SEQUOYAH
NUCLEAR
PLANT

OFFSITE DOSE CALCULATION MANUAL

TENNESSEE VALLEY AUTHORITY

SEQUOYAH NUCLEAR PLANT
ODCM AND PCP
REVISION 3

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1. Gaseous Effluents

1.1 Alarm/Trip Setpoints

Specification 3.11.2.1 requires that the dose rate in unrestricted areas due to gaseous effluents from the site shall be limited at all times to the following values:

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

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

Specification 3.3.3.10 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, in µCi/s, for each nuclide and release point. The second consists of using the release rate limits to determine the physical settings on the monitors.

1.1.1 Release Rate Limit Methodology - µCi/s

Step 1

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 used in licensing are also 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.

A. 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 design objective 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.

   6. Meteorological data are expressed as a joint-frequency distribution of wind speed, wind direction, and atmospheric stability for the period January 1972 to December 1975 (Table 1.3).

7. Raw meteorological data consist of wind speed and direction measurements at 10m and temperature measurements at 9m and 46m.

8. Dose is to be evaluated at the offsite exposure point where maximum concentrations are expected to exist.

9. Potential maximum-exposure points (Table 1.4) considered are the nearest site boundary points in each sector.

10. A semi-infinite cloud model is used.

11. No credit is taken for shielding by residence.

12. Plume depletion and radioactive decay are considered.

13. Building wake effects on effluent dispersion are considered.

14. A sector-average dispersion equation is used.

15. 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	2.80
6	3.4-5.5	4.45
7	5.6-8.2	6.91
9	> 10.9	13.00

16. The stability classes that will be used are the standard A through G classifications. The stability classes 1-7 will correspond to A=1, B=2, . . ., G=7.

17. Terrain effect are not considered.

Equations

To calculate the dose for any one of the 16 potential maximum-exposure points, the following equations are used.

For determining the air concentration of any radionuclide:

$$X_i = \sum_{j=1}^{9} \sum_{k=1}^{7} (2/\pi)^{1/2} \frac{f_{jk} Q_i P}{\Sigma_{zk} u_j \; (2\pi x/n)} \exp(-\lambda_i \; x/u_j) \qquad (1.1)$$

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, $\mu Ci/s$.

p = fraction of radionuclide remaining in plume, Figure 1.1.

Σzk = vertical dispersion coefficient for stability class k which includes a building wake adjustment,

$\Sigma zk = (\sigma_{zk}{}^2 + cA/\pi)^{1/2}$, where σzk is the vertical dispersion coefficient for stability class k (m), c is a building shape factor (c=0.5), and A is the minimum building cross-sectional area (1800 m^2), m.

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.

For determining the total body dose rate

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

where

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

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

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

For determining the skin dose rate

$$D_s = \sum_i X_i \left(DFS_i + 1.11\ DF_{\gamma i} \right) \qquad (1.3)$$

where

D_s = skin dose rate, mrem/y.

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

DFS_i = skin dose factor due to beta radiation, mrem/y per $\mu Ci/m^3$ (Table 1.5).

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

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

B. Equations and assumptions for calculating doses from radioiodines and particulates are as follows:

Assumptions

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 design objective 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.

6. Meteorological data are expressed as joint-frequency distributions (JFD's) of wind speed, wind direction, and atmospheric stability for the period January 1972 to December 1975 (Table 1.3).

7. Raw meteorological data for ground-level releases consist of wind speed and direction measurements at 10m and temperature measurements at 9m and 46m.

8. Dose is to be evaluated at the potential offsite exposure point where maximum concentrations are expected to exist.

9. Real cow locations are not considered.

10. Potential maximum exposure points (Table 1.4) considered are the nearest site boundary points in each sector.

11. Terrain effects are not considered.

12. Building wake effects on effluent dispersion are considered.

13. Plume depletion and radioactive decay are considered for air-concentration calculations.

14. Radioactive decay is considered for ground-concentration calculations.

15. Deposition is calculated based on the curves given in Figure 1.2.

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

17. No credit is taken for shielding by residence.

Equations

To calculate the dose for any one of the potential maximum-exposure points, the following equations are used:

1. Inhalation

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

For determining the thyroid dose rate:

$$D_{THI} = 1 \times 10^{-6} \sum_{i} X_i \, DFI_i \qquad (1.4)$$ 3

where:

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

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

DFI_i = infant inhalation dose factor, mrem/yr per $\mu Ci/cm^3$, (Table 1.7). 1

1×10^6 = m^3/cm^3 conversion factor.

2. Ground Contamination

For determining the ground concentration of any nuclide:

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

where:

G_i = ground concentration of radionuclide i, Ci/m^3.

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^{-1} (Figure 1.2).

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, y^{-1}.

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

3.15×10^7 = s/y conversion factor.

For determining the thyroid dose rate from ground contamination:

$$D_{THG} = (8{,}760)(1 \times 10^6) \sum G_i \, DFG_i \quad (1.6)$$

where:

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

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 1.8).

8,760 = occupation time, h/y.

1×10^6 = pCi/µCi conversion factor.

3. Milk Ingestion

For determining the concentration of any nuclide (except C-14 and H-3) in and on vegetation:

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

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^{-2} (Figure 1.2).

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 (1.0 for iodines, 0.2 for particulates).

λ_{Ei} = effective removal rate constant, $\lambda_{Ei} = \lambda_i + \lambda_w$, where λ_i is the radioactive decay coefficient, h^{-1}, and λ_w is a measure of physical loss by weathering (λ_w = .0021 H^{-1}).

t_e = period over which deposition occurs, 720 h.

Y_v = agricultural yield, 0.7 kg/m^2.

B_{iv} = transfer factor from soil to vegetation of radionuclide i (Table 1.6). 1

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

t_b = time for buildup of radionuclides on the ground, 3.07 x 10^5 h (3[illegible] y).

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

3,600 = s/h conversion factor.

For determining the concentration of C-14 in vegetation:

$$CV_{14} = 1 \times 10^3 X_{14} (0.11/0.16) \quad (1.8)$$

where:

CV_{14} = concentration of C-14 in vegetation, $\mu Ci/kg$.

X_{14} = air concentration of C-14, $\mu Ci/m^3$.

0.11 = fraction of total plant mass that is natural carbon.

0.16 = concentration of natural carbon in the atmosphere, g/m^3.

1×10^3 = g/kg conversion factor.

For determining the concentration of H-3 in vegetation:

$$CV_T = 1 \times 10^3 X_T (0.75)(0.5/H) \quad (1.9)$$

where:

CV_T = concentration of H-3 in vegetation, $\mu Ci/kg$.

X_T = air concentration of H-3, Ci/m^3.

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, g/m^3.

1×10^3 = g/kg conversion factor.

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

$$CM_i = CV_i FM_i Q_F \exp(-\lambda_i t_f) \quad (1.10)$$

where:

CM_i = concentration of radionuclide i (including C-14 and H-3) in cow's milk, $\mu Ci/l$

CV_i = concentration of radionuclide i in and or vegetation, $\mu Ci/kg$.

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 feed to milk to receptor, 2 days.

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

$$D_{THM} = 1 \times 10^6 \sum_i CM_i \; DFING_i \; UM \qquad (1.11)$$

where:

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

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

$DFING_i$ = infant ingestion dose factor, mrem/pCi, (Regulatory Guide 1.109) 1

UM = infant ingestion rate for milk 330 l/y.

1×10^6 = pCi/μCi conversion factor.

4. Total Thyroid Dose Rate

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

$$D_{TH} = D_{THI} + D_{THG} + D_{THM} \qquad (1.12)$$

where:

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

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

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

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

The maximum thyroid dose rate calculated in this step will be used in step 2.

STEP 2

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

Total body = 500 mrem/y

Skin = 3,000 mrem/y

Maximum Organ = 1,500 mrem/y

Dividing the above limits by the appropriate dose calcuaited in step 1 yields a useful ratio.

$$\frac{\text{Dose limit}}{\text{Dose step 1}} = R$$

This ratio, R, represents how far above or below the guidelines the step 1 calculation was. Multiplying the original source term by R will give release rates that should correspond to the dose limits given above. Step 1 is redone using the adjusted source terms to ensure that this is the case.

Appropriate release rate limits in μCi/s for each nuclide and release point will be provided to plant personnel for use in establishing monitor setpoints. The setpoint for each gaseous effluent monitor will be established using plant instructions. Release rate limit, principal gamma emitter, geometry, detector efficiency, and a safety factor are combined to give an equivalent setpoint in counts per minute (cpm). The safety factor ranges from 0.2 for systems without automatic isolation features and 0.5 for systems with automatic isolation features. The physical and technical description, location, and identification number for each gaseous radiation detector is contained in plant documentation.

1.2 Monthly Dose Calculations

Dose calculations will be performed monthly to determine compliance with specifications 3.11.2.2 and 3.11.2.3. These 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 the specification 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 any 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 X/Q based on licensing meteorology for ground level releases for any offsite location will be used.
3. No credit is taken for radioactive decay.
4. For gamma doses, releases of Xe-131m, Xe-133, Xe-135, Ar-41, and Kr-88 are considered.
5. For beta doses, releases of Xe-131m, Xe-133, Xe-135, Kr-85, and Ar-41 are considered.
6. Dose factors are calculated using data from TVA's nuclide library. 3
7. The calculations extrapolate doses assuming that only 90 percent of total dose was contributed.
8. A semi-infinite cloud model is used.
9. Building wake effects on effluent dispersion are considered.

Equations

For determining the gamma dose to air:

$$D\gamma = \frac{(X/Q)}{0.9}\left(\frac{10^6}{3.15 \times 10^7}\right)\sum_i Q_I \, DF\gamma_i \qquad (1.13)$$ 1

where:

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

$\bar{X}/Q$ = highest annual-average relative concentration, 5.13 x 10^{-6} s/m^3.

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

10^6 = µCi/Ci conversion factor 3

3.15 x 10^7 = s/y 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/m^3 (Table 1.5).

This equation then reduces to

$$D\gamma = 1.81 \times 10^{-7} \sum_i Q_i \quad DF\gamma_i \qquad (1.14)$$

1

For determining the beta dose to air:

$$D\beta = \frac{(\bar{X}/Q)}{0.9} \left(\frac{10^6}{3.15 \times 10^7}\right) \sum_i Q_i \; DF\beta_i \qquad (1.15)$$

where:

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

$\bar{X}/Q$ = highest annual-average relative concentration, 5.13 x 10^{-6} s/m^3.

0.9 = fraction of total beta dose expected to be contributed by these nuclides. 3

10^6 = µCi/Ci conversion factor

3.15 x 10^7 = s/y conversion factor

Q_i = monthly release of radionuclide i, Ci. 1

$DF\beta_i$ = gamma-to-air dose factor for radionuclide i, mrad/yr per µCi/m^3 (Table 1.5).

This equation then reduces to:

$$D_\beta = 1.81 \times 10^{-7} \sum_i Q_i \, DF_{\beta i} \qquad (1.16)$$

Step 2

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

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

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.
3. Historical onsite meteorological data for the appropriate months from the period 1972-1975 will be used.
4. All measured radionuclide releases are considered.
5. A semi-infinite cloud model is used.
6. Radioactive decay is considered.
7. Building wake effects on effluent dispersion are considered.
8. Dose factors are calculated using data from TVA's radionuclide library.

Equations

Equations for calculating air concentration, X, 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

$$D_{\gamma n} = t_m \sum_i X_{ni} \, DF_{\gamma i} \qquad (1.24)$$

where:

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

X_{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). 1

t_m = time period considered, yr

For determining the beta dose to air:

$$D\beta_n = t_m \sum_i x_{ni} \, DF\beta_i \qquad (1.25)$$

where:

$D\beta_n$ = beta dose to air for sector n, mrad.

X_{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 $\mu Ci/m^3$

t_m = time period considered, yr

The sector having the highest total dose is then used to check compliance with specification 3.11.2.2.

1.2.2 Iodines and Particulates

Step 1

Doses will be calculated using the methodology described in this step. If any 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 from vegetable 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 D/Q based on licensing meteorology for ground level releases will be used for I-131 and SR-90 doses.

4. The highest annual-average X/Q's based on licensing meteorology for ground level releases will be used for C-14 doses.

5. No credit is taken for radioactive decay.

6. Releases of I-131 and C-14 are considered for the milk pathway. SR-90 releases are considered for the vegetable pathway.

7. The calculations extrapolate doses assuming that only 90 percent of the total dose was contributed.

8. Releases of C-14 are based on the design source term.

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

Equations

For determining the thyroid dose from milk ingestion of I-131:

$$DTH_{131} = \frac{Q_{131} \; DF_{131} \; D/Q}{3.15 \times 10^7} \times 10^6 \qquad (1.26)$$ 1

where:

DTH_{131} = thyroid dose from I-131, mrem.

Q_{131} = monthly release of I-131, Ci.

DF_{131} = I-131 milk ingestion dose factor to infant, mrem/yr per $\mu Ci/m^2$-s (Table 1.7) 1

D/Q = relative deposition rate, $2.94 \times 10^{-9} m^{-2}$.

3.15×10^7 = s/y.
10^6 = μCi/Ci 3

For determining the thyroid dose from milk ingestion of C-14:

$$DTH_{14} = \frac{Q_{14} \; DF_{14} \; X/Q}{3.15 \times 10^7} \qquad (1.27)$$ 1

where:

DTH_{14} = thyroid dose from C-14, mrem.

Q_{14} = monthly release of C-14, Ci.

DF_{14} = C-14 milk ingestion dose factor, mrem/y per $\mu Ci/m^3$ (Table 1.7)

X/Q = relative dispersion factor, $1.76 \times 10^{-6} s/m^3$. 3

3.15×10^7 = s/yr conversion factor

For determining the total thyroid dose:

$$DTH = \frac{DTH_{131} + DTH_{14}}{0.9} \qquad (1.28)$$

where:

DTH = thyroid dose, mrem.

DTH_{131} = thyroid dose from release of I-131, mrem.

DTH_{14} = thyroid dose from release of C-14, mrem.

0.9 = fraction of total thyroid dose expected to be contributed by these radionuclides.

For determining the bone dose from vegetable ingestion:

$$DBC_s = \frac{Q_s \; DF_s \; D/Q}{3.15x10^7(0.9)} \quad x \; 10^6 \qquad (1.29)$$

where:

DBC_s = bone dose to child from SR-90, mrem.

Q_s = monthly release of Sr-90, Ci.

DF_s = Sr-90 vegetable ingestion dose factor to child, $1.62x10^{12}$ mrem/yr per $\mu Ci/m^2$-s.

D/Q = relative deposition rate, $7.32x10^{-9}m^{-2}$.

$3.15x10^7$ = s/yr.

10^6 = μCi/Ci.

0.9 = fraction of total bone dose expected to be contributed by Sr-90.

Step 2

This methodology is to be used if the calculations in step 1 yield doses that exceed 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.

The receptor having the highest total dose is then used to check compliance with specification 3.11.2.3.

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 Specifications 6.9.1.8 and 6.9.1.9. Methodology for this analysis is the same as that described in Section 1.1.1, except that real pathways and receptor locations (Table 1.4A) are considered. In addition, meteorological data representative of a ground level release for 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 consists of two waste-gas compressor packages, nine gas decay tanks, and the associated piping, valves, and instrumentation. Gaseous wastes are received from the following: degassing of the reactor coolant and purging of the volume control tank prior to a cold shutdown, displacing of cover gases caused by liquid accumulation in the tanks connected to the vent header, and boron recycle process operation.

1.4.2 Dose Calculations

Doses will be calculated monthly using the methodology described in Section 1.2. These doses will be used to ensure that the GRTS is operating as designed.

TABLE 1.1

EXPECTED ANNUAL ROUTINE RELEASES FROM ONE UNIT AT SEQUOYAH NUCLEAR PLANT

NUCLIDE	AUXILIARY BUILDING VENT	CONTAINMENT VENT	TURBINE BUILDING VENT
Kr-83m	4.9(-1)	3.3(-1)	3.0(-1)
Kr-85m	2.2(0)	2.3(0)	1.5(0)
Kr-85	2.0(0)	5.1(2)	1.2(0)
Kr-87	1.2(0)	8.1(-1)	8.2(-1)
Kr-88	4.0(0)	3.6(0)	2.7(0)
Kr-89	2.8(-2)	8.3(-3)	6.4(-2)
Xe-131m	1.7(0)	2.6(1)	1.1(0)
Xe-133m	3.7(0)	1.6(1)	2.4(0)
Xe-133	2.9(2)	2.4(3)	1.8(2)
Xe-135m	1.8(-1)	7.8(-2)	2.0(-1)
Xe-135	6.8(0)	9.9(0)	4.4(0)
Xe-137	5.6(-2)	1.8(-2)	1.2(-1)
Xe-138	5.9(-1)	2.4(-1)	6.2(-1)
Br-83	8.0(-4)	1.5(-5)	9.5(-5)
Br-84	3.5(-4)	4.9(-6)	1.7(-5)
Br-85	1.2(-5)	1.3(-7)	2.4(-7)
I-130	3.6(-4)	1.3(-5)	6.9(-5)
I-131	1.5(-2)	1.2(-2)	9.2(-3)
I-132	1.7(-2)	3.7(-4)	2.6(-3)
I-133	6.5(-2)	3.4(-3)	1.4(-2)
I-134	7.1(-3)	1.1(-4)	5.0(-4)
I-135	3.3(-2)	9.0(-4)	5.4(-3)
Rb-86	1.9(-9)	2.1(-8)	2.4(-7)
Rb-88	1.6(-2)	2.1(-2)	1.0(-4)
Cs-134	5.5(-7)	1.1(-5)	6.4(-5)
Cs-136	2.9(-7)	2.6(-6)	3.6(-5)
Cs-137	4.0(-7)	7.8(-6)	5.3(-5)
Cr-51	2.0(-8)	2.6(-7)	3.6(-7)
Mn-54	1.6(-8)	3.1(-7)	4.5(-7)
Fe-59	2.1(-8)	3.2(-7)	5.4(-7)
Co-58	5.3(-9)	8.8(-8)	9.0(-6)
Co-60	1.6(-8)	3.1(-7)	2.7(-7)
Sr-89	7.6(-9)	1.2(-7)	1.6(-7)
Sr-90	2.2(-10)	4.3(-9)	8.4(-9)
Sr-91	1.5(-8)	1.2(-8)	8.9(-8)
Y-90	3.8(-10)	4.7(-9)	8.2(-9)
Ym-91	9.1(-9)	7.4(-9)	6.1(-8)
Y-91	4.4(-8)	7.0(-7)	1.9(-6)
Y-93	3.0(-9)	2.4(-9)	3.6(-8)
Zr-95	1.3(-9)	2.1(-8)	8.4(-8)
Nb-95	1.1(-9)	2.2(-8)	8.4(-8)
Mo-99	1.0(-5)	3.0(-5)	1.4(-4)
Tc-99m	6.9(-6)	2.8(-5)	1.0(-4)
Ru-103	9.8(-10)	1.4(-8)	4.2(-8)
Ru-106	2.2(-10)	4.1(-9)	8.4(-9)
Rh-103m	1.1(-9)	1.4(-8)	2.8(-8)
Rh-106	2.2(-10)	4.1(-9)	2.7(-7)

TABLE 1.1

EXPECTED ANNUAL ROUTINE RELEASES FROM ONE UNIT AT SEQUOYAH NUCLEAR PLANT

NUCLIDE	AUXILIARY BUILDING VENT	CONTAINMENT VENT	TURBINE BUILDING VENT
Te-125m	6.3(-10)	1.0(-8)	1.3(-8)
Te-127m	6.1(-9)	1.1(-7)	2.1(-7)
Te-127	2.0(-8)	1.2(-7)	5.3(-7)
Te-129m	3.1(-8)	4.3(-7)	1.3(-6)
Te-129	3.6(-8)	2.8(-7)	8.3(-7)
Te-131m	5.6(-8)	9.1(-9)	2.0(-6)
Te-131	2.2(-8)	2.0(-8)	2.7(-7)
Te-132	6.0(-7)	2.0(-6)	2.1(-5)
Ba-137m	3.8(-7)	7.3(-6)	1.5(-5)
Ba-140	4.8(-9)	4.4(-8)	2.1(-7)
La-140	3.4(-9)	4.6(-8)	1.4(-7)
Ce-141	1.5(-9)	2.1(-8)	8.4(-8)
Ce-143	9.0(-10)	1.6(-9)	2.0(-8)
Ce-144	7.2(-10)	1.4(-8)	4.2(-8)
Pr-143	1.1(-9)	1.1(-8)	4.2(-8)
Pr-144	7.7(-10)	1.4(-8)	2.8(-8)
Np-239	2.7(-8)	7.0(-8)	1.2(-6)

TABLE 1.2

BASIC RADIONUCLIDE DATA

Nuclide		Half-Life (Days)	LAMUA (1/S)	T	C	BETA (MEV/DIS)	GAMMA (MEV/DIS)	WASH (1/S)
1 TRITIUM	101	4.49E 03	1.79E-09	2	1	5.68E-03	0.0	2.86E-07
2 C-14	604	2.09E 06	3.84E-12	2	1	5.17E-02	0.0	0.0
3 N-13	702	6.94E-03	1.16E-03	2	1	4.91E-01	1.02E 00	1.00E-02
4 O-19	804	3.36E-04	2.39E-02	2	1	1.02E 00	1.05E 00	1.00E-02
5 F-18	902	7.62E-02	1.05E-04	2	1	2.41E-01	9.88E-01	1.00E-04
6 NA-24	1104	6.33E-01	1.27E-05	5	1	5.55E-01	4.12E 00	1.00E-04
7 P-32	1504	1.43E 01	5.61E-07	5	1	6.95E-01	0.0	1.00E-04
8 AR-41	1805	7.63E-02	1.05E-04	2	1	3.63E-01	1.28E 00	0.0
9 CR-51	2405	2.78E 01	2.89E-07	5	1	3.75E-03	3.28E-02	1.00E-04
10 MN-54	2508	3.03E 02	2.65E-08	5	1	4.17E-03	8.36E-01	1.00E-04
11 MN-56	2509	1.07E-01	7.50E-05	5	1	7.93E-01	1.76E 00	1.00E-04
12 FE-59	2604	4.50E 01	1.78E-07	5	1	1.18E-01	1.19E 00	1.00E-04
13 CO-58	2706	7.13E 01	1.12E-07	5	1	2.05E-01	9.76E-01	1.00E-04
14 CO-60	2708	1.92E 03	4.18E-09	5	1	9.68E-02	2.50E 00	1.00E-04
15 ZN-69M	3007	5.75E-01	1.39E-05	5	1	0.0	4.15E 00	1.00E-04
16 ZN-69	3006	3.96E-02	2.03E-04	5	1	3.19E-01	0.0	1.00E-04
17 BR-84	3516	2.21E-02	3.63E-04	2	1	1.28E 00	1.68E 00	1.00E-04
18 BR-85	3518	2.08E-03	3.86E-03	2	2	1.04E 00	8.40E-01	1.00E-04
19 KR-85M	3611	1.83E-01	4.38E-05	1	2	2.53E-01	1.59E-01	1.00E-11
20 KR-85	3610	3.93E 03	2.04E-09	1	1	2.51E-01	2.21E-03	1.00E-11
21 KR-87	3612	5.28E-02	1.52E-04	1	1	1.32E 00	7.93E-01	1.00E-11
22 KR-88	3613	1.17E-01	6.86E-05	1	1	3.75E-01	1.96E 00	1.00E-11
23 KR-89	3614	2.21E-03	3.63E-01	1	1	1.23E 00	2.08E 00	1.00E-11
24 RB-88	3713	1.24E-02	6.47E-04	5	1	2.06E 00	6.86E-01	1.00E-04
25 RB-89	3714	1.07E-02	7.50E-04	5	1	0.0	2.40E 00	1.00E-04
26 SR-89	3808	5.20E 01	1.54E-07	5	1	5.73E-01	1.36E-04	2.67E-07
27 SR-90	3810	1.03E 04	7.79E-10	5	1	1.96E-01	0.0	2.67E-07
28 SR-91	3811	4.03E-01	1.99E-05	5	2	6.50E-01	6.95E-01	2.67E-07
29 SR-92	3812	1.13E-01	7.10E-05	5	1	1.95E-01	1.34E 00	2.67E-07
30 SR-93	3813	5.56E-03	1.44E-03	5	1	1.61E 00	6.28E-01	2.67E-07
31 Y-90	3916	2.67E 00	3.00E-06	5	1	9.36E-01	0.0	1.00E-04
32 Y-91M	3919	3.47E-02	2.31E-04	5	1	0.0	5.56E-01	1.00E-04
33 Y-91	3918	5.88E 01	1.36E-07	5	1	6.06E-01	3.61E-03	1.00E-04
34 Y-92	3920	1.47E-01	5.46E-05	5	1	1.44E 00	2.50E-01	1.00E-04
35 Y-93	3921	4.29E-01	1.87E-05	5	1	1.17E 00	8.94E-02	1.00E-04
36 ZR-95	4014	6.50E 01	1.23E-07	5	2	1.20E-01	7.35E-01	1.00E-04

TABLE [illegible] (cont'd)

BASIC RADIONUCLIDE DATA

Nuclide		Half-Life (Days)	LAMUA (1/S)	T	C	BETA (MEV/DIS)	GAMMA (MEV/DIS)	WASH (1/S)
37 NB-95M	4115	3.75E 00	2.14E-06	5	1	2.85E-01	5.87E-02	1.00E-04
38 NB-95	4114	3.50E 01	2.29E-07	5	1	4.50E-02	7.64E-01	1.00E-04
39 MO-99	4209	2.79E 00	2.87E-06	5	2	3.96E-01	1.62E-01	1.00E-04
40 TC-99M	4314	2.50E-01	3.21E-05	5	1	4.85E-03	1.43E-01	1.00E-04
41 TC-99	4313	7.74E 07	1.04E-13	5	1	8.38E-02	0.0	1.00E-04
42 TC-104	4320	1.25E-02	6.42E-04	5	1	0.0	0.0	1.00E-04
43 RU-106	4407	3.67E 02	2.19E-08	5	1	1.01E-02	0.0	1.00E-04
44 TE-132	5223	3.24E 00	2.48E-06	5	1	1.00E-01	2.05E-01	1.00E-04
45 I-129	5315	6.21E 09	1.29E-15	3	1	4.02E-02	3.77E-03	5.00E-06
46 I-131	5317	8.05E 00	9.96E-07	3	2	1.94E-01	3.81E-01	5.00E-06
47 MI-131	15317	8.05E 00	9.96E-07	4	2	1.94E-01	3.81E-01	5.00E-06
48 I-132	5318	9.58E-02	8.37E-05	3	1	5.14E-01	2.33E 00	5.00E-06
49 MI-132	15318	9.58E-02	8.37E-05	4	1	5.14E-01	2.33E 00	5.00E-06
50 I-133	5319	8.75E-01	9.17E-06	3	2	4.08E-01	6.10E-01	5.00E-06
51 MI-133	15319	8.75E-01	9.17E-06	4	2	4.08E-01	6.10E-01	5.00E-06
52 I-134	5320	3.61E-02	2.22E-04	3	1	6.10E-01	2.59E 00	5.00E-06
53 MI-134	15320	3.61E-02	2.22E-04	4	1	6.10E-01	2.59E 00	5.00E-06
54 I-135	5321	2.79E-01	2.87E-05	3	2	3.68E-01	1.58E 00	5.00E-06
55 MI-135	15321	2.79E-01	2.87E-05	4	2	3.68E-01	1.58E 00	5.00E-06
56 XE-131M	5412	1.18E 01	6.80E-07	1	1	1.43E-01	2.01E-02	1.00E-11
57 XE-133M	5414	2.26E 00	3.55E-06	1	1	1.90E-01	4.16E-02	1.00E-11
58 XE-133	5413	5.27E 00	1.52E-06	1	1	1.35E-01	4.54E-02	1.00E-11
59 XE-135M	5416	1.08E-02	7.43E-04	1	1	9.50E-02	4.32E-01	1.00E-11
60 XE-135	5415	3.83E-01	2.09E-05	1	1	3.17E-01	2.47E-01	1.00E-11
61 XE-137	5417	2.71E-03	2.96E-03	1	1	1.64E 00	1.94E-01	1.00E-11
62 XE-138	5418	1.18E-02	6.80E-04	1	1	6.06E-01	1.18E 00	1.00E-11
63 CS-134	5510	7.48E 02	1.07E-08	5	1	1.57E-01	1.04E 00	1.00E-04
64 CS-135	5512	1.10E 09	7.29E-15	5	1	5.74E-02	0.0	1.00E-04
65 CS-136	5514	1.30E 01	6.17E-07	5	1	1.01E-01	2.20E 00	1.00E-04
66 CS-137	5515	1.10E 04	7.29E-10	5	1	2.52E-01	5.97E-01	1.00E-04
67 CS-138	5516	2.24E-02	3.58E-04	5	1	1.23E 00	2.30E 00	1.00E-04
68 BA-139	5615	5.76E-02	1.39E-04	5	1	6.54E-02	5.05E-02	1.00E-04
69 BA-140	5616	1.28E 01	6.27E-07	5	1	3.15E-01	1.95E-01	1.00E-04
70 LA-140	5715	1.68E 00	4.77E-06	5	1	5.40E-01	2.31E 00	1.00E-04
71 CE-144	5815	2.84E 02	2.82E-08	5	1	9.13E-02	3.29E-02	1.00E-04
72 PR-143	5912	1.36E 01	5.90E-07	5	1	3.14E-01	0.0	1.00E-04
73 PR-144	5913	1.20E-02	6.68E-04	5	1	1.23E 00	3.10E-01	1.00E-04
74 NP-239	9310	2.35E 00	3.41E-06	5	1	1.24E-01	2.08E 00	1.00E-04

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS A
DELTA T =-1.9 DEG. C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 72 - DEC 31, 75

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	.01	0.01	0.01	0.03	0.04	0.04	0.0	0.0	0.0	0.13
NNE	0.0	0.0	0.04	0.19	0.20	0.16	0.01	0.0	0.0	0.60
NE	0.0	0.0	0.08	0.26	0.15	0.13	0.0	0.0	0.0	0.56
ENE	0.0	0.0	0.03	0.03	0.01	0.0	0.0	0.0	0.0	0.07
E	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.01
ESE	0.0	0.0	0.01	0.01	0.0	0.0	0.01	0.0	0.0	0.03
SE	0.0	0.0	0.01	0.02	0.0	0.0	0.0	[illegible]	0.0	0.03
SSE	0.0	0.0	0.01	0.03	0.02	0.02	0.01	0.0	0.0	0.09
S	0.0	0.0	0.01	0.04	0.06	0.05	0.01	0.0	0.0	0.17
SSW	0.0	0.0	0.01	0.09	0.18	0.16	0.01	0.0	0.0	0.45
SW	0.0	0.0	0.04	0.12	0.10	0.09	0.02	0.0	0.0	0.37
WSW	0.0	0.0	0.02	0.03	0.03	0.02	0.02	0.0	0.0	0.12
W	0.0	0.0	0.01	0.0	0.01	0.02	0.0	0.0	0.0	0.04
WNW	0.0	0.0	0.0	0.0	0.0	[illegible]	0.01	0.0	0.0	0.02
NW	0.0	0.0	0.01	0.01	0.01	[illegible]	0.01	0.0	0.0	0.09
NNW	0.0	0.0	0.01	0.0	0.02	[illegible]	0.01	0.0	0.0	0.12
SUBTOTAL	0.01	0.01	0.31	0.80	0.83	[illegible]	0.12	0.0	0.0	2.90

958 STABILITY CLASS A OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

934 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 958 STABILITY CLASS A OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

TABLE 1.3

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED
FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS B
-1.9 DELTA-T = -1.7 DEG. C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 72 - DEC 31, 75

WIND DIRECTION	CALM	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	0.01	0.01	0.02	0.03	0.0	0.0	0.0	0.07
NNE	0.0	0.0	0.05	0.2[illegible]	0.20	0.18	0.01	0.0	0.0	0.67
NE	.01	0.0	0.08	0.2[illegible]	0.09	0.06	0.0	0.0	0.0	0.52
EWE	0.0	0.0	0.03	0.0[illegible]	0.01	0.0	0.0	0.0	0.0	0.07
E	0.0	0.0	0.02	0.[illegible]1	0.0	0.0	0.0	0.0	0.0	0.03
ESE	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.01
SE	0.0	0.0	0.01	0.02	0.0	0.01	0.0	0.0	0.0	0.04
SSE	0.0	0.0	0.01	0.03	0.0	0.02	0.0	0.0	0.0	0.06
S	0.0	0.0	0.03	0.03	0.07	0.04	0.01	0.0	0.0	0.18
SSW	0.0	0.0	0.04	0.09	0.20	0.20	0.03	0.0	0.0	0.56
SW	0.0	0.0	0.03	0.11	0.14	0.10	0.02	0.0	0.0	0.40
WSW	0.0	0.0	0.01	0.01	0.03	0.02	0.01	0.01	0.0	0.09
W	0.0	0.0	0.0	0.0	0.01	0.01	0.0	0.0	0.0	0.02
WNW	0.0	0.0	0.0	0.01	0.01	0.03	0.0	0.0	0.0	0.05
NW	0.0	0.0	0.0	0.0	0.01	0.05	0.0	0.0	0.0	0.06
NNW	0.0	0.0	0.01	0.02	0.02	0.06	0.01	0.0	0.0	0.12
SUBTOTAL	0.01	0.0	0.33	0.90	0.81	0.81	0.09	0.01	0.0	2.95

969 STABILITY CLASS B OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

953 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 969 STABILITY CLASS B OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

TABLE 1.3

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED
FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS C
-1.7 DELTA-T = -1.5 DEG. C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 72 - DEC 31, 75

WIND DIRECTION	CALM	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	0.01	0.02	0.02	0.02	0.0	0.0	0.0	0.07
NNE	0.0	0.0	0.05	0.12	0.11	0.11	0.0	0.0	0.0	0.39
NE	0.0	0.0	0.05	0.14	0.05	0.03	0.0	0.0	0.0	0.27
ENE	0.0	0.0	0.03	0.02	0.0	0.0	0.0	0.0	0.0	0.05
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	0.01	0.0	0.0	0.0	0.0	0.0	0.02
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	0.01	0.02	0.0	0.02	0.0	0.0	0.0	0.05
S	0.0	0.0	0.03	0.04	0.06	0.05	0.0	0.0	0.0	0.18
SSW	0.0	0.0	0.01	0.11	0.14	0.13	0.02	0.0	0.0	0.41
SW	0.0	0.0	0.03	0.08	0.12	0.07	0.01	0.0	0.0	0.31
WSW	0.0	0.0	0.01	0.02	0.03	0.02	0.0	0.0	0.0	0.08
W	0.0	0.0	0.0	0.01	0.0	0.01	0.01	0.0	0.0	0.03
WNW	0.0	0.0	0.0	0.01	0.01	0.01	0.0	0.0	0.0	0.03
NW	0.0	0.0	0.0	0.0	0.02	0.03	0.01	0.0	0.0	0.06
NNW	0.0	0.0	0.0	0.02	0.02	0.05	0.0	0.0	0.0	0.09
SUBTOTAL	0.0	0.0	0.26	0.64	0.58	0.55	0.05	0.0	0.0	2.08

684 STABILITY CLASS C OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

672 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 684 STABILITY CLASS C OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

TABLE 1.3

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED
FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS D
-1.5 DELTA-T -0.5 DEG. C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 72 - DEC 31, 75

WIND DIRECTION	CALM	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	[illegible]	0.01	0.24	0.22	0.16	0.17	0.0	0.0	0.0	0.80
NNE	.017	0.06	0.73	1.03	0.84	0.78	0.07	0.0	0.0	3.51
NE	.006	0.02	0.76	0.98	0.42	0.42	0.05	0.0	0.0	2.55
ENE	.003	0.01	0.21	0.11	0.03	0.0	0.0	0.0	0.0	0.36
E	.003	0.01	0.12	0.03	0.02	0.01	0.0	0.0	0.0	0.19
ESE	.003	0.01	0.06	0.02	0.0	0.0	0.0	0.0	0.0	0.09
SE	0.0	0.0	0.12	0.08	0.0	0.0	0.0	0.0	0.0	0.20
SSE	0.0	0.0	0.15	0.15	0.05	0.06	0.01	0.01	0.0	0.43
S	.003	0.01	0.31	0.53	0.38	0.25	.02	0.0	0.0	1.50
SSW	.003	0.01	0.44	1.25	0.95	0.70	0.07	0.0	0.0	3.42
SW	.003	0.01	0.47	[illegible]	1.03	0.52	0.03	0.01	0.0	3.24
WSW	0.0	0.0	0.22	[illegible]	0.18	0.21	0.07	0.01	0.0	1.03
W	.003	0.01	0.06	[illegible]	0.10	0.19	0.02	0.01	0.0	0.47
WNW	.003	0.01	0.06	[illegible]	0.11	0.18	0.01	0.0	0.0	0.42
NW	0.0	0.0	0.08	[illegible]	0.22	0.31	0.03	0.0	0.0	0.72
NNW	.003	0.01	0.15	0.14	0.25	0.36	0.02	0.0	0.0	0.93
SUBTOTAL	0.05	0.18	4.18	6.16	4.74	4.16	0.40	0.04	0.0	19.86

6567 STABILITY CLASS D OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

6345 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 6567 STABILITY CLASS D OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METERORLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

TABLE 1.3

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS E
-0.5 DELTA-T = 1.5 DEG C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 72 - DEC 31, 75

WIND DIRECTION	CALM	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	.017	0.23	1.26	[illegible]	0.39	0.27	[illegible]	0.0	0.0	2.98
NNE	.023	0.31	2.83	2.46	1.07	0.92	0.03	0.0	0.0	7.62
NE	.011	0.15	1.03	0.71	0.31	0.18	0.01	0.0	0.0	2.39
ENE	.009	0.12	0.48	0.16	0.04	0.0	0.0	0.0	0.0	0.80
E	.010	0.14	0.24	0.05	0.01	0.01	0.0	0.0	0.0	0.45
ESE	.007	0.09	0.11	0.01	0.01	0.01	0.01	0.0	0.0	0.24
SE	.007	0.10	0.37	0.06	0.01	0.01	0.0	0.0	0.0	0.55
SSE	.008	0.11	0.58	0.24	0.13	0.23	0.04	0.02	0.0	1.35
S	.013	0.17	1.33	1.49	0.91	1.05	0.08	0.0	0.0	5.03
SSW	.007	0.10	1.67	2.32	1.67	1.45	0.11	0.0	0.0	7.32
SW	.013	0.17	1.59	2.07	1.30	0.99	0.10	0.0	0.0	6.22
WSW	.010	0.13	0.87	0.55	0.35	0.40	0.06	0.0	0.0	2.36
W	.007	0.10	0.42	0.28	0.21	0.22	0.03	0.0	0.0	1.26
WNW	.010	0.14	[illegible]	0.22	0.19	0.27	0.02	0.0	0.0	1.21
NW	.007	0.10	0.50	0.37	0.43	0.38	0.02	0.0	0.0	1.80
NNW	.011	0.15	0.80	0.68	0.57	0.40	0.01	0.0	0.0	2.61
SUBTOTAL	0.17	2.31	14.45	12.50	7.60	6.79	0.52	0.02	0.0	44.19

14624 STABILITY CLASS E OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

14146 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 14624 STABILITY CLASS E OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEROROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

TABLE 1.3

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS F
1.5 DELTA-T = 4.0 DEG. C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 72 - DEC 31, 75

WIND DIRECTION	CALM	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	.011	0.21	1.37	0.44	0.04	0.0	0.0	0.0	0.0	2.06
NNE	.018	0.35	3.61	0.84	0.05	0.0	0.0	0.0	0.0	4.85
NE	.011	0.21	1.15	0.28	0.01	0.0	0.0	0.0	0.0	1.65
ENE	.008	0.16	0.39	0.03	0.0	0.0	0.0	0.0	0.0	0.56
E	.010	0.20	0.22	0.0	0.0	0.0	0.0	0.0	0.0	0.42
ESE	.007	0.13	0.18	0.02	0.0	0.0	0.0	0.0	0.0	0.33
SE	.007	0.14	0.23	0.02	0.0	0.0	0.0	0.0	0.0	0.39
SSE	.008	0.15	0.37	0.07	0.03	0.01	0.0	0.0	0.0	0.63
S	.009	0.17	0.77	0.30	0.10	0.06	0.0	0.0	0.0	1.40
SSW	.006	0.12	1.13	0.71	0.26	0.11	0.0	0.0	0.[illegible]	2.33
SW	.005	0.10	0.99	0.86	0.27	0.13	0.0	0.0	0.0	2.35
WSW	.005	0.09	0.46	0.19	0.04	0.01	0.0	0.0	0.0	0.79
W	.004	0.07	0.20	0.07	0.01	0.0	0.0	0.0	0.0	0.35
WNW	.005	0.10	0.24	0.07	0.01	0.0	0.0	0.0	0.0	0.42
NW	.003	0.05	0.29	0.15	0.05	0.01	0.0	0.0	0.0	0.55
NNW	.005	0.09	0.52	0.34	0.05	0.01	0.0	0.0	0.0	1.01
SUBTOTAL	0.12	2.34	12.12	4.39	0.92	0.34	0.0	0.0	0.0	2[illegible].11

6542 STABILITY CLASS F OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

6461 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 6542 STABILITY CLASS F OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METERORQLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

TABLE ..3

JOINT PERCENTAGE FREQUENCIES OF WIND DIRECTION AND WIND SPEED
FOR DIFFERENT STABILITY CLASSES*

STABILITY CLASS G
DELTA-T 4.0 DEG. C/100M

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 72 - DEC 31, 75

WIND DIRECTION	CALM	WIND SPEED(MPH) 0.6-..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	.003	0.06	0.33	0.09	0.0	0.0	0.0	0.0	0.0	0.48
NNE	.005	0.10	1.03	0.20	0.0	0.0	0.0	0.0	0.0	1.33
NE	.005	0.09	0.74	0.12	0.0	0.0	0.0	0.0	0.0	0.95
ENE	.007	0.13	0.42	0.02	0.0	0.0	0.0	0.0	0.0	0.57
E	.007	0.14	0.18	0.01	0.0	0.0	0.0	0.0	0.0	0.33
ESE	.006	0.11	0.08	0.01	0.0	0.0	0.0	0.0	0.0	0.20
SE	.005	0.09	0.08	0.0	0.0	0.0	0.0	0.0	0.0	0.17
SSE	.008	0.16	0.21	0.0	0.0	0.0	0.0	0.0	0.0	0.37
S	.006	0.11	0.39	0.04	0.01	0.0	0.0	0.0	0.0	0.55
SSW	.003	0.06	0.48	0.32	0.02	0.01	0.0	0.0	0.0	0.89
SW	.002	0.03	0.44	0.42	0.06	0.0	0.0	0.0	0.0	0.95
WSW	.001	0.01	0.11	0.07	0.0	0.0	0.0	0.0	0.0	0.19
W	.002	0.03	0.08	0.02	0.0	0.0	0.0	0.0	0.0	0.13
WNW	.001	0.01	0.03	0.01	0.0	0.01	0.0	0.0	0.0	0.06
NW	.001	0.02	0.06	0.03	0.0	0.0	0.0	0.0	0.0	0.11
NNW	.001	0.02	0.08	0.03	0.0	0.0	0.0	0.0	0.0	0.13
SUBTOTAL	0.06	1.17	4.74	1.39	0.09	0.02	0.0	0.0	0.0	7.41

2379 STABILITY CLASS G OCCURRENCES OUT OF TOTAL 32723 VALID TEMPERATURE DIFFERENCE READINGS

2378 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF TOTAL 2379 STABILITY CLASS G OCCURRENCES

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEROROLOGICAL FACILITY LOCATED ..4 MILES SW OF SEQUOYAH NUCLEAR PLANT
TEMPERATURE INSTRUMENTS 33 AND 150 FEET ABOVE GROUND
WIND INSTRUMENTS 33 FEET ABOVE GROUND

TABLE 1.3

PERCENT OCCURRENCE OF WIND
SPEED FOR ALL WIND DIRECTIONS

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JAN 1, 72 - DEC 31, 75

WIND DIRECTION	CALM	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	.044	0.51	3.20	1.63	0.67	0.58	0.0	0.0	0.0	6.59
NNE	.063	0.82	8.30	5.05	2.46	2.16	0.11	0.0	0.0	18.92
NE	.043	0.48	3.86	2.59	1.01	0.83	0.06	0.0	0.0	8.83
ENE	.027	0.42	1.58	0.39	0.09	0.0	0.01	0.0	0.0	2.49
E	.030	0.50	0.80	0.11	0.03	0.02	0.01	0.0	0.0	1.47
ESE	.023	0.33	0.45	0.07	0.02	0.01	0.02	0.0	0.0	[illegible]
SE	.019	0.34	0.82	0.19	0.01	0.02	0.0	0.0	0.0	1.38
SSE	.024	0.41	1.36	0.55	0.23	0.36	0.06	0.02	0.0	2.99
S	.031	0.47	2.89	2.49	1.58	1.53	0.14	0.0	0.0	9.10
SSW	.019	0.29	3.79	4.91	3.44	2.84	0.24	0.0	0.0	15.51
SW	.023	0.30	3.55	4.79	3.02	1.93	0.20	0.02	0.0	13.81
WSW	.016	0.24	1.68	1.19	0.66	0.69	0.16	0.02	0.0	4.64
W	.016	0.21	0.78	0.47	0.35	0.44	0.06	0.01	0.0	2.32
WNW	.019	0.27	0.70	0.36	0.34	0.51	0.03	0.0	0.0	2.21
NW	.011	0.18	0.93	0.63	0.74	0.83	0.07	0.0	0.0	3.38
NNW	.020	0.27	1.55	1.23	0.93	0.99	0.04	0.0	0.0	5.01
SUBTOTAL	0.43	6.04	36.24	26.65	15.58	13.76	1.21	0.07	0.0	99.55

32338 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF 35040 TOTAL HOURS = 92.29 PERCENT

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
WIND INSTRUMENTS 33 FEET ABOVE GROUND

TABLE 1.4

SEQUOYAH NUCLEAR PLANT LAND SITE BOUNDARY DATA*

Sector	Distance (m)	X/Q (s/m^2)	D/Q (m^{-2})
N	950	5.13(-6)	1.29(-8)
NNE	2,260	1.94(-6)	5.28(-9)
NE	1,910	2.33(-6)	6.33(-9)
ENE	1,680	1.12(-6)	2.64(-9)
E	1,570	7.11(-7)	1.46(-9)
ESE	1,460	7.92(-7)	1.58(-9)
SE	1,460	9.17(-7)	2.41(-9)
SSE	1,550	1.34(-6)	3.23(-9)
S	1,570	2.37(-6)	4.18(-9)
SSW	1,840	4.51(-6)	9.26(-9)
SW	2,470	1.38(-6)	2.63(-9)
WSW	910	2.93(-6)	3.86(-9)
W	670	3.63(-6)	3.74(-9)
WNW	660	2.49(-6)	2.44(-9)
NW	660	2.85(-6)	3.67(-9)
NNW	730	3.96(-6)	6.59(-9)

*All release points treated as ground level.

TABLE 1.4A

REAL RECEPTOR LOCATIONS

SECTOR	NEAREST RESIDENT(m)	HOME-USE GARDEN(m)	MILCH[a] ANIMAL(m)
N	1344	1344	4219
NNE	2812	2812	4531
NE	3438	3438	5625
ENE	2187	2187	-
E	1812	2656	-
ESE	1812	2031	2344
SE	1719	2062	-
SSE	2250	2344	-
S	2375	2375	7031
SSW	2250	2750	3594
SW	2969	3438	-
WSW	1469	2062	-
W	938	938	-
WNW	1812	1812	1875
NW	1188	1188	2031, 5781 (goat)
NNW	781	1875	2438 (goat)

a. All are real cow locations except where noted otherwise.

3

TABLE 1.5

DOSE FACTORS FOR SUBMERSION IN NOBLE GASES

	DFB[1]	DF[2]	DFS[1]	DF[2]
Kr-85m	1.17(+3)[3]	1.21(+3)	1.46(+3)	3.86(+3)
Kr-85	1.61(+1)	1.69(+1)	1.34(+3)	3.83(+3)
Kr-87	5.92(+3)	6.05(+3)	9.73(+3)	2.01(+4)
Kr-88	1.47(+4)	1.50(+4)	2.37(+3)	5.72(+3)
Kr-89	1.66(+4)	1.59(+4)	1.01(+4)	1.88(+4)
Xe-131m	9.15(+1)	1.53(+2)	4.76(+2)	2.18(+3)
Xe-133m	2.51(+2)	3.17(+2)	9.94(+2)	2.90(+3)
Xe-133	2.94(+2)	3.46(+2)	3.06(+2)	2.06(+3)
Xe-135m	3.12(+3)	3.30(+3)	7.11(+2)	1.45(+3)
Xe-135	1.81(+3)	1.88(+3)	1.86(+3)	4.84(+3)
Xe-137	1.42(+3)	1.48(+3)	1.22(+4)	2.50(+4)
Xe-138	8.83(+3)	9.00(+3)	4.13(+3)	9.25(+3)
Ar-41	8.84(+3)	9.76(+3)	2.69(+3)	5.54(+3)

1. mrem/y per $\mu Ci/m^3$
2. mrad/y per $\mu Ci/m^3$
3. 1.17(+3) = 1.17×10^3

TABLE 1.6

STABLE ELEMENT TRANSFER DATA

Element	B_{iv} Veg/Soil	F_m (Cow) Milk (d/ℓ)
H	4.8E 00	1.0E-02
C	5.5E 00	1.2E-02
Na	5.2E-02	4.0E-02
P	1.1E 00	2.5E-02
Cr	2.5E-04	2.2E-03
Mn	2.9E-02	2.5E-04
Fe	6.6E-04	1.2E-03
Co	9.4E-03	1.0E-03
Ni	1.9E-02	6.7E-03
Cu	1.2E-01	1.4E-02
Zn	4.0E-01	3.9E-02
Rb	1.3E-01	3.0E-02
Sr	1.7E-02	8.0E-04
Y	2.6E-03	1.0E-05
Zr	1.7E-04	5.0E-06
Nb	9.4E-03	2.5E-03
Mo	1.2E-01	7.5E-03
Tc	2.5E-01	2.5E-02
Ru	5.0E-02	1.0E-06
Rh	1.3E 01	1.0E-02
Ag	1.5E-01	5.0E-02
Te	1.3E 00	1.0E-03
I	2.0E-02	6.0E-03
Cs	1.0E-02	1.2E-02
Ba	5.0E-03	4.0E-04
La	2.5E-03	5.0E-06
Ce	2.5E-03	1.0E-04
Pr	2.5E-03	5.0E-06
Nd	2.4E-03	5.0E-06
W	1.8E-02	5.0E-04
Np	2.5E-03	5.0E-06

TABLE 1.7

INTERNAL DOSE FACTORS[1] - INFANT THYROID

Radionuclide	Inhalation[2] $\frac{mrem}{yr}$ $\frac{cm^3}{\mu Ci}$	Cow Milk Ingestion $\frac{mrem}{yr}$ $\frac{m^2-s}{\mu Ci}$
H-3	4.30(+8)	2.75(+9)*
C-14	5.04(+9)	6.55(+11)*
Te-132	2.38(+7)	1.45(+7)
I-131	1.41(+13)	9.12(+11)
I-133	4.66(+12)	1.21(+10)

*Unit for H-3 and C-14 is mrem/yr per μCi/cm^3.

1. Based on Regulatory Guide 1.109 methodology.
2. Assumes infant breathing rate of 1400 m^3/yr.

TABLE 1.8

EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND
(mrem/hr per pCi/m^2)

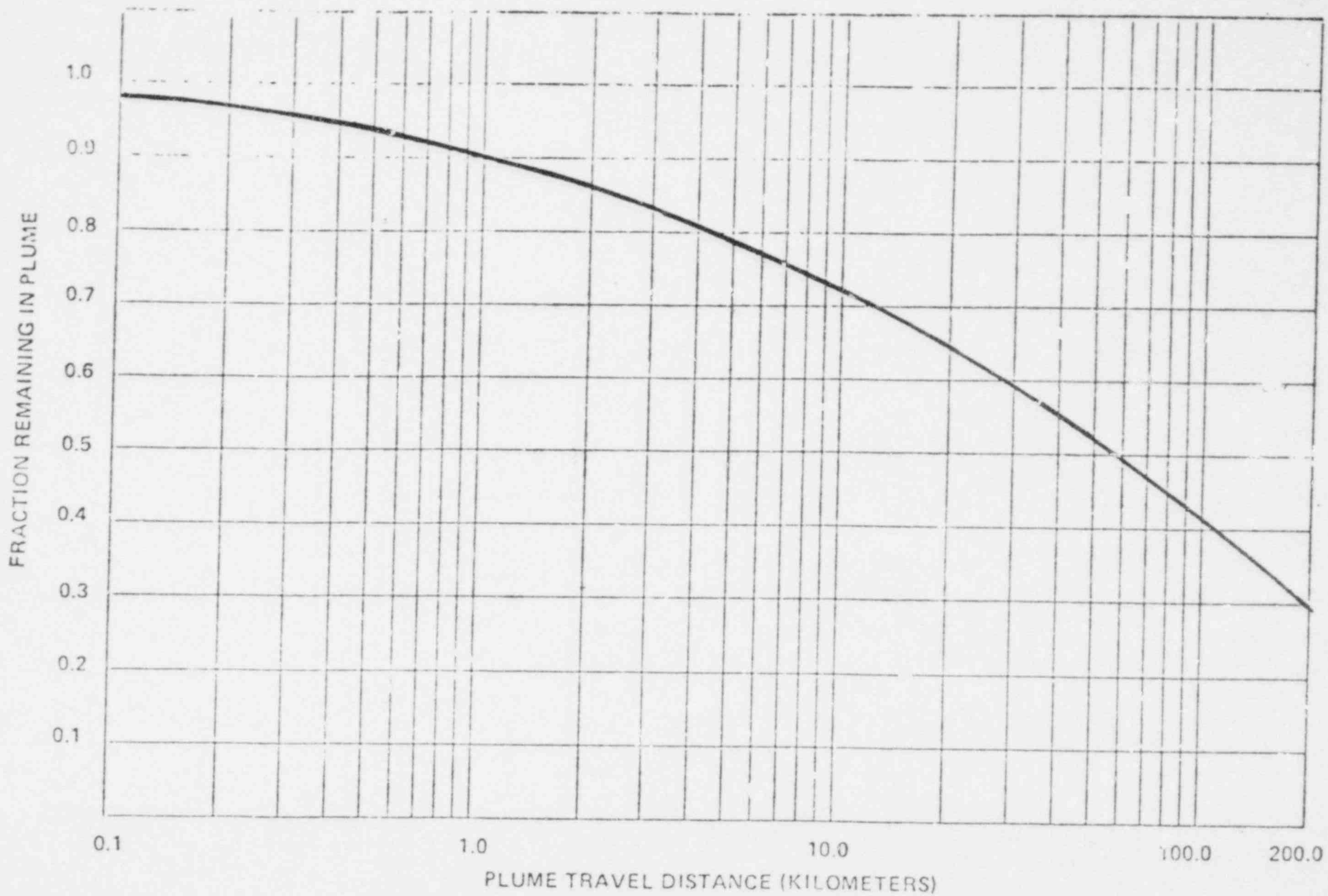
Element	Total Body	Skin
H-3	0.0	0.0
C-14	0.0	0.0
NA-24	2.50E-08	2.90E-08
P-32	0.0	0.0
Cr-51	2.20E-10	2.60E-10
Mn-54	5.80E-09	6.80E-09
Mn-56	1.10E-08	1.30E-08
Fe-55	0.0	0.0
Fe-59	8.00E-09	9.40E-09
Co-58	7.00E-09	8.20E-09
Co-60	1.70E-08	2.00E-08
Ni-63	0.0	0.0
Nr-65	3.70E-09	4.30E-09
Cu-64	1.50E-09	1.70E-09
Zn-65	4.00E-09	4.60E-09
Zn-69	0.0	0.0
Br-83	6.40E-11	9.30E-11
Br-84	[illegible].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	[illegible].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-0[illegible]
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.[illegible]0E-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
Te-132	1.70E-09	2.00E-09
I-130	1.40E-08	1.70E-08
I-131	2.80E-09	3.40E-09

TABLE 1.8 (cont'd)

EXTERNAL DOSE FACTORS FOR STANDING ON CONTAMINATED GROUND
(mrem/hr per pCi/m^2)

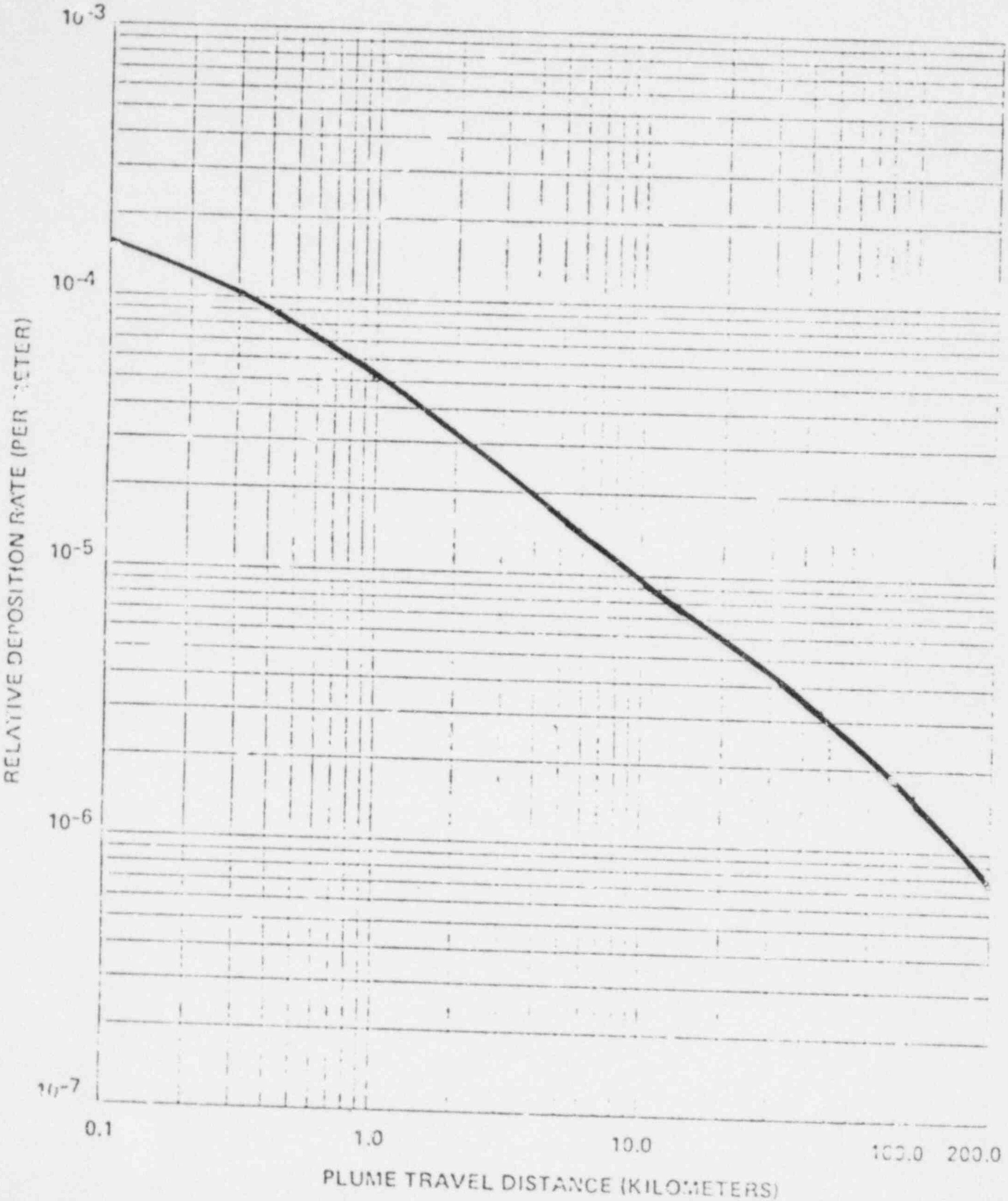
Element	Total Body	Skin
I-132	1.70E-08	2.00E-08
I-133	3.70E-09	4.50E-09
I-134	1.60E-08	1.90E-08
I-135	1.20E-08	1.40E-08
Cs-134	1.20E-08	1.40E-08
Cs-136	1.50E-08	1.70E-08
Cs-137	4.20E-09	4.90E-09
Cs-138	2.10E-08	2.40E-08
Ba-139	2.40E-09	2.70E-09
Ba-140	2.10E-09	2.40E-09
Ba-141	4.30E-09	4.90E-09
Ba-142	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

FIGURE [illegible]



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

FIGURE 1.2



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

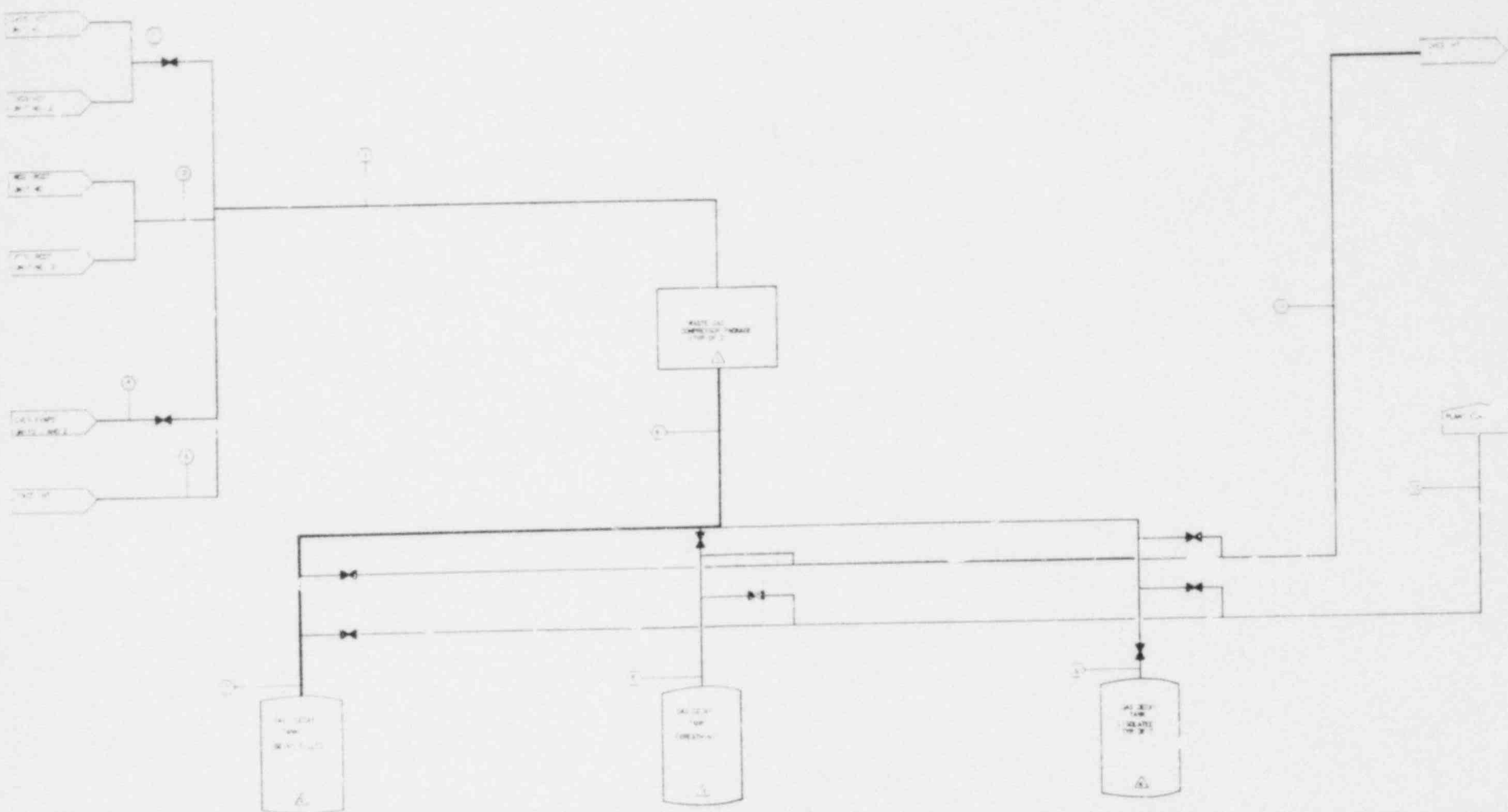


Figure 1.3 Process Flow Diagram

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2. Liquid Effluents

2.1 Concentration

2.1.1 RETS Requirement

Specification 3.11.1.1 of the Radiological Effluent Technical Specifications (RETS) requires that the concentration of radioactive material released at any time from the site to unrestricted areas shall be limited to the Maximum Permissible Concentration (MPC, attached as Appendix I) 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

Most tanks will be recirculated through two volume changes prior to sampling to ensure that a representative sample is obtained. Because of their size the high crud tanks, non-reclaimable waste tank, and cask decontamination tank will not necessarily be recirculated through two volumes. An appropriate recirculation time for these tanks will be determined by a one time test. The tank will be recirculated and periodically sampled for suspended particulates during the test. The appropriate recirculation time will be the time that the suspended particulate concentration reaches steady state. The condensate demineralizer waste evaporator blowdown tank cannot be recirculated. However the contents of the tank will be under administrative control and could be transferred to the distillate tanks prior to release.

Prior to release a grab sample will be analyzed for each release point for the concentration of each radionuclide.

$$C_j = \sum_{i=1}^{n} C_i \qquad (2.1)$$

where:

C_j = total concentration in the liquid effluent at release point j, μCi/ml.

C_i = concentration of radionuclide i, μCi/ml.

2.1.3 MPC-Sum of the Ratios

The sum of the ratios (R_j) for each release point will be calculated by the following relationship.

$$R_j = \frac{C_A}{MPC_A} + \frac{C_B}{MPC_B} + \cdots + \frac{C_i}{MPC_i} \cdots + \frac{C_n}{MPC_n} \qquad (2.2)$$

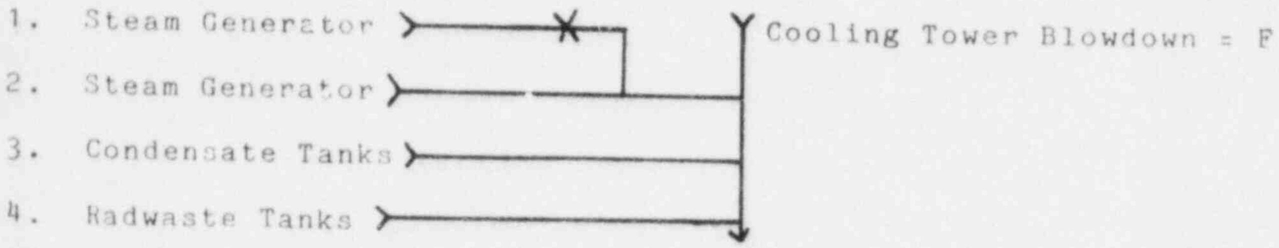
where:

C_i = undiluted effluent concentration of radionuclide i, as determined in Section 2.1.2, μCi/ml.

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

R_j = the sum of the ratios for release point j.

There are 4 possible liquid release points into cooling tower blowdown.



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

$$f_1(R_1-1) + f_2(R_2-1) + f_3(R_3-1) + f_4(R_4-1) \leq F \qquad (2.3)$$

where:

f_1, f_2, f_3, f_4 = the effluent flow rate (gallons/minute) at the respective release point determined by plant personnel.

R_1, R_2, R_3, R_4 = the sum of the ratios of the respective release point as determined by Equation 2.2.

F = minimum dilution flow rate for prerelease analysis (cooling tower blowdown, gallons/minute) = 15,000 gal/min.

For releases into the cooling tower blowdown line, additional mixing is assumed to occur in the diffuser pond when SQN is operating in Helper or Open cooling mode. 2

The results, from field tests conducted in September 1979, are expressed in terms of relative concentration r:

$$r = 2.4\times10^{-6}\ (F + f_1 + f_2 + f_3 + f_4)$$

Equations 2.3 then becomes 2

$$2.4\times10^{-6}\ (F + f_1 + f_2 + f_3 + f_4)\left[f_1(R_1-1) + f_2(R_2-1) + f_3(R_3-1) + f_4(R_4-1)\right] \leq F \qquad (2.3a)$$

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 physical and technical description location and identification number for each liquid effluent radiation detector is contained in plant documentation.

The respective alarm/trip setpoints at each release point will be set such that the sum of the ratios at each point, as calculated by Equation 2.2, will not be exceeded. The R_j is directly related to the total concentration calculated by Equation 2.1. An increase in the concentration would indicate an increase in the respective R_j. A large increase would cause the limits specified in Section 2.1.1 to be exceeded. The minimum alarm/trip setpoint value is equal to the release concentration, but for ease of operation it may be desired that the setpoint(s) be set above the effluent concentration (C_j). That is,

$$S_j = b_j \times C_j \qquad (2.4)$$

or

$$b_j = \frac{S_j}{C_j}$$

where:

S_j = desired alarm/trip setpoint at release point j.

b_j = scaling factor to prevent alarms/trips due to variations in the effluent concentrations at release point j.

C_j = total concentration in the liquid effluent at release point j specified by Equation 2.1, μCi/ml.

The R_j used in Equation 2.3a must also be scaled by the corresponding scale factor. Equation 2.3 and the corresponding alarm/trip setpoints become 2

$$2.4\times10^{-6}\ (F + f_1 + f_2 + f_3 + f_4)\ \Big[F_1(b_1R_1-1) + F_2\ (b_2\ R_2-1) + f_3\ (b_3\ R_3-1) + f_4\ (b_4\ R_4-1)\Big] \leq F \qquad (2.5)$$ 3

$$b_1 = \frac{S_1}{C_1} \qquad (2.6)$$

$$b_2 = \frac{S_2}{C_2} \qquad (2.7)$$

$$b_3 = \frac{S_3}{C_3} \qquad (2.8)$$

$$b_4 = \frac{S_4}{C_4} \qquad (2.9)$$

For example, for 2 release points, minimum dilution flow and no diffuser pond dilution this becomes, 2

$$f_1\left[\left(\frac{S_1}{C_1} \times R_1\right)-1\right] + f_2\left[\left(\frac{S_2}{C_2} \times R_2\right) -1\right] < 15{,}000 \qquad (2.10)$$

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 the actual liquid radwaste (f) and dilution (F) flow rates (or volumes) during the release. The data will be substituted into Equation 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 3.11.1.2 of the Radiological Effluent Technical Specification (RETS) requires that the dose or dose commitment to an individual from radioactive materials in liquid effluents released to unrestricted areas from each reactor (see Figure 2.2.1-1) shall be limited:

a. During any calendar 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 exceeds the above limits, the methodology in Section 2.3.3 will be implemented.

Calculated doses from liquid effluents (based upon historical release data) have been dominated by the Phosphorus-32 (P-32) dose to the bone. To further ensure accurate dose assessment, ten additional nuclides are considered. The 11 nuclides (listed below) contribute more than 95 percent of the dose to the total body and the two most critical organs (bone and gastro-intestinal tract (G.I. tract)) for both water and fish ingestion. 3

H-3	Co-58	Nb-95
P-32	Co-60	Xe-133
Mn-54	Sr-89	Ce-144
Fe-55	Sr-90	

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 released of each of the above eleven radionuclides will be noted. This information will then be used in the following calculations. 3

2.3.2.1 Water Ingestion

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

$$D_j = \frac{1}{.95} \sum_{i=1}^{11} (DCF)_{ij} \times I_i, \text{rem} \qquad (2.11)$$ 3

where:

D_j = dose for the j^{th} organ from eleven radionuclides, rem

j = the organ of interest (bone GI tract and total body)

k = the release point of interest (cooling tower blowdown or turbine building sump).

.95 = conservative correction factor, considering only eleven radionuclides.

DCF_{ij} = adult ingestion dose commitment factor for the j^{th} organ from the i^{th} radionuclide rem/μCi, see attached as Table 2.1.

I_i = monthly activity ingested of the i^{th} radionuclide, μCi.

I_i is described by

$$I_i = \frac{A_i V (30)}{Fd (7.34 \times 10^{10})}, \mu Ci \qquad (2.12)$$

where:

A_i = activity released of i^{th} radionuclide during the month, μCi.

V = average rate of water consumption (730 ml/d ICRP 23, p. 358)

30 = days per month

F = average river flow at Chickamauga Dam for the month (cubic feet per second)

d = fraction of river flow available for dilution (1/5)

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

The dose equation then becomes

$$D_j = \frac{1.57\times10^{-3}}{F} \sum_{i=1}^{11} (DCF)_{ij} \times A_i, \text{ mrem} \qquad (2.13)$$

considering the conversion factor from rem to mrem.

2.3.2.2 Fish Ingestion

The dose to an individual from the consumption of fish is described by Equation 2.11. In this case the activity ingested of the i^{th} radionuclide (I_i) is described by

$$I_i = \frac{A_i B_i M}{Fd\,(7.34x10^{10})}, \mu Ci \qquad (2.14)$$

where:

A_i = activity released of i^{th} radionuclide during the month, µCi

B_i = effective fish concentration factor for the ith radionuclide $\frac{\mu Ci/gm}{\mu Ci/ml}$, see attached as Table 2.1.

M = amount of fish eaten monthly ($1.9x10^3$ gm)

F = average river flow at Chickamauga Dam for month (cubic feet per second)

d = fraction river flow available for dilution (1/5)

$7.34x10^{10}$ = conversion from cubic feet per second to milliliters per month.

3

The dose equation then becomes

$$D_j = \frac{1.36x10^{-4}}{F} \sum_{i=1}^{11} A_i x B_i x DCF_{ij}, \text{ mrem} \qquad (2.15)$$

considering the conversion factor from rem to mrem.

If these calculated monthly doses exceed limits specified in Section 2.3.1, then a more accurate and complete calculation will be done as described in Section 2.3.3. 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 of 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 dose analysis utilizing the total estimated liquid releases for each calendar quarter will be performed and reported as required 1
in Specifications 6.9.1.8 and 6.9.1.9. This analysis will replace 3
previous estimates calculated in Section 2.3.2 and consists of the following approach. The dose to the j^{th} organ from m radionuclides, D_j, is described by

$$D_j = \sum_{i=1}^{m} D_{ij}, \text{ rem} \qquad (2.16)$$

$$= \sum_{i-1}^{m} (DCF)_{ij} \times I_i, \text{ rem} \qquad (2.17)$$ 3

where:

D_{ij} = dose to the j^{th} organ from the i^{th} radionuclide, rem.

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

$(DCF)_{ij}$ = adult ingestion dose commitment factor for the j^{th} organ from the i^{th} radionuclide, rem/μCi, see Table 2.1.

I_i = activity ingested of the i^{th} radionuclide, μCi.

I_i for water ingested is described by

$$I_i = \frac{A_i \quad V \quad n}{Fd}, \ \mu\text{Ci} \qquad (2.18)$$

and for fish ingestion I_i is described by

$$I_i = \frac{A_i \ B_i \quad M}{Fd}, \ \mu\text{ Ci} \qquad (2.19)$$

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where:

A_i = activity released of j^{th} radionuclide during the release period, μCi.

V = average rate of water consumption (730 ml/d).

n = number of days during the release period (d).

F = total river flow at location of interest for period, ml. 3

d = fraction of river flow available for dilution (1/5 above Chickamauga Dam, 1 below the dam)

B_i = fish concentration factor, $\frac{\mu Ci/gm}{\mu Ci/ml}$

M = amount of fish eaten during period (fraction of year x 50 lb/year x 453.6 g/lb)

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.

2.4 Operability of Liquid Radwaste Equipment

Specification 3.11.1.3 of the Radiological Effluent Technical Specifications requires that the liquid radwaste system 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 2.1.1-1) 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.

TABLE 2.1

DOSE COMMITMENT AND FISH CONCENTRATION FACTORS

NUCLIDE	RADIOLO. HALF-LIFE (DAYS)	BIOLOGICAL HALF-LIFE (DAYS)	EFFECTIVE HALF/LIFE (DAYS)	HUMAN DOSE COMMITMENT FACTORS (REM/UCI)					FISH		
									CONCENTRATION FACT.		BIOLOGICAL HALF-LIFE DAYS
				BONE	GI TRACT	THYROID	TOTAL BODY	LIVER	STABLE	RADIOLO.	
H-3	4.48E+03	1.00E+01	9.98E+00	9.77E-05	1.05E-04	1.05E-04	1.05E-04	1.05E-04	1.00E+00	1.00E+00	0.0
C-14	2.09E+06	1.00E+01	1.00E+01	2.84E-03	5.68E-04	5.88E-04	5.68E-04	5.68E-04	4.55E+03	4.55E+03	0.0
NA-24	6.33E-01	1.10E+01	5.99E-01	1.70E-03	1.70E-03	1.70E-03	1.70E-03	1.70E-03	1.00E+02	1.00E+02	0.0
P-32	1.43E+01	2.57E+02	1.35E+01	1.93E-01	2.17E-02	7.47E-03	7.46E-03	1.20E-02	1.00E+05	*2.50E+04	0.0
K-40	4.60E+11	5.80E+01	5.80E+01	3.45E-02	0.0	3.45E-02	3.45E-02	3.45E-02	2.50E+03	2.50E+03	0.0
CR-51	2.78E+01	6.16E+02	2.66E+01	3.21E-06	6.69E-04	1.59E-06	2.66E-06	2.66E-06	2.00E+02	2.00E+02	0.0
MN-54	3.03E+02	1.70E+01	1.61E+01	8.83E-04	1.40E-02	8.83E-04	8.72E-04	4.57E-03	4.00E+02	4.00E+02	0.0
MN-56	1.07E-01	1.70E+01	1.06E-01	2.04E-05	3.67E-03	2.04E-05	2.04E-05	1.15E-04	4.00E+02	4.00E+02	0.0
FE-55	9.50E+02	8.00E+02	4.34E+02	2.75E-03	1.09E-03	2.74E-04	4.43E-04	1.90E-03	1.00E+02	1.00E+02	0.0
FE-59	4.56E+01	8.00E+02	4.31E+01	4.34E-03	3.40E-02	3.81E-03	3.91E-03	1.02E-02	1.00E+02	1.00E+02	0.0
CO-58	7.13E+01	9.50E+00	8.38E+00	1.69E-03	1.51E-02	1.69E-03	1.67E-03	7.45E-04	5.00E+01	2.08E+01	1.00E+02
CO-60	1.92E+03	9.50E+00	9.45E+00	4.73E-03	4.02E-02	4.73E-03	4.72E-03	2.14E-03	5.00E+01	4.75E+01	1.00E+02
NI-65	1.07E-01	6.67E+02	1.07E-01	5.28E-04	1.74E-03	3.27E-05	3.13E-05	6.86E-05	1.00E+02	1.00E+02	0.0
CU-64	5.31E-01	8.00E+01	5.27E-01	3.91E-05	7.10E-03	3.91E-05	3.91E-05	8.33E-05	5.00E+01	5.00E+01	0.0
ZN-65	2.45E+02	9.33E+02	1.94E+02	4.84E-03	9.70E-03	7.13E-03	6.96E-03	1.54E-02	2.00E+03	1.42E+03	1.00E+02
ZN-69M	5.75E-01	9.33E+02	5.75E-01	1.55E-04	2.91E-03	3.64E-05	3.64E-05	4.09E-04	2.00E+03	1.14E+01	1.00E+02
ZN-69	3.96E-02	9.33E+02	3.96E-02	1.03E-05	2.96E-06	1.37E-06	1.37E-06	1.97E-05	2.00E+03	7.92E-01	1.00E+02
BR-82	1.48E+00	8.00E+00	1.25E+00	2.26E-03	2.59E-03	2.26E-03	2.26E-03	2.26E-03	4.20E+02	4.20E+02	0.0
BR-83	1.00E-01	8.00E+00	9.88E-02	3.55E-05	5.79E-05	3.55E-05	4.02E-05	4.02E-05	4.20E+02	4.20E+02	0.0
BR-84	2.21E-02	8.00E+00	2.20E-02	6.04E-05	4.09E-10	6.04E-05	5.21E-05	5.21E-05	4.20E+02	4.20E+02	0.0
BR-85	2.08E-03	8.00E+00	2.08E-03	5.17E-07	1.00E-21	5.17E-07	2.14E-06	2.14E-06	4.20E+02	4.20E+03	0.0
KR-83M	7.75E-02	1.00E+00	7.19E-02	0.0	1.46E-04	0.0	0.0	0.0	1.00E+00	1.00E+00	0.0
KR-85M	1.83E-01	1.00E+00	1.55E-01	0.0	3.30E-03	0.0	0.0	0.0	1.00E+00	1.00E+00	0.0
KR-85	3.93E+03	1.00E+00	1.00E+00	0.0	4.62E-02	0.0	0.0	0.0	1.00E+00	1.00E+00	0.0
RB-86	1.87E+01	4.50E+01	1.32E+01	9.63E-03	4.16E-03	9.8[illegible]E-03	9.83E-03	2.11E-02	2.00E+03	2.00E+03	0.0
RB-88	1.24E-02	4.50E+01	1.24E-02	3.34E-05	8.36E-16	8.34E-05	3.21E-05	6.05E-05	2.00E+03	2.00E+03	0.0
RB-89	1.07E-02	4.50E+01	1.07E-02	2.86E-05	2.33E-18	2.86E-05	2.82E-05	4.01E-05	2.00E+03	2.00E+03	0.0
SR-89	5.27E+01	1.30E+04	5.25E+01	3.08E-01	4.94E-02	9.22E-03	8.84E-03	8.84E-03	3.00E+01	1.04E+01	1.00E+02
SR-90	1.01E+04	1.30E+04	5.68E+03	7.58E+00	2.19E-01	1.76E+00	1.86E+00	1.86E+00	3.00E+01	2.97E+01	1.00E+02
SR-91	4.03E-01	1.30E+04	4.03E-01	5.67E-03	2.70E-02	1.92E-04	2.29E-04	2.29E-04	3.00E+01	1.20E-01	1.00E+02
SR-92	1.13E-01	1.30E+04	1.13E-01	2.15E-03	4.26E-02	6.89E-05	9.30E-05	9.30E-05	3.00E+01	3.39E-02	1.00E+02
SR-93	5.56E-03	1.30E+04	5.56E-03	6.39E-05	1.89E-03	8.90E-06	8.90E-06	8.90E-06	3.00E+01	1.67E-03	1.00E+02
Y-90	2.67E+00	1.40E+04	2.67E+00	9.62E-06	1.02E-01	2.57E-07	2.58E-07	2.58E-07	2.50E+01	2.50E+01	0.0
Y-91M	3.47E-02	1.40E+04	3.47E-02	9.09E-08	2.67E-07	1.72E-09	3.52E-09	3.52E-09	2.50E+01	2.50E+01	0.0
Y-91	5.88E+01	1.40E+04	5.8[illegible]E+01	1.41E-04	7.76E-02	3.66E-06	3.77E-06	3.77E-06	2.50E+01	2.50E+01	0.0
Y-92	1.47E-01	1.40E+04	1.47E-01	8.45E-07	1.48E-02	2.47E-08	2.47E-08	2.47E-08	2.50E+01	2.50E+01	0.0
Y-93	4.29E-01	1.40E+04	4.29E-01	2.68E-06	8.50E-02	5.51E-08	7.40E-08	7.40E-08	2.50E+01	2.50E+01	0.0
ZR-95	6.55E+01	4.50E+02	5.72E+01	3.04E-05	3.09E-02	6.38E-06	6.60E-06	9.75E-06	3.33E+00	3.33E+00	0.0
ZR-97	7.08E-01	4.50E+02	7.07E-01	1.68E-06	1.05E-01	1.55E-07	1.55E-07	3.39E-07	3.33E+00	3.33E+00	0.0
NB-95M	3.75E+00	7.60E+02	3.73E+00	5.86E-07	3.55E-02	2.88E-07	2.88E-07	4.63E-07	3.00E+04	3.00E+04	0.0
NB-95	3.50E+01	7.60E+02	3.35E+01	6.22E-06	2.10E-02	1.83E-06	1.86E-06	3.46E-06	3.00E+04	3.00E+04	0.0
NB-97	5.00E-02	7.60E+02	5.00E-02	4.90E-08	2.10E-03	4.60E-09	4.60E-09	1.27E-08	3.00E+04	3.00E+04	0.0

*This effective concentration factor includes an adjustment of 0.25 for the fraction of the toal phosphorus found in edible portions.

TABLE 2.1

DOSE COMMITMENT AND FISH CONCENTRATION FACTORS

NUCLIDE	RADIOLO. HALF-LIFE (DAYS)	BIOLOGICAL HALF-LIFE (DAYS)	EFFECTIVE HALF/LIFE (DAYS)	HUMAN DOSE COMMITMENT FACTORS (REM/UCI) BONE	GI TRACT	THYROID	TOTAL BODY	LIVER	FISH CONCENTRATION FACT. STABLE	FISH CONCENTRATION FACT. RADIOLO.	FISH BIOLOGICAL HALF-LIFE DAYS
RU-103	3.96E+01	7.30E+00	6.16E+00	1.85E-04	2.16E-02	7.98E-05	7.95E-05	7.97E-05	1.00E+01	1.00E+01	0.0
RU-106	3.68E+02	7.30E+00	7.16E+00	2.75E-03	1.78E-01	3.50E-04	3.48E-04	3.48E-04	1.00E+01	1.00E+01	0.0
RH103M	3.96E-02	7.30E+00	3.94E-02	1.67E-07	1.21E-04	4.99E-08	4.99E-08	7.21E-07	1.00E+01	1.00E+01	0.0
AG110M	2.53E+02	5.00E+00	4.90E+00	1.60E-04	6.04E-02	8.78E-05	8.79E-05	1.48E-04	2.00E+00	2.00E+00	0.0
SB-124	6.02E+01	3.80E+01	2.33E+01	2.80E-[illegible]	7.95E-02	6.79E-06	1.11E-03	5.30E-05	1.00E+00	1.00E+00	0.0
SB-125	9.96E+02	3.80E+01	3.66E+01	1.79E-03	1.97E-02	1.82E-06	4.26E-04	2.40E-05	1.00E+00	1.00E+00	0.0
TE125M	5.80E+01	1.50E+01	1.19E+01	2.68E-03	1.07E-02	8.06E-04	3.59E-04	9.71E-04	4.00E+02	4.00E+02	0.0
TE127M	1.09E+02	1.50E+01	1.32E+01	6.77E-03	2.27E-02	1.73E-03	8.25E-04	2.42E-03	4.00E+02	4.00E+02	0.0
TE-127	3.92E-01	1.50E+01	3.82E-01	1.10E-04	8.68E-03	8.15E-05	2.38E-05	3.95E-05	4.00E+02	4.00E+02	0.0
TE129M	3.41E+01	1.50E+01	1.04E+01	1.15E-02	5.79E-02	3.95E-03	1.82E-03	4.29E-03	4.00E+02	4.00E+02	0.0
TE-129	4.77E-02	1.50E+01	4.75E-02	3.14E-05	2.37E-05	2.41E-05	7.65E-06	1.18E-05	4.00E+02	4.00E+02	0.0
TE131M	1.25E+00	1.50E+01	[illegible].15E+00	1.[illegible]E-03	8.40E-02	1.34E-03	7.05E-04	8.46E-04	4.00E+02	4.00E+02	0.0
TE-131	1.72E-02	1.50E+01	1.72E-02	1.97E-05	2.79E-06	1.62E-05	6.22E-06	8.23E-06	4.00E+02	4.00E+02	0.0
TE-132	3.24E+00	1.50E+01	2.66E+00	2.52E-03	7.71E-02	1.80E-03	1.53E-03	1.63E-03	4.00E+02	4.00E+02	0.0
TE-134	2.92E-02	1.50E+01	2.91E-02	2.10E-05	8.93E-05	2.00E-05	1.57E-05	2.13E-05	4.00E+02	4.00E+02	0.0
I-129	6.21E+09	1.38E+02	1.38E+02	3.10E-03	0.0	9.61E+00	1.24E-02	2.8[illegible]E-03	5.00E+01	5.00E+01	1.00E+00
I-130	5.17E-01	5.17E-01	2.59E-01	7.56E-04	1.92E-03	1.89E-01	8.80E-04	2.23E-03	5.00E+01	1.70E+01	1.00E+00
I-131	8.05E+00	1.38E+02	7.61E+00	4.16E-03	1.57E-03	1.95E+00	3.[illegible]E-03	5.95E-03	5.00E+01	4.45E+01	1.00E+00
I-132	9.42E-02	1.38E+02	9.41E-02	2.03E-04	1.02E-04	1.90E-02	1.90E-04	5.43E-04	5.00E+01	4.30E+00	1.00E+00
I-133	8.46E-01	1.38E+02	8.41E-01	1.42E-03	2.22E-03	3.63E-01	7.53E-04	2.47E-03	5.00E+01	2.29E+01	1.00E+00
I-134	3.61E-02	1.38E+02	3.61E-02	1.06E-04	2.51E-07	4.99E-03	1.03E-04	2.88E-04	5.00E+01	1.74E+00	1.00E+00
I-135	2.78E-01	1.38E+02	2.77E-01	4.43E-04	1.31E-03	7.65E-02	4.28E-04	1.16E-03	5.00E+01	1.09E+01	1.00E+00
XE 133M	2.26E+00	1.00E+00	6.93E-01	0.0	2.45E-02	0.0	0.0	0.0	1.00E+00	1.00E+00	0.0
XE-133	5.27E+00	1.00E+00	8.41E-01	0.0	2.58E-02	0.0	0.0	0.0	1.00E+00	1.00E+00	0.0
XE 135M	1.08E-02	1.00E+00	1.07E-02	0.0	3.29E-04	0.0	0.0	0.0	1.00E+00	1.00E+00	0.0
XE-135	3.83E-01	1.00E+00	2.77E-01	0.0	1.00E-02	0.0	0.0	0.0	1.00E+00	1.00E+00	0.0
CS-134	7.47E+02	7.00E+01	6.40E+01	6.22E-02	2.59E-03	1.20E-01	1.21E-01	1.48E-01	2.00E+03	2.00E+03	1.00E+00
CS-135	1.10E+09	1.15E+02	1.15E+02	1.96E-02	0.0	8.06E-03	8.06E-03	1.80E-02	2.00E+03	2.00E+03	1.00E+00
CS-136	1.37E+01	7.00E+01	1.15E+01	6.51E-03	2.92E-03	2.03E-02	1.85E-02	2.57E-02	2.00E+03	1.86E+03	1.00E+00
CS-137	1.10E+04	7.00E+01	6.96E+01	7.97E-02	2.11E-03	7.28E-02	7.14E-02	1.09E-01	2.00E+03	2.00E+03	1.00E+00
CS-138	2.24E-02	7.00E+01	2.24E-02	5.52E-05	4.65E-10	5.72E-05	5.40E-05	1.09E-04	2.00E+03	4.38E+01	1.00E+00
BA-139	5.76E-02	6.50E+01	5.75E-02	9.70E-05	1.72E-04	3.07E-06	2.84E-06	6.91E-08	4.00E+00	4.00E+00	0.0
BA-140	1.28E+01	6.50E+01	1.07E+01	2.03E-02	4.18E-02	1.23E-03	1.33E-03	2.55E-05	4.00E+00	4.00E+00	0.0
LA-140	1.68E+00	5.00E+02	1.67E+00	2.50E-06	9.25E-02	3.09E-07	3.33E-07	1.26E-06	2.50E+01	2.50E+01	0.0
LA-141	1.63E-01	5.[illegible]E+01	1.62E-01	3.90E-07	9.60E-03	2.03E-08	2.03E-08	9.91E-08	2.50E+01	2.50E+01	0.0
CE-141	3.25E+01	5.63E+02	3.07E+01	9.36E-06	2.42E-02	7.72E-07	7.18E-07	6.33E-06	2.50E+01	2.50E+01	0.0
CE-143	1.38E+00	5.63E+02	1.38E+00	1.65E-06	4.56E-02	3.56E-08	1.35E-07	1.22E-03	2.50E+01	2.50E+01	0.0
CE-144	2.84E+02	5.63E+02	1.89E+02	4.88E-04	1.65E-01	2.64E-05	2.62E-05	2.04E-04	2.50E+01	2.50E+01	0.0
PR-143	1.36E+01	7.50E+02	1.34E+01	9.20E-06	4.03E-02	4.60E-07	4.56E-07	3.69E-06	2.50E+01	2.50E+01	0.0
PR-144	1.20E-02	7.50E+02	1.20E-02	3.01E-08	4.33E-15	1.54E-09	1.53E-09	1.25E-08	2.50E+01	2.50E+01	0.0
ND-147	1.11E+01	6.56E+02	1.09E+01	6.29E-06	3.49E-02	4.55E-07	4.35E-07	7.27E-06	2.50E+01	2.[illegible]E+01	0.0
PM-147	9.57E+02	6.56E+02	3.89E+02	7.60E-05	1.33E-02	2.89E-06	2.89E-06	7.10E-06	2.50E+01	2.5[illegible]E+01	0.0
PM-149	2.21E+00	6.56E+02	2.20E+00	1.54E-06	4.86E-02	8.87E-08	8.87E-08	2.15E-07	2.50E+01	2.50E+01	0.0
PM-151	1.16E+00	6.56E+02	1.16E+00	6.74E-07	3.17E-02	5.91E-08	5.91E-08	1.17E-07	2.50E+01	2.50E+01	0.0
SM-151	3.18E+04	6.56E+02	6.43E+02	6.09E-05	4.37E-03	1.56E-06	1.56E-06	1.19E-05	2.50E+01	2.50E+01	0.0
SM-153	1.95E+00	6.56E+02	1.94E+00	1.03E-06	3.58E-02	6.65E-08	6.66E-08	7.16E-07	2.50E+01	2.50E+01	0.0

TABLE [illegible]

DOSE COMMITMENT AND FISH CONCENTRATION FACTORS

NUCLIDE	RADIOLO. HALF-LIFE (DAYS)	BIOLOGICAL HALF-LIFE (DAYS)	EFFECTIVE HALF/LIFE (DAYS)	HUMAN DOSE COMMITMENT FACTORS (REM/UCI) BONE	GI TRACT	THYROID	TOTAL BODY	LIVER	FISH CONCENTRATION FACT. STABLE	RADIOLO.	FISH BIOLOGICAL HALF-LIFE DAYS
SM-156	3.92E-01	6.56E+02	3.92E-01	4.63E-07	5.86E-03	5.33E-08	5.33E-08	5.33E-05	2.50E+01	2.50E+01	0.0
EU-155	6.61E+02	6.35E+02	3.24E+02	5.75E-05	1.35E-02	3.35E-06	3.35E-06	1.22E-05	2.50E+01	2.50E+01	0.0
EU-156	1.54E+01	6.35E+02	1.50E+01	1.31E-05	1.02E-01	1.65E-06	1.65E-06	1.06E-05	2.50E+01	2.50E+01	0.0
W-187	9.96E-01	1.00E+00	4.99E-01	1.03E-04	2.82E-02	2.70E-05	3.01E-05	1.03E-04	1.20E+03	1.20E+03	0.0
NP-239	2.35E+00	3.90E+04	2.35E+00	1.19E-06	2.40E-02	7.74E-08	6.45E-08	1.19E-06	1.00E+01	1.00E+01	0.0

3.0 Radiological Environmental Monitoring

3.1 Monitoring Program

An environmental radiological monitoring program shall be conducted in accordance with Technical Specification 3.12.1. The monitoring program described in Tables 3.1-1, 3.1-2, and 3.1-3, and in Figures 3.1-1, 3.1-2, 3.1-3, and 3.1-4 shall be conducted. Results of this program shall be reported in accordance with Technical Specifications 6.9.1.6 and 6.9.1.7.

The atmospheric environmental radiological monitoring program shall consist of 12 monitoring stations from which samples of air particulates, atmospheric radioiodine, rainwater, and heavy particle fallout shall be collected.

The terrestrial monitoring program shall consist of the collection of milk, soil, ground water, drinking water, and food crops. In addition, direct gamma radiation levels will be measured 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 unavailability, or to 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 3.2-1 are achieved.

TABLE 3.1-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Locations*	Sampling and Collection Frequency	Type and Frequency of Analysis
1. AIRBORNE			
a. Particulates	2 samples from locations (in different sectors) at or near the site boundary (LM 1 and 2)	Continuous sampler operation with sample collection weekly	Gross beta weekly, gamma isotopic analysis if gross beta 10 times mean of control sample. Composite quarterly (by location) for gamma scan.
	8 samples from communities approximately 6-10 miles distance from the plant (PM 1-8)		
	2 samples from control locations greater than 10 miles from the plant (RM 1 and 2)		
b. Radioiodine	Samples from same locations as air particulates	Continuous sampler operation with filter collection weekly.	^{131}I weekly
c. Fallout	Samples from same locations as air particulates	Heavy particulate fallout collected continuously on gummed acetate paper with paper collection monthly.	Gross beta monthly

*Sample locations are shown on Figures 3.1-1, 3.1-2, 3.1-3, and 3.1-4.
**Samples shall be collected by collecting an aliquot at intervals not exceeding 2 hours.

TABLE 3.1-1 (cont'd)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Locations*	Sampling and Collection Frequency	Type and Frequency of Analysis
d. Rainwater	Samples from same locations as air particualtes	Rainwater collected continuously with composite samples analyzed monthly.	Gamma scan monthly
e. Soil	Samples from same locations as air particulates	Once per 3 years	Gamma scan, $^{89,90}Sr$ once each 3 years
2. DIRECT RADIATION	2 or more dosimeters placed at 10 of the air particulate sampling stations (PM 1-8 and RM 1 and 2)	Quarterly	Gamma dose quarterly
	2 or more dosimeters placed at each of at least 3 other locations (in different sectors) at or near the site boundary (Figure 3.1-2)		
3. WATERBORNE			
a. Surface (Figure 3.1-4)	TRM 497.0 TRM 483.4 TRM 473.2	Collected by automatic sequential-type sampler** with composite sampler taken monthly.	Gamma scan monthly. Composite for tritium quarterly.
b. Ground (Figure 3.1-2)	1 sample adjacent to plant (location W-6)	Quarterly	Gamma scan and tritium quarterly.
	1 sample from ground water source upgradient		
c. Drinking (Table 3.1-3) (Figure 3.1-4)	1 sample at the first potable surface water supply downstream from the plant (TRM 473.0).	Collected by automatic sequential-type sampler** with composite sample taken monthly.	Gross beta and gamma scan monthly. Composite for tritium, $^{89,90}Sr$ quarterly.
	1 sample at the next 2 downstream potable surface water supplies (greater than 10 miles downstream) (TRM 470.5 and 466.3).	Monthly grab sample	

TABLE 3.1-1 (cont'd)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Locations*	Sampling and Collection Frequency	Type and Frequency of Analysis
	2 samples at control locations (Little Soddy Creek Mile 0.5 and TRM 503.8).	Monthly grab sample	
d. Sediment	TRM 496.5 TRM 483.4 TRM 480.5 TRM 472.8	Semiannually	Gamma scan semiannually
4. INGESTION			
a. Milk (Figure 3.1-3)	1 sample from milk producing animals in each of 1-3 areas indicated by the cow census where doses are calculated to be highest. If samples are not available from an area, doses to that area will be estimated by projecting the doses from concentrations detected in milk from other sectors or by sampling vegetation where milk is not available. At least 1 sample from a control location.	Semimonthly when animals are on pasture, monthly at other times.	^{131}I analysis semimonthly on collection. Gamma scan, $^{89,90}Sr$ monthly.
b. Fish	1 sample each from Nickajack, Chickamauga, and Watts Bar Reservoirs.	Semiannually. One sample of each of the following species: Channel Catfish White Crappie Smallmouth Buffalo	Gamma scan on edible portion

TABLE 3.1-1 (cont'd)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Locations*	Sampling and Collection Frequency	Type and Frequency of Analysis
c. Food Products	1 sample each of prinicpal food products grown at private gardens and/or farms in the immediate vicinity of the plant. Selection of locations to be based on the land use census.	Annually at time of harvest. The types of foods available for sampling will vary. Following is a list of typical foods which may be available: Cabbage and/or Lettuce Corn Green Beans Potatoes Tomatoes	Gamma scan on edible portion.

TABLE 3.1-2

Atmospheric and Terrestrial Monitoring Station Locations

Sequoyah Nuclear Plant

Sample Station	Location Approximate Distance and Direction from Plant
LM-1 S	1/4 mile SW
LM-2 S	1/4 mile N
PM-1 S (Northwoods)	10 miles WSW
PM-2 S (Hamilton County Park)	3-3/4 miles WSW
PM-3 S (Daisy)	5-1/2 miles WNW
PM-4 S (Sale Creek)	10-1/2 miles N
PM-5 S (Georgetown)	9 miles ENE
PM-6 S (Work)	5 miles NE
PM-7 S (Harrison Bay)	3-1/2 miles SE
PM-8 S (Harrison)	8-1/2 miles SSW
RM-1 S (Chattanooga, Riverside)	16 miles WSW
RM-2 S (Dayton) (Identical with RM-2 WB, Watts Bar Nuclear Plant)	17-1/2 miles NNE
Farm L	2-3/4 miles NNE
Farm M	3-1/2 miles NNE
Farm J	1-1/4 miles W
Farm C (control)	16 miles NE
Farm B (control)	43 miles NE
Farm S (control)	12 miles NNE

TABLE 3.1-3

PUBLIC WATER SUPPLIES SAMPLED IN ENVIRONMENTAL MONITORING PROGRAM

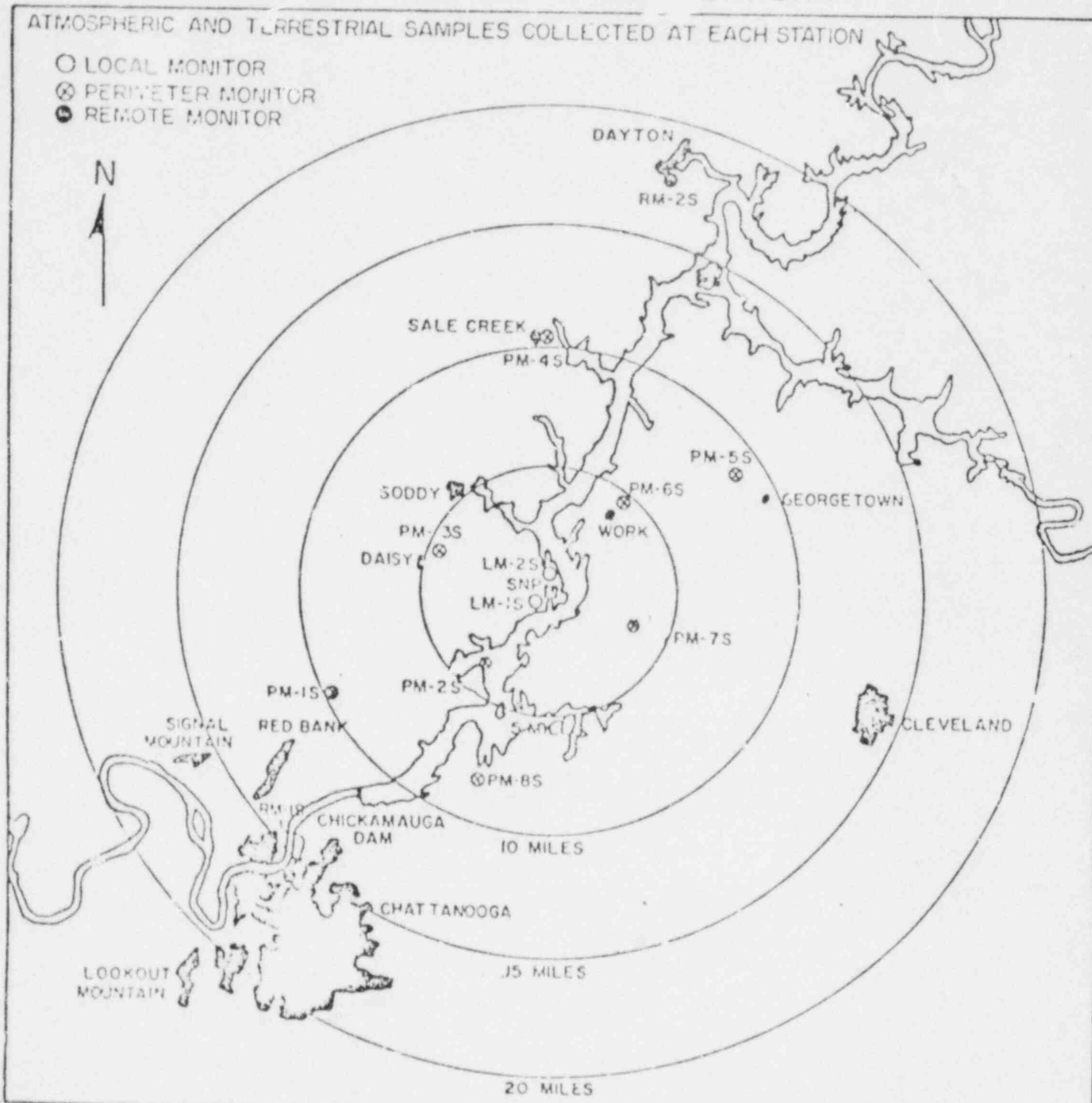
Water Supply	Distance from Site[a]	Source	Sampling Frequency
Chattanooga (C. F. Industries)	11.5	Tennessee River (mile 473.0)	Monthly[b]
Chattanooga (E. I. DuPont and Company)	14.0	Tennessee River (mile 470.5)	Monthly
Chattanooga	19.0	Tennessee River (mile 465.3)	Monthly
Daisy-Soddy-Falling Water Utility District	8.2	Little Soddy Creek	Monthly
Dayton	19.3	Tennessee River (mile 503.8)	Monthly

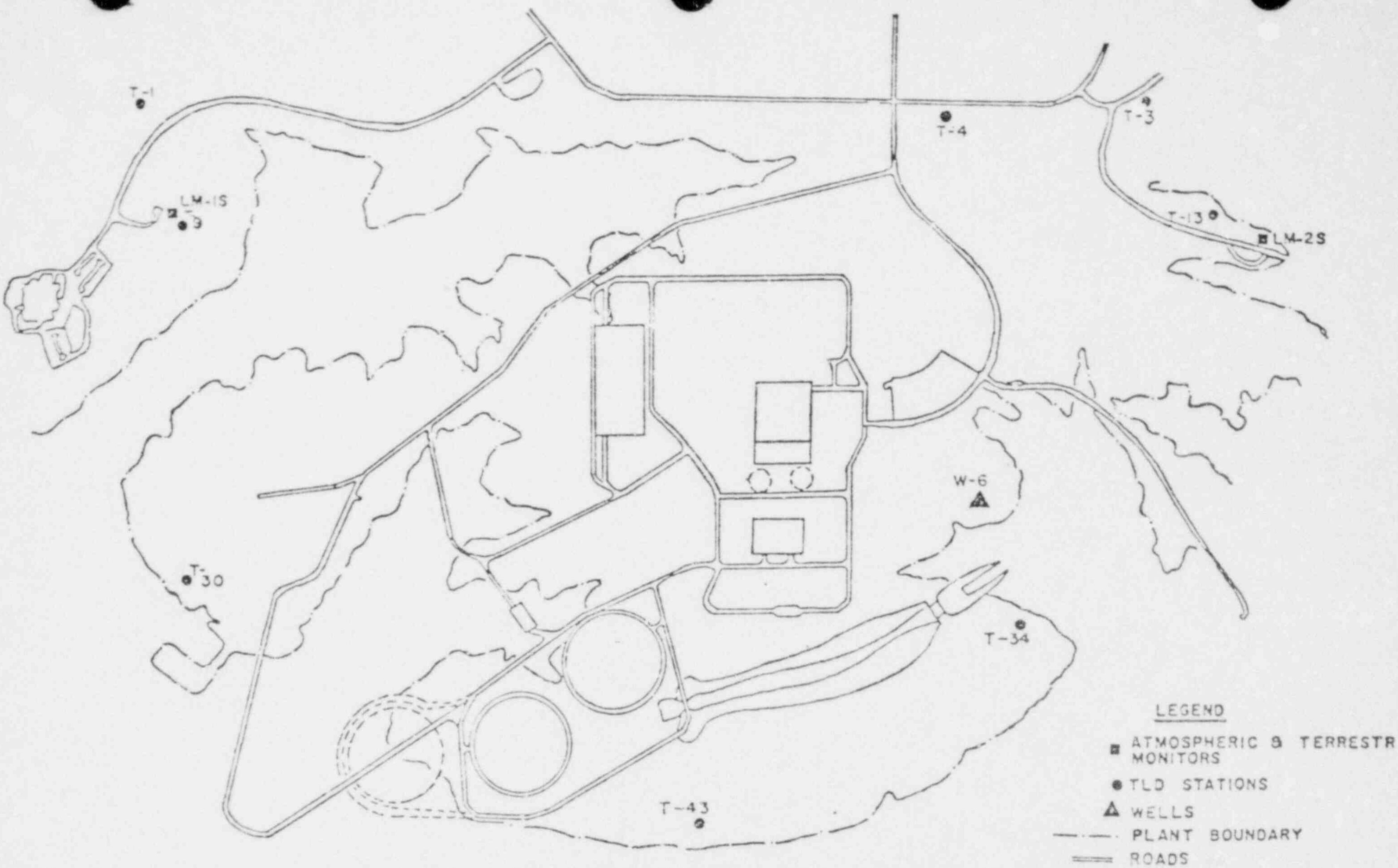
a. River mile distance from TRM 484.5 except for supplies that take water from a source other than the Tennessee River which are shown as radial distance from Sequoyah Nuclear Plant.

b. Sample collected by an automatic sequential-type water sampler with composite sample taken monthly.

Figure 3.1-1

ATMOSPHERIC AND TERRESTRIAL MONITORING NETWORK





SEQUOYAH NUCLEAR PLANT
SITE MONITORING STATIONS

Figure 3.1-2

Figure 3.1-3

LOCAL MONITORING STATIONS
SEQUOYAH NUCLEAR PLANT

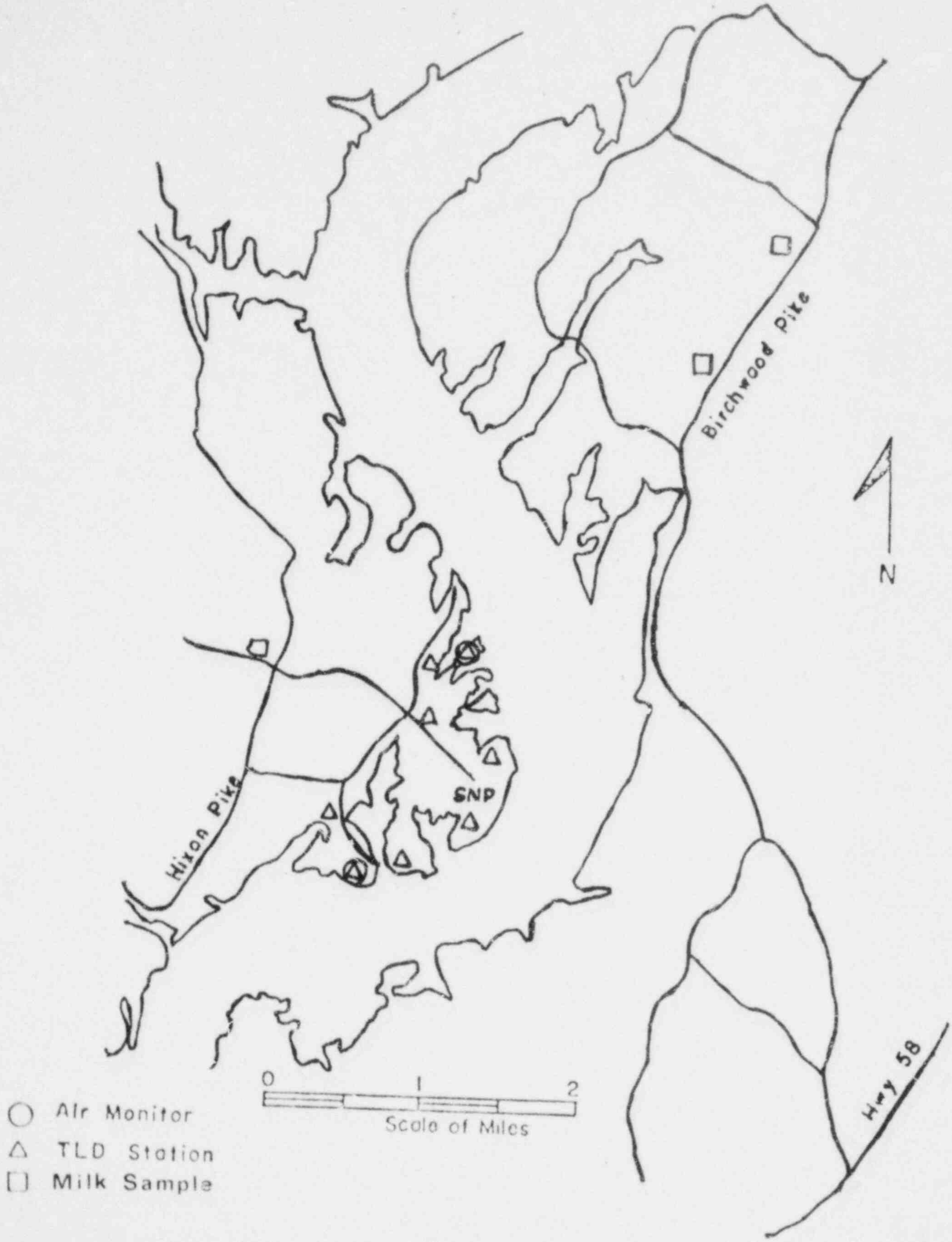


Figure 3.1-4

RESERVOIR MONITORING NETWORK
SEQUOYAH NUCLEAR PLANT

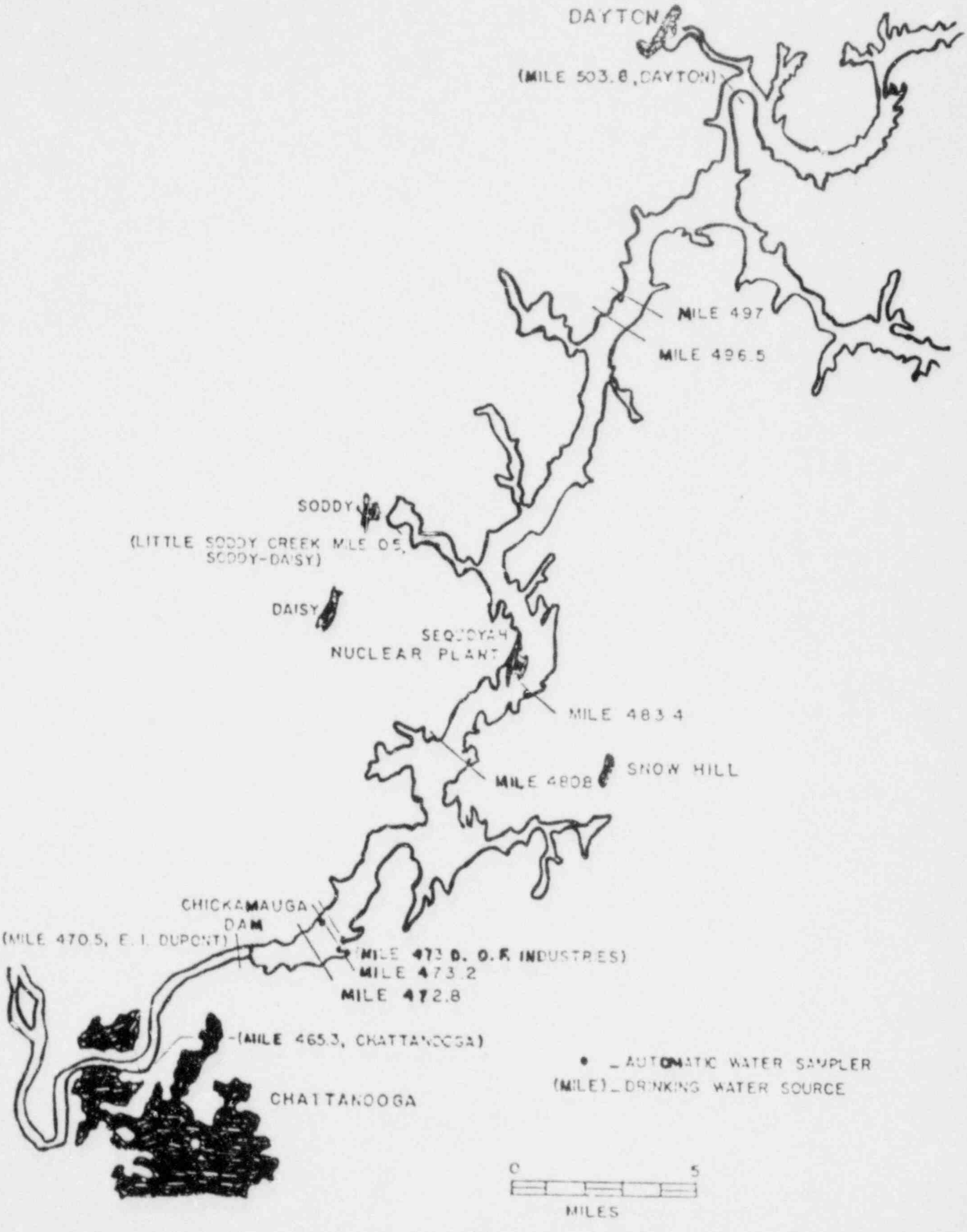


Table 3.2-1

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS

A. Specific Analyses

NOMINAL LOWER LIMIT OF DETECTION (LLD)*

	Air Particulates pCi/m^3	Charcoal pCi/m^3	Fallout mCi/km^2	Water pCi/l	Vegetation and grain pCi/g, dry	Soil and Sediment pCi/g, dry	Fish, clam flesh, plankton, pCi/g, dry	Clam shells pCi/g, dry	Foods, meat, poultry, pCi/kg, wet	Milk pCi/l
Total					0.01				1.5	
Gross	0.005		0.05	2.0	0.05	0.35	0.1	0.7		
Gross b	0.01			2.4	0.20	0.70	0.1	0.7	25	
^{3}H				330						
^{131}I		0.01								0.5
^{89}Sr	0.005			10	0.25	1.5	0.5	5.0	40	10
^{90}Sr	0.001			2	0.05	0.3	0.1	1.0	8	2

B. Gamma Analyses

NOMINAL LOWER LIMIT OF DETECTION (LLD)

	Air particulates pCi/m^3		Water and milk pCi/l		Vegetation and grain pCi/g, dry		Soil and sediment pCi/g, dry		Fish pCi/g, dry	
	NaI*	Ge(Li) **	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)
^{141,144}Ce	0.03		38		0.55		0.35		0.35	
^{144}Ce		0.02		33		0.22		0.06		0.06
^{51}Cr	0.07	0.03	60	44	1.10	0.47	0.60	0.10	0.60	0.10
^{131}I	0.01	0.01	15	5	0.35	0.09	0.20	0.02	0.20	0.02
^{103,106}Ru	0.04		40		0.65		0.45		0.45	
^{106}Ru		0.03		40		0.51		0.11		0.11
^{134}Cs	0.01	0.02	10	26	0.20	0.33	0.12	0.08	0.12	0.08
^{137}Cs	[illegible]	0.01	[illegible]	5	0.10	0.05	0.12	0.02	0.12	0.02
^{95}Zr-Nb	0.01		10		0.20		0.12		0.12	
^{95}Zr		0.01		10		0.11		0.03		0.03
^{95}Nb		0.01		5		0.05		0.01		0.01
^{58}Co	0.02	0.01	15	5	0.23	0.05	0.20	0.01	0.20	0.01
^{54}Mn	0.02	0.01	10	5	0.20	0.05	0.15	0.01	0.15	0.01
^{65}Zn	0.02	0.01	15	9	0.23	0.11	0.23	0.02	0.23	0.02
^{60}Co	0.01	0.01	10	5	0.17	0.06	0.11	0.01	0.11	0.01
^{40}K	0.10		150		2.50		[illegible]		0.90	
^{140}Ba-La	0.02		15		[illegible]		0.15		0.15	
^{140}Ba		0.02		25		0.34		0.07		0.07
^{140}La		0.01		7		0.08		0.02		0.02

	Clam Flesh and plankton pCi/g, dry		Clam shells pCi/g, dry		Foods, tomatoes potatoes, etc. pCi/kgm, wet		Meat and poultry pCi/kgm, wet	
	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)	NaI	Ge(Li)
^{141,144}Ce			0.35		35		30	
^{144}Ce		0.35		0.06		33		40
^{51}Cr		0.56	0.60	0.10	60	44	200	90
^{131}I		0.07	0.20	0.02	15	8	50	20
^{103,106}Ru			0.45		40		150	
^{106}Ru		0.74		0.11		40		90
^{134}Cs		0.48	0.12	0.08	10	26	40	50
^{137}Cs		0.08	0.12	0.02	10	5	40	15
^{95}Zr-Nb			0.12		10		40	
^{95}Zr		0.15		0.03		10		20
^{95}Nb		0.07		0.01		5		15
^{58}Co		0.07	0.20	0.01	15	[illegible]	55	15
^{54}Mn		0.08	0.15	0.01	10	[illegible]	40	15
^{65}Zn		0.17	0.23	0.02	15	4	70	20
^{60}Co		0.08	0.11	0.01	10	5	30	15
^{40}K			0.90		150		400	
^{140}Ba-La			0.15		15		50	
^{140}Ba		0.30		0.07		75		50
^{140}La		0.10		0.02		7		15

TABLE NOTATIONS

* The NaI(T1) LLD values are calculated by the method developed by Pasternak and Harley as described in HASL-300 and Nucl. Instr. Methods, 533-40 (1971). These LLD values are expected to vary depending on the activities of the components in the samples. These figures do not represent the LLD values achievable on a given sample. Water is counted in a 3.5-L Marinelli beaker. Vegetation, fish, soil, and sediment are counted in a 1-pint container as dry weight. The average dry weight is 120 grams for vegetation and 400-500 grams for soil sediment and fish. Meat and poultry are counted in a 1-pint container as dry weight, then corrected to wet weight using an average moisture content of 70%. Average dry weight is 250 grams. Air particulates are counted in a well crystal. The counting system consists of a multichannel analyzer and either a 4" x 5" well NaI(T1) crystal. The counting time is 4000 seconds. All calculations are performed by the least-squares computer program ALPHA-M. The assumption is made that the samples are analyzed within one week of the collection date.

** The Ge(Li) LLD values are calculated by the methods developed by Pasternak and Harley as described in HASL-300. These LLD values are expected to vary depending on the activities of the components in the samples. These figures do not represent the LLD values achievable on given samples. Water is counted in either a 0.5-L or 3.5-L Marinelli beaker. Solid samples such as soil, sediment, and clam shells are counted in a 0.5-L Marinelli beaker as dry weight. The average dry weight is 400-500 grams. Air filters and very small volume samples are counted in petrie dishes centered in the detector endcap. The counting system consists of a ND-4420 multichannel analyzer and either a 8%, 14%, or 18% Ge(Li) detector. The counting time is normally 8 hours. All spectral analysis is performed using the soft-water provided with the ND-4420. The assumption is made that all samples are analyzed within one week of the collection date.

a. All LLD values for isotopic separations are calculated by the method developed by Pasternak and Harley as described in HASL-300. Factors such as sample size, decay times, chemical yield, and counting efficiency may vary for a given sample; these variations may change the LLD value for the given sample. The assumption is made that all samples are analyzed within one week of the collection date.

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

TABLE NOTATION

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 lower limit of detection as defined above (as pCi 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 transformation)

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

2.22 is the number of transformation per minute per picocurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

t is the elapsed time between sample collection (or end of the sample collection period) and time of counting

The value of s_b used in the calculation of the LLD for a detection system shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicted variance.

b. The LLD values listed in this table may change slightly after routine evaluation of background, sample size, counting times, etc.. The most recently calculated values will be included in the Annual Radiological Environmental Operating Report.