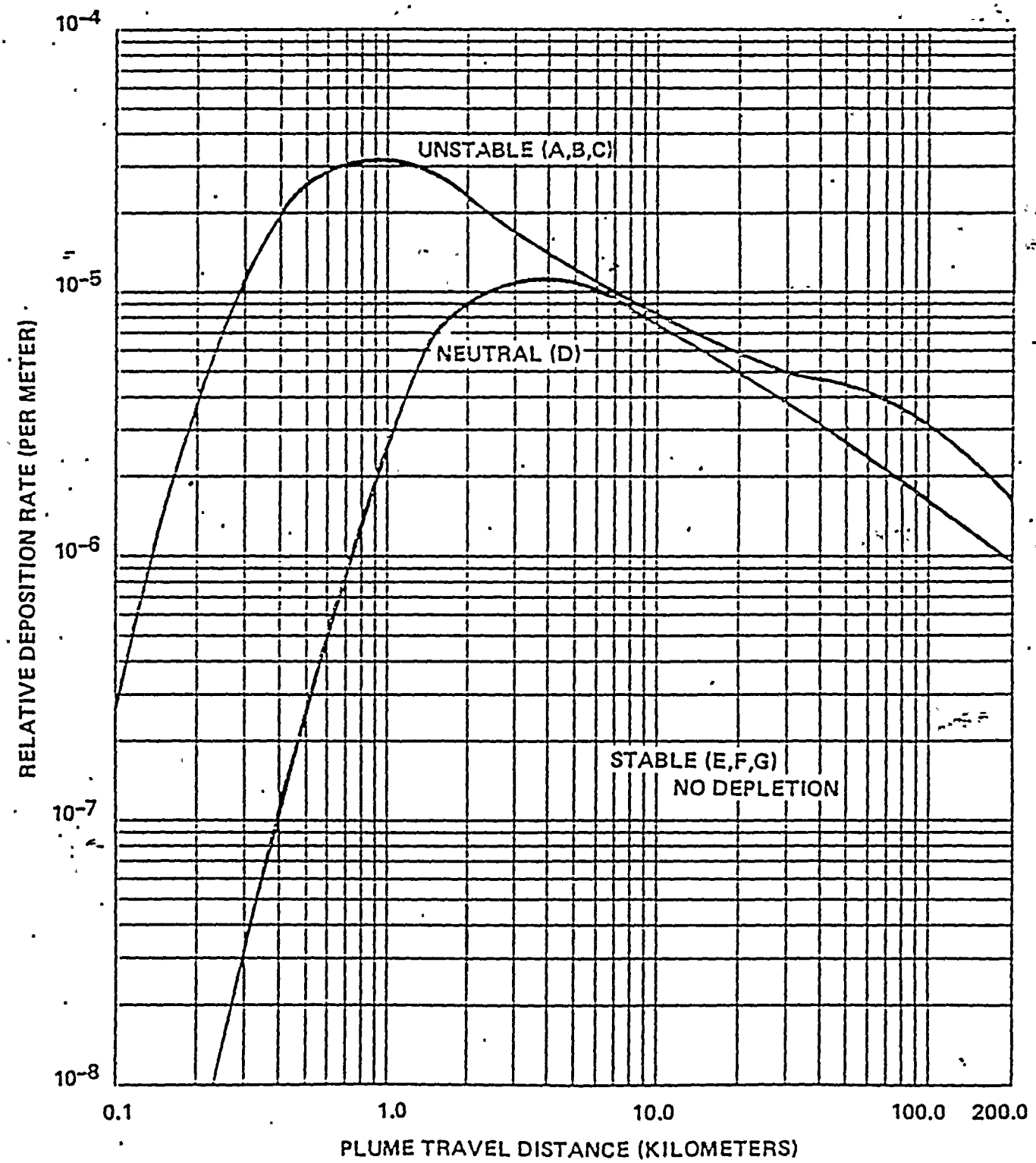
Relative Deposition for 30m Releases (Letters denote Pasquill Stability Class)

Figure 1.6
(Sheet 3 of 4)



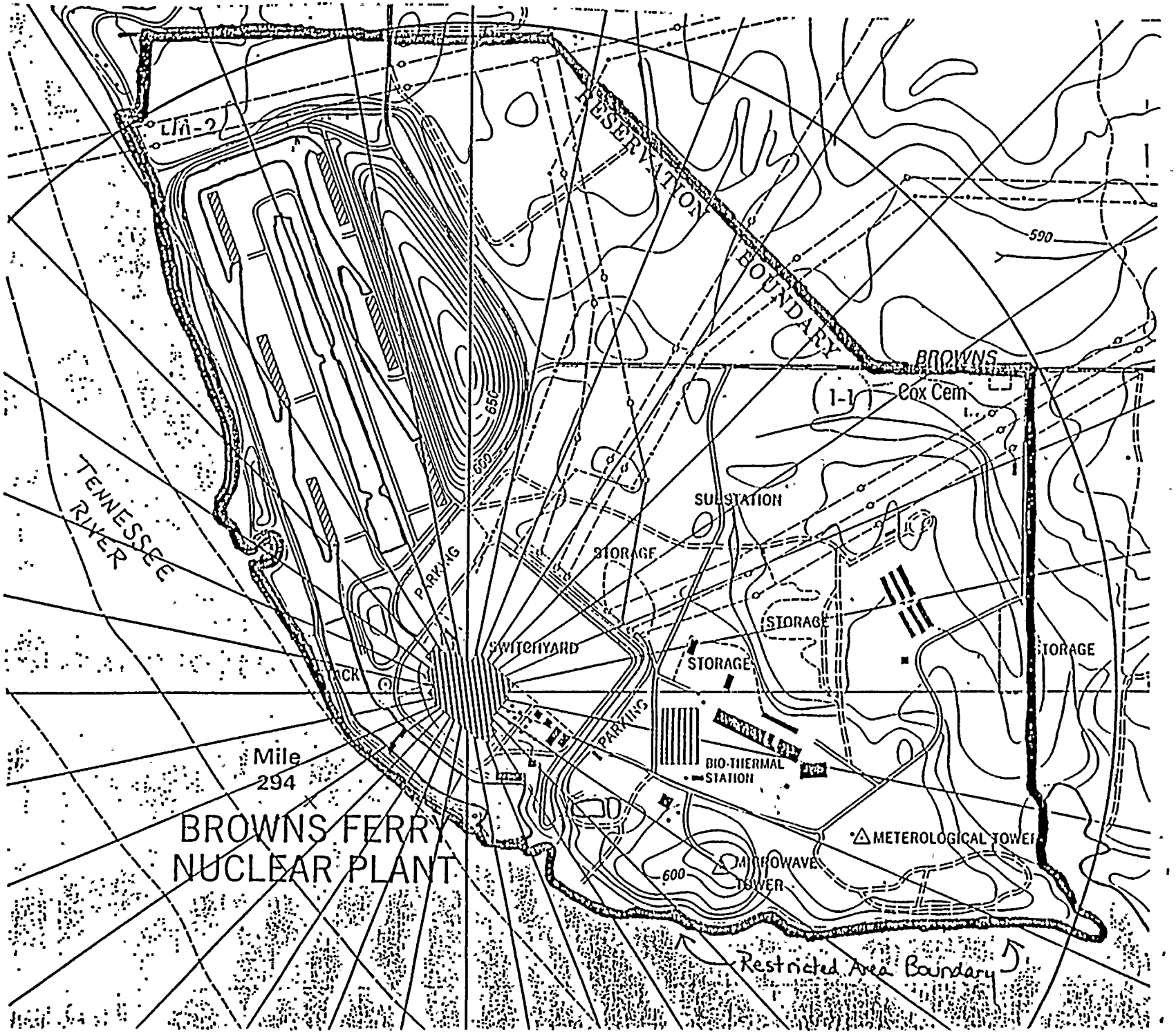
Relative Deposition for 60m Releases (Letters denote Pasquill Stability Class)

Figure 1.6
(Sheet 4 of 4)



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

Figure 2.1 - ASSUMED LIQUID EFFLUEN[illegible]STRICTED AREA



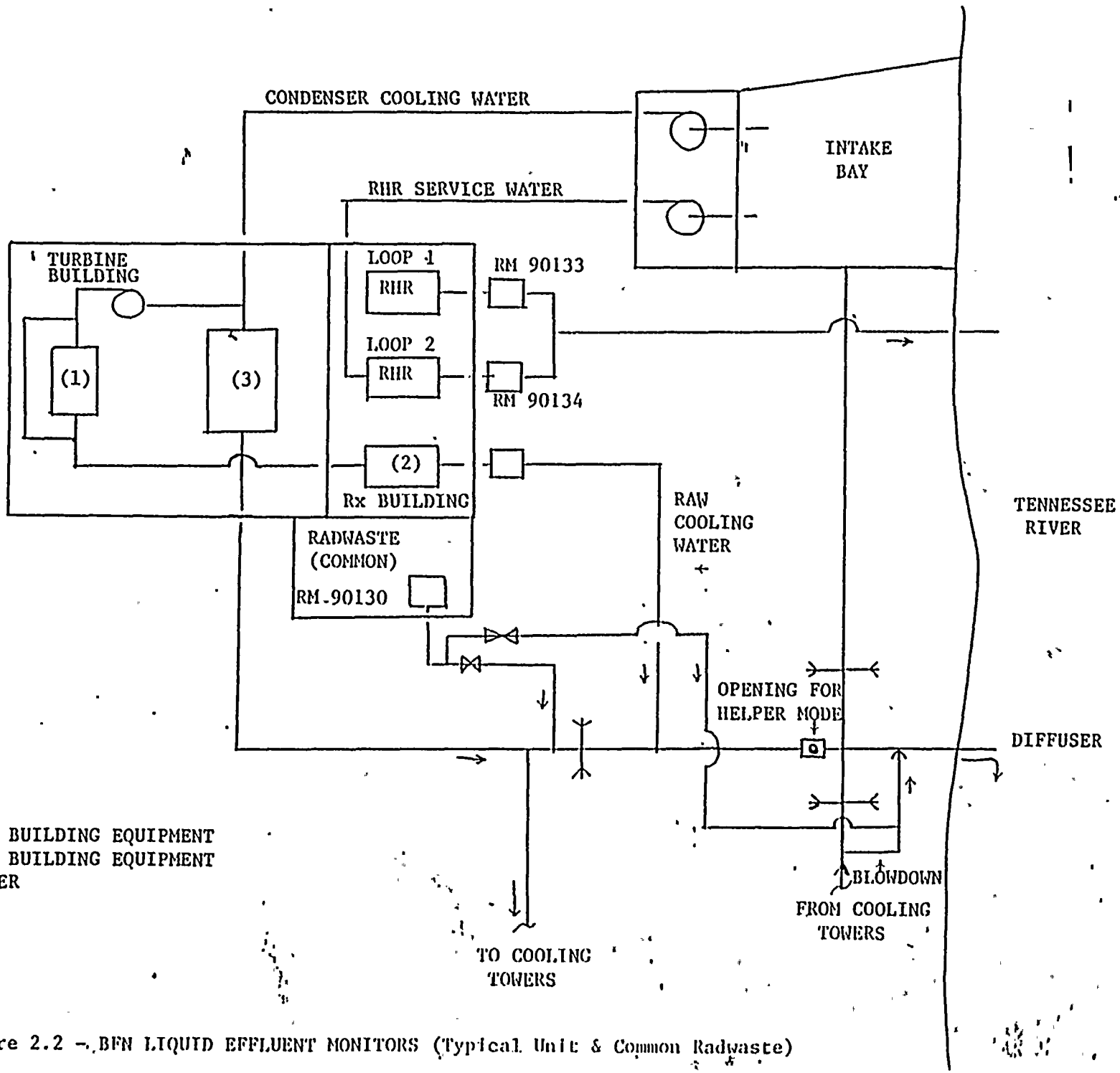


Figure 2.2 – BFN LIQUID EFFLUENT MONITORS (Typical Unit & Common Radwaste)

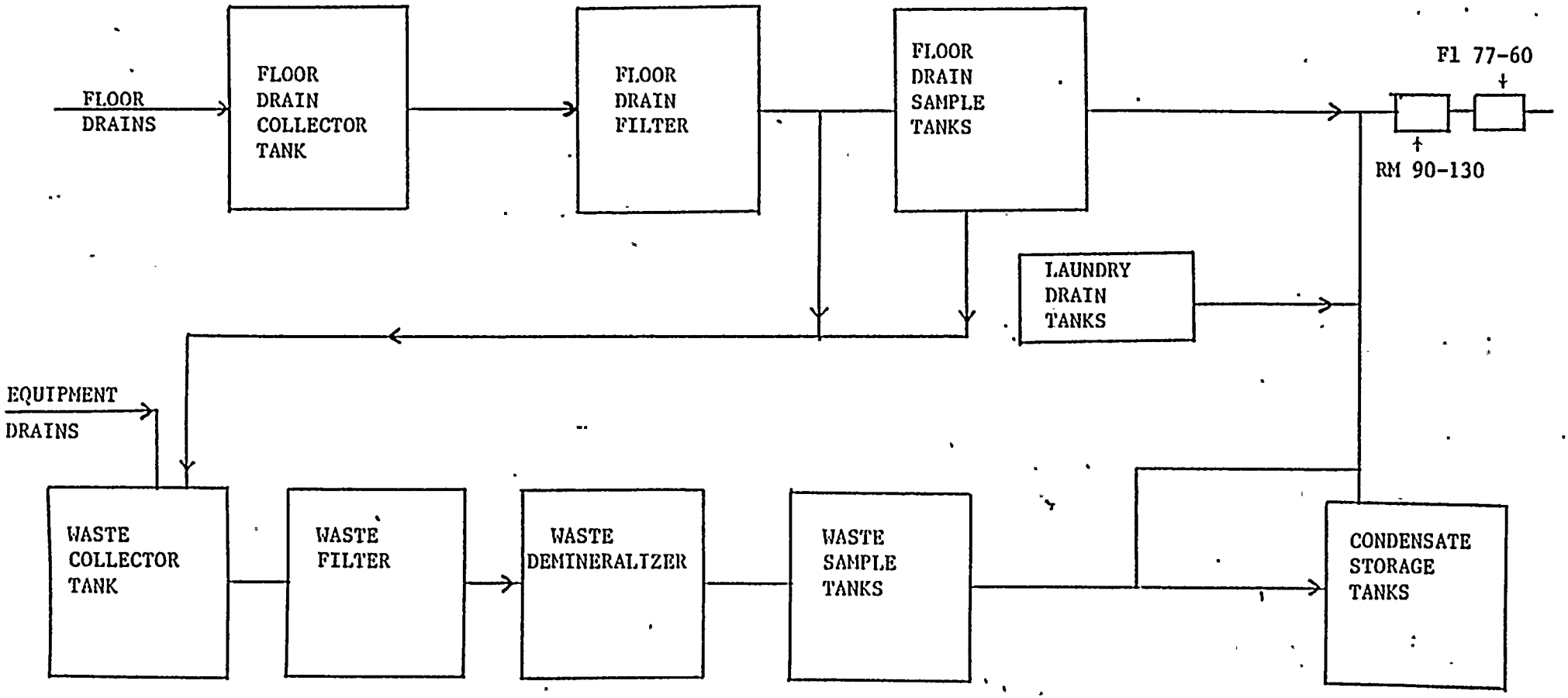
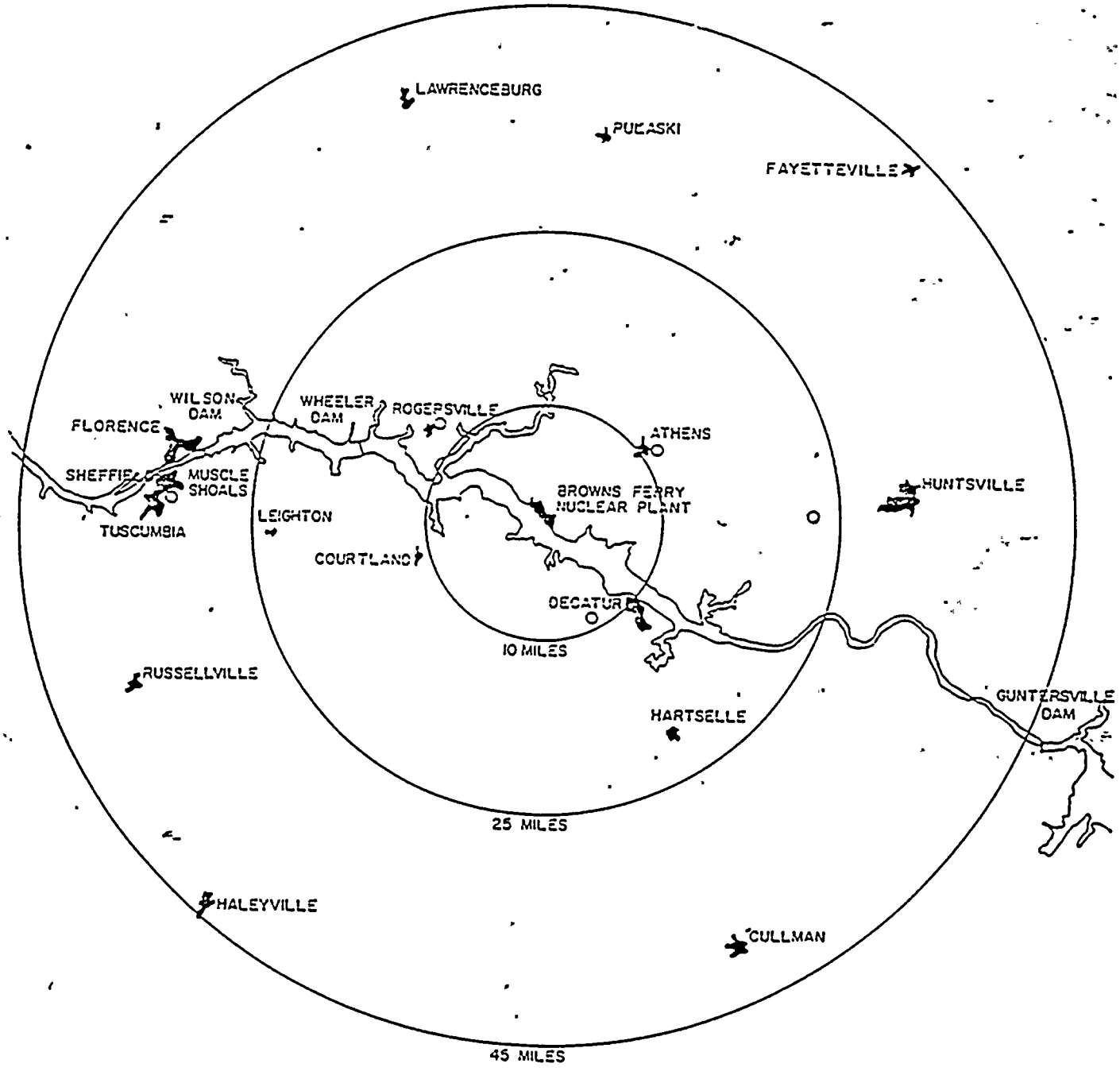


Figure 2.3 - Liquid Radwaste Treatment System

Figure 3.1

ATMOSPHERIC AND TERRESTRIAL MONITORING NETWORK



O—ENVIRONMENTAL MONITORING STATION

Figure 3.2

LOCAL MONITORING STATIONS

BROWNS FERRY NUCLEAR PLANT

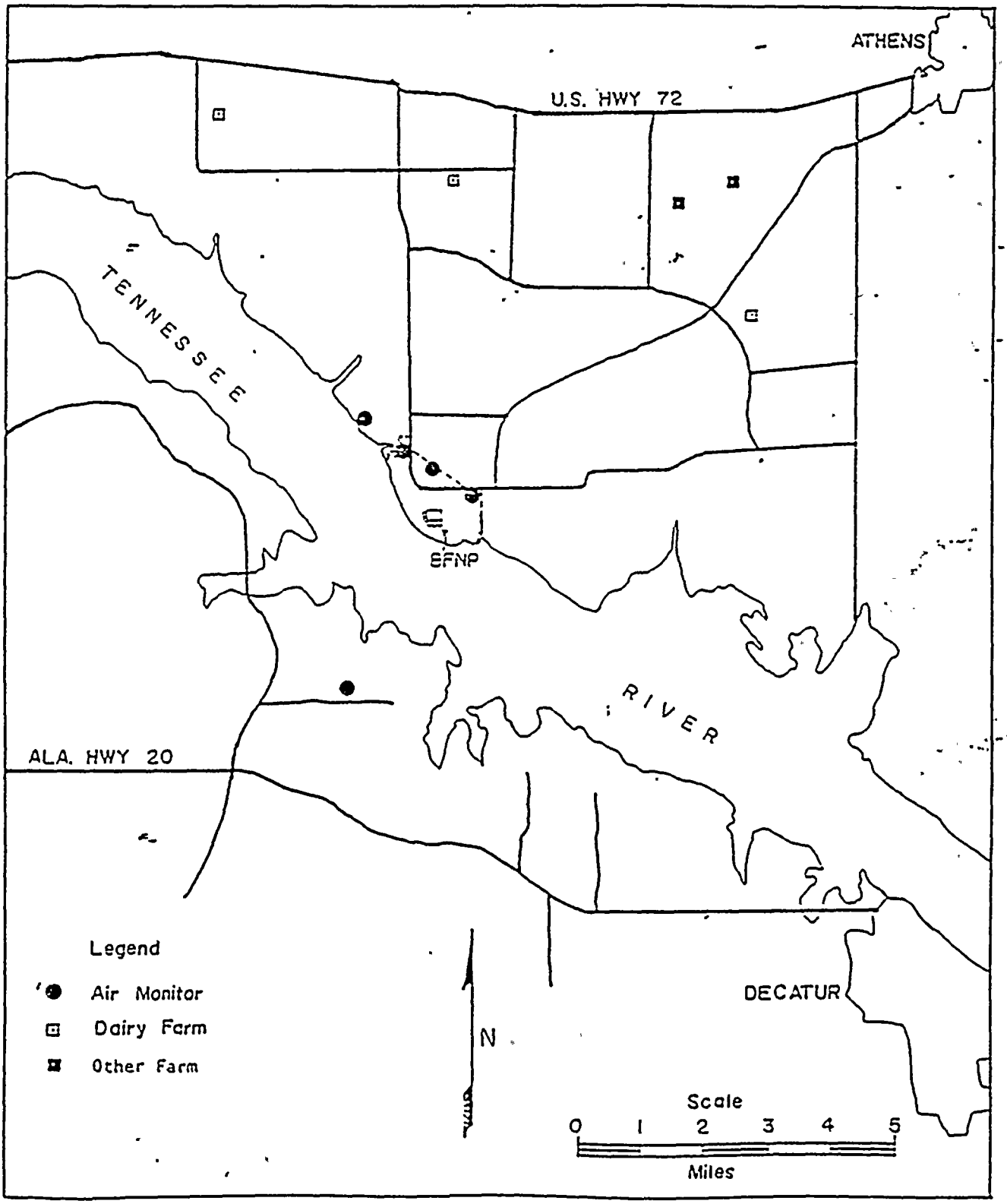


Figure 3.3

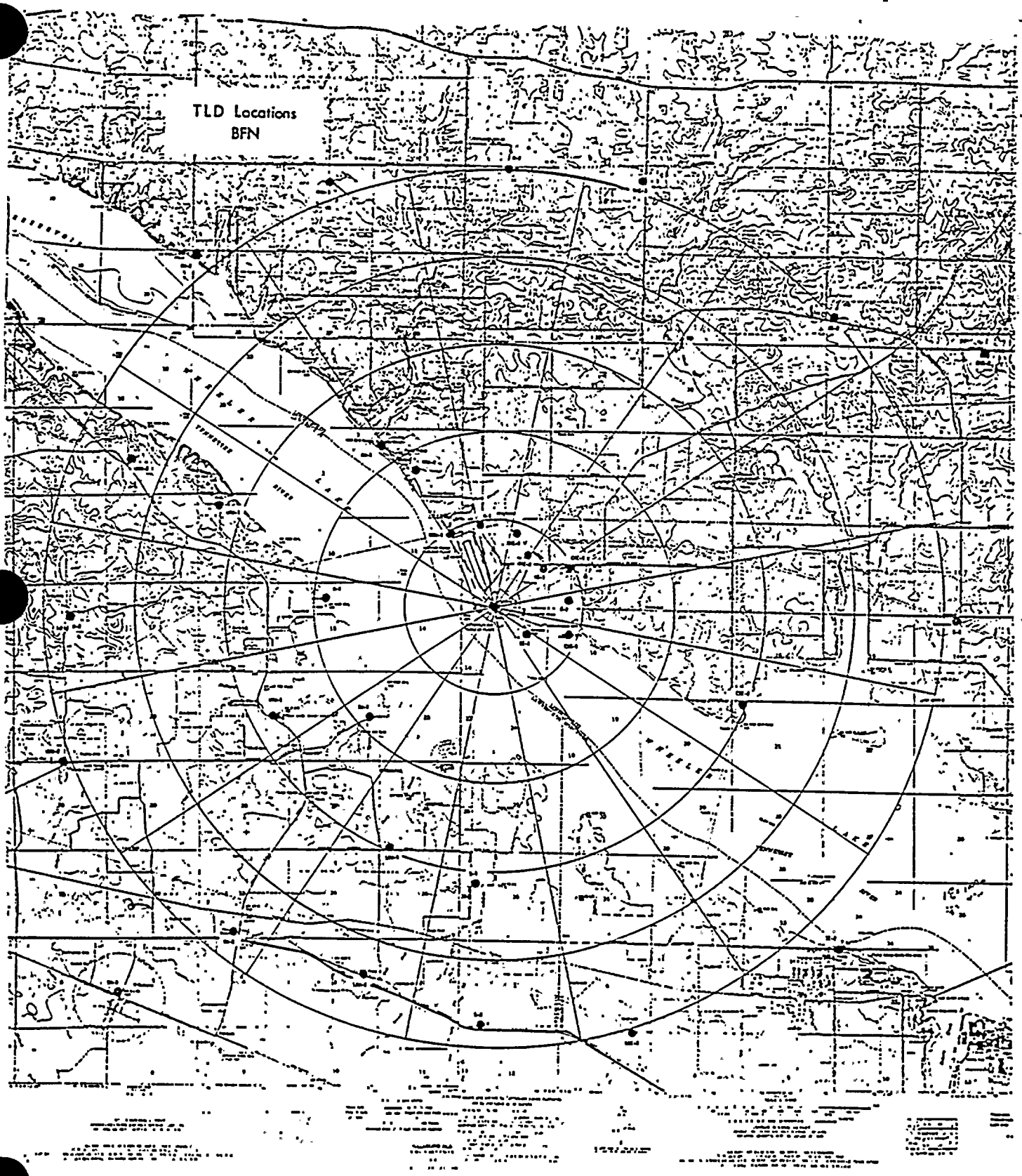


Figure 3.4

RESERVOIR MONITORING NETWORK