OFFSITE DOSE CALCULATION MANUAL

FOR

PUBLIC SERVICE ELECTRIC AND GAS COMPANY

HOPE CREEK GENERATING STATION

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REFERENCES

The following documents are referred to by number in the text of this Manual.

1. Radiological Effluent Technical Specifications, Hope Creek Generating Station, Draft, March 1985.

2. Final Safety Analysis Report, Hope Creek Generating Station, updated through Amendment 9.

3. Applicant's Environmental Report - Operating License Stage, Hope Creek Generating Station, updated through Amendment 4.

4. U. S. Nuclear Regulatory Commission, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Regulatory Guide 1.109, Revision 1, 1977.

5. U. S. Nuclear Regulatory Commission, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Regulatory Guide 1.111, Revision 1, 1977.

6. U. S. Nuclear Regulatory Commission, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," USNRC Rept. NUREG-0133, 1978.

7. "Artificial Island Radiological Environmental Monitoring Program - 1983 Radiological Report," Public Service Electric and Gas Company, March 1984.

8. U. S. Nuclear Regulatory Commission, "Final Environmental Statement Related to the Operation of the Hope Creek Generating Station," USNRC Rept. NUREG-1074, 1984.

9. Lawrence Radiation Laboratory, "Concentration Factors of Chemical Elements in Edible Aquatic Organisms," USAEC Rept. UCRL-50564, Rev. 1, 1972.

Section 1.0
INTRODUCTION

The OFFSITE DOSE CALCULATION MANUAL is a supporting document of the RADIOLOGICAL EFFLUENT TECHNICAL SPECIFICATIONS. As such the ODCM describes the methodology and parameters to be used in the calculation of offsite doses due to radioactive liquid and gaseous effluents, and in the calculation of liquid and gaseous effluent monitoring instrumentation alarm/trip setpoints. The ODCM contains a list and graphical description of the specific sample locations for the radiological environmental monitoring program. Schematic configurations of liquid and gaseous radwaste effluent systems are also included.

The ODCM will be maintained at the plant for use as a reference guide and training document of accepted methodologies and calculations. Changes in the calculational methods or parameters will be incorporated into the ODCM in order to assure that the ODCM represents the present methodology in all applicable areas. Computer software to perform the described calculations will be maintained current with the ODCM.

Section 2.Ø
LIQUID EFFLUENTS

The Hope Creek Generating Station is located on the Delaware River which supplies service make-up water to the Cooling Tower Basin and receives water from the Cooling Tower Blowdown Line. All releases from the liquid waste management system are made to the Liquid Radwaste Discharge Line which releases into the Cooling Tower Blowdown Line for dilution prior to discharge to the Delaware River.

2.1 LIQUID EFFLUENT MONITOR SETPOINT CALCULATIONS

Technical Specification 3.3.7.1Ø states, in part:

The radioactive liquid effluent monitoring instrumentation channels shown in Table 3.3.7.1Ø-1 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Specification 3.11.1.1 are not exceeded.

The limits for radioactive liquid effluents presented below are as stated in Specification 3.11.1.1:

The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS shall be limited to the concentrations specified in 1ØCFR2Ø, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited as shown in Table 3.11-1 (of RETS). [RETS Table 3.11-1 is included as Table 2.1-1 of the ODCM.]

The two liquid effluent monitors listed in Technical Specification Table 3.3.7.1Ø-1 are the following:

RE4861 - Liquid Radwaste Discharge Line Monitor

RE8817 - Cooling Tower Blowdown Effluent Line Monitor

The methodology of this section applies to setpoints for these two montiors. The setpoints calculated according to this section are regarded as upper bounds for the actual monitor setpoints. That is, setpoint adjustments are not required to be performed if the existing setpoint level corresponds to a lower count rate than the calculated value. The actual monitor setpoint, which corresponds to the calculated concentration plus background for the specific monitor, is determined from calibration data or from operational data associated with liquid sample analysis data.

For the purpose of satisfying Technical Specification 3.3.7.10, the setpoints of each of the two station liquid effluent line monitors shall be established according to the methodology presented for each monitor below.

2.1.1 Liquid Radwaste Discharge Line Monitor - RE4861

The liquid radwaste discharge line monitor provides alarm and automatic termination of release functions prior to exceeding the concentration limits specified in 10CFR20, Appendix B, Table II, Column 2 at the release point to the unrestricted area. To meet this specification, the alarm/trip setpoints for the liquid radwaste discharge monitor and flow measurement devices are set to assure that the following equation is satisfied:

$$\frac{cf}{F+f} \leq C_{MPC} \qquad (2\text{-}1)$$

where:

C_{MPC} = the effluent concentration limit (Specification 3.11.1.1) implementing 10CFR20 for the site, corresponding to the specific mix of radionuclides in the effluent stream being considered for discharge [uCi/ml].

c = the setpoint [uCi/ml] of the radioactivity monitor measuring the radioactivity concentration in the effluent line prior to dilution and subsequent release; the setpoint represents a value which, if exceeded, would result in concentrations exceeding the limits of 10CFR20 in the unrestricted area.

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

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

2.1.1.1 Releases of Single Liquid Radwaste Streams

At the Hope Creek Generating Station, the Liquid Waste Sample Tanks, the Floor Drain Sample Tanks, the Detergent Drain Tanks, and the Condensate Storage Tanks all discharge to the Liquid Radwaste Discharge Line. The effluent in the Liquid Radwaste Discharge Line is monitored prior to discharge into the Cooling Tower Blowdown Line to the Delaware River. The Cooling Tower Blowdown Line furnishes the dilution flow (F). The waste effluent flow (f) and the monitor setpoint (c) for the Liquid Radwaste Discharge Line Monitor are determined and set to meet the conditions of equation (2-1) for a given effluent concentration, C. The method by

which this is accomplished is as follows:

Step 1) The potential liquid radwaste streams at the Hope Creek Generating Station are the following:

a) Waste Sample Tanks
b) Floor Drain Sample Tanks
c) Detergent Drain Tanks
d) Condensate Storage Tank

A sample is obtained from the tank(s) planned for discharge into the Liquid Radwaste Discharge Line.

Step 2) The radionuclide concentration for a liquid waste tank to be released is obtained from the sum of measured concentrations as determined by the analyses required in RETS Table 4.11-1:

$$\sum_i C_i = \left[\sum_g C_g + (C_a + C_s + C_f + C_t) \right]$$

where:

C_g = the concentration of each measured gamma emitter observed by gamma-ray spectroscopy of each waste sample [uCi/ml].

C_a = the concentration of alpha emitters in liquid waste as measured in the most recent QUARTERLY composite sample for the tank under consideration [uCi/ml]. (NOTE: Sample is analyzed for gross alpha.)

C_s = the measured concentrations of Sr-89 and Sr-90 in liquid waste as observed in the most recent QUARTERLY composite sample for the tank under consideration [uCi/ml].

C_f = the measured concentration of Fe-55 in liquid waste as observed in the most recent QUARTERLY composite sample for the tank under consideration [uCi/ml].

C_t = the measured concentration of H-3 in liquid waste as determined from analysis of the most recent QUARTERLY composite sample for the tank under consideration [uCi/ml].

A new C_g term will be included in the analysis of each batch. Results from the most current QUARTERLY composite will comprise values used in the terms for alpha, strontiums, iron, and tritium.

Step 3) The measured radionuclide concentrations are used to calculate a Dilution Factor, DF, which is the ratio of total dilution flow rate to tank flow rate required to assure that the limiting concentrations of 10CFR20, Appendix B, Table II, Column 2 are met at the point of discharge to the Delaware River.

$$DF = \sum_i \left(\frac{C_i}{MPC_i}\right) \div SF$$

$$= \left[\sum_g \left(\frac{C_g}{MPC_g}\right) + \left(\frac{C_a}{MPC_a} + \frac{C_s}{MPC_s} + \frac{C_f}{MPC_f} + \frac{C_t}{MPC_t}\right) \right] \div SF$$

where:

C_i = the measured concentration of C_g, C_a, C_s, C_f and C_t as defined in Step 2.

MPC= MPC_g, MPC_a, MPC_s, MPC_f, and MPC_t are limiting concentrations of the appropriate radionuclides from 10CFR20, Appendix B, Table II, Column 2. For dissolved or entrained noble gases, the concentration shall be limited to the specific MPC values presented in Table 2.1-1.

SF = the safety factor; a conservative factor used to compensate for statistical fluctuations and errors of measurements. The actual value to be used for the safety factor will be determined in implementing procedures.(For example, SF = 0.5 corresponds to a 100 percent variation.)

Step 4) The dilution flow rate setpoint for minimum dilution flow rate, F_d, is established at ninety percent of the expected dilution flow rate:

F_d =(0.9) X (Expected Cooling Tower Blowdown Line Flow Rate)

NOTE: If radioactivity from plant operations accumulates in the Cooling Tower Blowdown Basin such that measurable quantities of radionuclides are detected in the Cooling Tower Blowdown Basin, calculations of F_d must include a term to account for radioactivity present in the dilution stream prior to the introduction of the liquid waste tank effluent:

$F_d' = (F_d)$ X (1 - MPC fraction of the Cooling Tower Blowdown).

Step 5) For the case $DF \leq 1$, the liquid waste tank effluent concentration meets the limits of 10CFR20 without dilution, and effluent discharge flow rate may be assigned any desired value. For DF>1, the setpoint for the maximum permissible effluent discharge flow rate, f_e, must be calculated:

$$f_e = \frac{F_d + f_t}{DF} = \frac{F_d}{DF} \text{ for } F_d >> f_t$$

where:

f_e = maximum permissible effluent discharge flow rate (i.e., for effluent discharging through the Liquid Radwaste Discharge Line into the Cooling Tower Blowdown Line).

F_d = the dilution flow rate setpoint from Step 4.

f_t = the expected flow rate of liquid waste tank discharge. (This value will have an upper limit of the maximum discharge capacity of the particular liquid waste tank pump(s).) The maximum discharge capacities for the liquid waste tanks at HCGS are presented in Table 2.1-2.

DF = Dilution Factor from Step 3.

Step 6) The liquid radwaste effluent radiation monitor setpoint may now be determined based on the values of $\sum_i C_i$, f_e and F_d which were specified to provide compliance with the limits of 10 CFR20, Appendix B, Table II, Column 2. The monitor response is primairly to gamma radiation; therefore, the actual setpoint is based on $\sum_g C_g$. The monitor setpoint which corresponds to the particular setpoint concentration, c, is determined based on monitor calibration data or on operational data which correlates monitor response to sample analyses associated with actual effluent releases.

The setpoint concentration, c [uCi/ml], is determined as follows:

$$c = A \sum_g C_g \text{ [uCi/ml]}$$

where:

$\sum_g C_g$ = the sum of the concentrations of all measured gamma emitters as determined in Step 2.

A = Adjustment factor which will allow the setpoint to be established in a practical manner for convenience and to prevent spurious alarms. So as to alarm should an inadvertent release occur, A is not to exceed 20.

$$A = \frac{f_e}{f_t}$$ (See Note 2 below.)

where:

f_e = maximum permissible effluent discharge flow rate determined according to Step 5 above.

f_t = the expected flow rate of liquid waste tank discharge from Step 5 above.

If A $\geq$ 1, Calculate c and determine the maximum value for the actual monitor setpoint.

If A < 1, Release may not be made as planned. Re-evaluate Steps 3,4, and 5.

NOTE 1: The calculated setpoint concentration, c, establishes the base value for the monitor setpoint. However, in establishing the actual monitor setpoint for a particular monitor, background radiation levels must be considered. Normally,

the actual monitor setpoint includes the calculated setpoint value plus background. Background levels must be controlled such that radioactivity levels in the effluent stream being monitored can be accurately assessed at or below the calculated setpoint value.

NOTE 2: If DF<1, then A = (1/DF), not to exceed A = 20.

If calculated setpoint values are near actual concentrations planned for release, it may be impractical to set the monitor alarm based on this value. In this case a new setpoint may be calculated by decreasing the effluent flow, increasing the dilution flow, or by decreasing $\sum_i C_i$ by further processing of the liquid radwaste planned for release, and by following the methodology presented in Steps 3, 4, and 5.

If no discharge is planned for this pathway, the monitor setpoint should be established as close to background as practical to prevent spurious alarms and yet alarm should an inadvertent release occur.

2.1.1.2 Simultaneous Releases of Liquid Radwaste Streams

If two or more liquid waste tanks (or liquid waste streams) are to be released simultaneously, then the Liquid Radwaste Discharge Line Radiation Monitor setpoint is determined as follows:

Step A) Perform Step 3 from Section 2.1.1.1 separately for each liquid waste tank, solving the equation for DF using the values in the concentration term from the sample analyses of each liquid waste stream to be discharged simultaneously. (DF_1) = DF for Tank 1, (DF_2) = DF for Tank 2, ...

Step B) Determine DF', which is the greatest value for DF selected from DF_1, DF_2, DF_3... determined in Step A above. Use DF' in the determination of f_e in Step E below.

Step C) Determine f_s, which is the sum of the expected flow rates for all waste tanks releasing simultaneously. Use f_s in the determination of f_e in Step E below.

$$f_s = f_{t1} + f_{t2} + f_{t3}$$

Step D) Perform Step 4 of Section 2.1.1.1.

Step E) Perform Step 5 of Section 2.1.1.1, where f_t = fs as determined in Step C above; DF = DF' as determined in Step B above; and where all other terms in Step 5 are as previously defined.

NOTE: If $f_e \leq f_s$, Simultaneous releases may not be made as planned; Re-evaluate Steps A, B, C and D.

If $f_e > f_s$, Then individual tanks may be released at expected flow rates; proceed to Step F to determine the actual monitor setpoint.

Step F) Perform Step 6 of Section 2.1.1.1 to determine the monitor setpoint, where $f_t = f_s$ as determined in Step C above; and where the value for $\sum_g C_g$ is the highest value for any of the tanks releasing simultaneously.

2.1.2 Cooling Tower Blowdown Line Effluent Monitor (RE8817)

The Cooling Tower Blowdown Line is the blowdown line to the Delaware River, and it provides dilution for the liquid radwaste discharges. The radiation monitor has no control function, but serves as support (backup) for the Liquid Radwaste Discharge Line Monitor. The Cooling Tower Blowdown Line Effluent Monitor setpoint is established as follows:

$$c = (\sum_g C_g) \div DF \qquad [uCi/ml]$$

where $\sum_g C_g$ and DF have values as determined in Section 2.1.1 Step 2 and Step 3 respectively for the liquid radwaste sample tank(s) planned for release.

(For practicality, for this monitor only, if DF is determined to be < 1, DF may be set equal to 1 for the purpose of calculating the monitor setpoint.)

Table 2.1-1

MAXIMUM PERMISSIBLE CONCENTRATION OF DISSOLVED OR ENTRAINED NOBLE GASES RELEASED FROM THE SITE TO UNRESTRICTED AREAS IN LIQUID WASTE *

NUCLIDE	MPC (uCi/ml)
Kr 85m	2E-4
Kr 85	5E-4
Kr 87	4E-5
Kr 88	9E-5
Ar 41	7E-5
Xe 133m	5E-4
Xe 133	6E-4
Xe 135m	2E-4
Xe 135	2E-4

* -- From Table 3.11-1 of Reference 1.

Table 2.1-2
MAXIMUM DISCHARGE CAPACITY OF LIQUID RADWASTE STREAMS
FOR THE HOPE CREEK GENERATING STATION

Liquid Radwaste Stream	Maximum Discharge Capacity Flow Rate (GPM)
1. Waste Sample Tanks	176 *
2. Floor Drain Sample Tanks	176 *
3. Detergent Drain Tanks	25 *
4. Condensate Storage Tanks	1300 +

* -- Section 11.2.3, Ref. 2.

+ -- Chapter 9, Ref. 2.

2.2 LIQUID EFFLUENT DOSE CALCULATIONS

Technical Specification 3.11.1.2 states, in part:

The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each reactor unit, to UNRESTRICTED AREAS shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrems to the total body and to less than or equal to 5 mrems to any organ, and

b. During any calendar year to less than or equal to 3 mrems to the total body and to less than or equal to 10 mrems to any organ.

There is no potable water pathway for liquids from HCGS. Thus, for liquid dose calculations, only the fish and invertebrate consumption pathways are applicable (Ref. 2, Section 11.2.4). The methodology by which dose computations shall be performed for the purpose of demonstrating compliance with this Technical Specification is presented below.

The dose contribution to an exposed individual by way of fish and invertebrate consumption from all radionuclides identified in liquid effluents released to unrestricted areas is calculated using the following expression:

$$D_t = \sum_i A_{it} \sum_{l=1}^{m} [\Delta t_l \; C_{il} \; F_l]$$

where:

D_t = the cumulative dose commitment to the total body or any organ t, due to radioactivity in liquid effluents for the total time period $\sum_{l=1}^{m} \Delta t_l$, [mrem] (Ref. 6, Section 4.3).

Δt_l = the length of the lth time period over which C_{il} and F_l are averaged for all liquid releases, [hours].

C_{il} = the average concentration of radionuclide i, in undiluted liquid effluent during time period Δt_l from any liquid release [uCi/ml].

F_l = the near field average dilution factor for C_{il} during any liquid effluent release [unitless]. Defined as the ratio of the undiluted liquid waste flow during release to the product of the average flow from the discharge structure to unrestricted receiving water times Z.

$$F_l = \frac{\text{(average undiluted liquid waste flow)}}{\text{(average flow from the discharge structure during periods of radioactive materials release)} * (Z)}$$

NOTE: The denominator is limited to 1000 cfs (448,000 gpm) or less. (Ref. 6, Section 4.3)

NOTE: If radioactivity in the Cooling Tower Blowdown Line becomes > LLD, prior to the junction with the Liquid Radwaste Effluent Line, that concentration must be included in the dose determination. For this part of the dose calculation, $F_l = 1/Z$ and Δt_l = the entire time period for which the dose is being calculated.

Z = 10, which is the applicable dilution factor for the receiving water body at the Hope Creek Generating Station, (Ref. 2, Chapter 11).

A_{it} = the site related fish and invertebrate consumption dose commitment factor to the total body or any organ t for each identified principal gamma and beta emitter listed in Table 2.2-1 [mrem/hr per uCi/ml].

$$A_{it} = K_o\left[(U_F * BF_i) + (U_I * BI_i)\right] DF_i$$

where

K_o = Units conversion factor, 1.14 E+5

$$= 1\ E{+}6\ \frac{pCi}{uCi} * 1\ E{+}3\ \frac{ml}{l} \div 8760\ \frac{hr}{yr}$$

U_F = Adult fish consumption (21 kg/yr).

BF_i = Bioaccumulation factor for radionuclide i, in fish, [pCi/kg per pCi/l], from Table 2.2-2. The more conservative of salt and fresh water values for radionuclide i is incorporated into Table 2.2-2 for use in the liquid dose calculations (Ref. 4, Table A-1).

U_I = Adult invertebrate consumption (5 kg/yr).

BI_i = Bioaccumulation factor for radionuclide i, in invertebrates [pCi/kg per pCi/l], from Table 2.2-2. The more conservative of salt and fresh water values for radionuclide i is incorporated into Table 2.2-2 for use in the liquid dose calculations (Ref. 4, Table A-1).

DF_i = Dose conversion factor for radionuclide i, for adults in preselected organ t [mrem/pCi] from Table 2.2-3 (Ref. 4, Table E-11).

Table 2.2-1
SITE RELATED INGESTION DOSE COMMITMENT FACTOR, A_{it}
(FISH AND INVERTEBRATE CONSUMPTION)
(mrem/hr per uCi/ml)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E+00	2.82E-01	2.82E-01	2.82E-01	2.82E-01	2.82E-01	2.82E-01
C-14	4.60E+04	9.20E+03	9.20E+03	9.20E+03	9.20E+03	9.20E+03	9.20E+03
Na-24	6.01E+02	6.01E+02	6.01E+02	6.01E+02	6.01E+02	6.01E+02	6.01E+02
P-32	4.95E+07	3.08E+06	1.91E+06	0.00E+00	0.00E+00	0.00E+00	5.57E+06
Cr-51	0.00E+00	0.00E+00	5.58E+00	3.34E+00	1.23E+00	7.40E+00	1.40E+03
Mn-54	0.00E+00	2.40E+05	4.59E+04	0.00E+00	7.16E+04	0.00E+00	7.37E+05
Mn-56	0.00E+00	6.05E+03	1.07E+03	0.00E+00	7.68E+03	0.00E+00	1.93E+05
Fe-55	5.11E+04	3.53E+04	8.23E+03	0.00E+00	0.00E+00	1.97E+04	2.03E+04
Fe-59	8.06E+04	1.90E+05	7.27E+04	0.00E+00	0.00E+00	5.30E+04	6.32E+05
Co-58	0.00E+00	6.03E+02	1.35E+03	0.00E+00	0.00E+00	0.00E+00	1.22E+04
Co-60	0.00E+00	1.73E+03	3.82E+03	0.00E+00	0.00E+00	0.00E+00	3.25E+04
Ni-63	4.96E+04	3.44E+03	1.67E+03	0.00E+00	0.00E+00	0.00E+00	7.18E+02
Ni-65	2.02E+02	2.62E+01	1.20E+01	0.00E+00	0.00E+00	0.00E+00	6.65E+02
Cu-64	0.00E+00	2.14E+02	1.01E+02	0.00E+00	5.40E+02	0.00E+00	1.83E+04
Zn-65	1.61E+05	5.13E+05	2.32E+05	0.00E+00	3.43E+05	0.00E+00	3.23E+05
Zn-69	3.43E+02	6.56E+02	4.56E+01	0.00E+00	4.26E+02	0.00E+00	9.85E+01
Br-83	0.00E+00	0.00E+00	4.80E+01	0.00E+00	0.00E+00	0.00E+00	6.91E+01
Br-84	0.00E+00	0.00E+00	6.22E+01	0.00E+00	0.00E+00	0.00E+00	4.88E-04
Br-85	0.00E+00	0.00E+00	2.55E+00	0.00E+00	0.00E+00	0.00E+00	1.19E-15
Rb-86	0.00E+00	1.13E+05	5.27E+04	0.00E+00	0.00E+00	0.00E+00	2.23E+04
Rb-88	0.00E+00	3.24E+02	1.72E+02	0.00E+00	0.00E+00	0.00E+00	4.48E-09
Rb-89	0.00E+00	2.15E+02	1.51E+02	0.00E+00	0.00E+00	0.00E+00	1.25E-11
Sr-89	3.97E+04	0.00E+00	1.14E+03	0.00E+00	0.00E+00	0.00E+00	6.36E+03
Sr-90	9.76E+05	0.00E+00	2.40E+05	0.00E+00	0.00E+00	0.00E+00	2.82E+04
Sr-91	7.30E+02	0.00E+00	2.95E+01	0.00E+00	0.00E+00	0.00E+00	3.48E+03
Sr-92	2.77E+02	0.00E+00	1.20E+01	0.00E+00	0.00E+00	0.00E+00	5.49E+03
Y-90	6.06E+00	0.00E+00	1.63E-01	0.00E+00	0.00E+00	0.00E+00	6.42E+04
Y-91m	5.73E-02	0.00E+00	2.22E-03	0.00E+00	0.00E+00	0.00E+00	1.68E-01
Y-91	8.88E+01	0.00E+00	2.37E+00	0.00E+00	0.00E+00	0.00E+00	4.89E+04
Y-92	5.32E-01	0.00E+00	1.56E-02	0.00E+00	0.00E+00	0.00E+00	9.32E+03
Y-93	1.69E+00	0.00E+00	4.66E-02	0.00E+00	0.00E+00	0.00E+00	5.35E+04
Zr-95	1.59E+01	5.11E+00	3.46E+00	0.00E+00	8.02E+00	0.00E+00	1.62E+04
Zr-97	8.81E-01	1.78E-01	8.13E-02	0.00E+00	2.68E-01	0.00E+00	5.51E+04
Nb-95	4.47E+02	2.49E+02	1.34E+02	0.00E+00	2.46E+02	0.00E+00	1.51E+06
Mo-99	0.00E+00	1.28E+02	2.43E+01	0.00E+00	2.89E+02	0.00E+00	2.96E+02
Tc-99m	1.59E-02	4.50E-02	5.73E-01	0.00E+00	6.83E-01	2.20E-02	2.66E+01
Tc-101	1.64E-02	2.36E-02	2.31E-01	0.00E+00	4.24E-01	1.20E-02	7.09E-14
Ru-103	1.10E+02	0.00E+00	4.73E+01	0.00E+00	4.19E+02	0.00E+00	1.28E+04
Ru-105	9.15E+00	0.00E+00	3.61E+00	0.00E+00	1.18E+02	0.00E+00	5.59E+03

Table 2.2-1
SITE RELATED INGESTION DOSE COMMITMENT FACTOR, A_{it}
(FISH AND INVERTEBRATE CONSUMPTION)
(mrem/hr per uCi/ml)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
Ru-106	1.63E+03	0.00E+00	2.07E+02	0.00E+00	3.15E+03	0.00E+00	1.06E+05
Ag-110m	1.56E+03	1.45E+03	8.60E+02	0.00E+00	2.85E+03	0.00E+00	5.91E+05
Te-125m	1.19E+04	4.31E+03	1.59E+03	3.57E+03	4.83E+04	0.00E+00	4.75E+04
Te-127m	3.00E+04	1.07E+04	3.66E+03	7.67E+03	1.22E+05	0.00E+00	1.01E+05
Te-127	4.88E+02	1.75E+02	1.06E+02	3.61E+02	1.99E+03	0.00E+00	3.85E+04
Te-129m	5.10E+04	1.90E+04	8.07E+03	1.75E+04	2.13E+05	0.00E+00	2.57E+05
Te-129	1.39E+02	5.23E+01	3.39E+01	1.07E+02	5.85E+02	0.00E+00	1.05E+02
Te-131m	7.67E+03	3.75E+03	3.13E+03	5.94E+03	3.80E+04	0.00E+00	3.73E+05
Te-131	8.74E+01	3.65E+01	2.76E+01	7.18E+01	3.83E+02	0.00E+00	1.24E+01
Te-132	1.12E+04	7.23E+03	6.78E+03	7.98E+03	6.96E+04	0.00E+00	3.42E+05
I-130	4.87E+01	1.44E+02	5.67E+01	1.22E+04	2.24E+02	0.00E+00	1.24E+02
I-131	2.68E+02	3.83E+02	2.20E+02	1.26E+05	6.57E+02	0.00E+00	1.01E+02
I-132	1.31E+01	3.50E+01	1.22E+01	1.22E+03	5.57E+01	0.00E+00	6.57E+00
I-133	9.15E+01	1.59E+02	4.85E+01	2.34E+04	2.78E+02	0.00E+00	1.43E+02
I-134	6.83E+00	1.86E+01	6.63E+00	3.21E+02	2.95E+01	0.00E+00	1.62E-02
I-135	2.85E+01	7.47E+01	2.76E+01	4.93E+03	1.20E+02	0.00E+00	8.44E+01
Cs-134	3.33E+05	7.93E+05	6.48E+05	0.00E+00	2.57E+05	8.52E+04	1.39E+04
Cs-136	3.49E+04	1.38E+05	9.91E+04	0.00E+00	7.66E+04	1.05E+04	1.56E+04
Cs-137	4.27E+05	5.84E+05	3.83E+05	0.00E+00	1.98E+05	6.59E+04	1.13E+04
Cs-138	2.96E+02	5.84E+02	2.89E+02	0.00E+00	4.29E+02	4.24E+01	2.49E-03
Ba-139	1.34E+01	9.53E-03	3.92E-01	0.00E+00	8.91E-03	5.41E-03	2.37E+01
Ba-140	2.80E+03	3.52E+00	1.83E+02	0.00E+00	1.20E+00	2.01E+00	5.77E+03
Ba-141	6.50E+00	4.91E-03	2.19E-01	0.00E+00	4.57E-03	2.79E-03	3.06E-09
Ba-142	2.94E+00	3.02E-03	1.85E-01	0.00E+00	2.55E-03	1.71E-03	4.14E-18
La-140	1.57E+00	7.94E-01	2.10E-01	0.00E+00	0.00E+00	0.00E+00	5.83E+04
La-142	8.06E-02	3.67E-02	9.13E-03	0.00E+00	0.00E+00	0.00E+00	2.68E+02
Ce-141	5.56E+00	3.76E+00	4.26E-01	0.00E+00	1.75E+00	0.00E+00	1.44E+04
Ce-143	9.80E-01	7.25E+02	8.02E-02	0.00E+00	3.19E-01	0.00E+00	2.71E+04
Ce-144	2.90E+02	1.21E+02	1.56E+01	0.00E+00	7.19E+01	0.00E+00	9.80E+04
Pr-143	5.79E+00	2.32E+00	2.87E-01	0.00E+00	1.34E+00	0.00E+00	2.54E+04
Pr-144	1.90E-02	7.87E-03	9.64E-04	0.00E+00	4.44E-03	0.00E+00	2.73E-09
Nd-147	3.96E+00	4.58E+00	2.74E-01	0.00E+00	2.68E+00	0.00E+00	2.20E+04
W-187	2.98E+02	2.49E+02	8.70E+01	0.00E+00	0.00E+00	0.00E+00	8.15E+04
Np-239	3.00E-01	2.95E-02	1.63E-02	0.00E+00	9.20E-02	0.00E+00	6.05E+03

Table 2.2-2
BIOACCUMULATION FACTORS
(pCi/kg per pCi/liter)*

ELEMENT	FISH	INVERTEBRATES
H	9.0E-01	9.3E-01
C	4.6E+03	9.1E+03
NA	1.0E+02	2.0E+02
P	1.0E+05	3.0E+04
CR	4.0E+02	2.0E+03
MN	5.5E+02	9.0E+04
FE	3.0E+03	2.0E+04
CO	1.0E+02	1.0E+03
NI	1.0E+02	2.5E+02
CU	6.7E+02	1.7E+03
ZN	2.0E+03	5.0E+04
BR	4.2E+02	3.3E+02
RB	2.0E+03	1.0E+03
SR	3.0E+01	1.0E+02
Y	2.5E+01	1.0E+03
ZR	2.0E+02	8.0E+01
NB	3.0E+04	1.0E+02
MO	1.0E+01	1.0E+01
TC	1.5E+01	5.0E+01
RU	1.0E+01	1.0E+03
RH	1.0E+01	2.0E+03
AG**	3.3E+03	3.3E+03
TE	4.0E+02	6.1E+03
I	1.5E+01	5.0E+01
CS	2.0E+03	1.0E+03
BA	1.0E+01	2.0E+02
LA	2.5E+01	1.0E+03
CE	1.0E+01	1.0E+03
PR	2.5E+01	1.0E+03
ND	2.5E+01	1.0E+03
W	1.2E+03	3.0E+01
NP	1.0E+01	4.0E+02

* -- Values in Table 2.2-2 are taken from Ref. 4, Table A-1, except as noted below. The more conservative of salt and fresh water values have been included in Table 2.2-2 for the purpose of liquid dose calculations.

**-- Values for Ag are taken from Reference 9.

Table 2.2-3

ADULT INGESTION DOSE FACTORS*
(mrem/pCi ingested)

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NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	NO DATA	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07
C 14	2.84E-06	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07
NA 24	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06
P 32	1.93E-04	1.20E-05	7.46E-06	NO DATA	NO DATA	NO DATA	2.17E-05
CR 51	NO DATA	NO DATA	2.66E-09	1.59E-09	5.86E-10	3.53E-09	6.69E-07
MN 54	NO DATA	4.57E-06	8.72E-07	NO DATA	1.36E-06	NO DATA	1.40E-05
MN 56	NO DATA	1.15E-07	2.04E-08	NO DATA	1.46E-07	NO DATA	3.67E-06
FE 55	2.75E-06	1.90E-06	4.43E-07	NO DATA	NO DATA	1.06E-06	1.09E-06
FE 59	4.34E-06	1.02E-05	3.91E-06	NO DATA	NO DATA	2.85E-06	3.40E-05
CO 58	NO DATA	7.45E-07	1.67E-06	NO DATA	NO DATA	NO DATA	1.51E-05
CO 60	NO DATA	2.14E-06	4.72E-06	NO DATA	NO DATA	NO DATA	4.02E-05
NI 63	1.30E-04	9.01E-06	4.36E-06	NO DATA	NO DATA	NO DATA	1.88E-06
NI 65	5.28E-07	6.86E-08	3.13E-08	NO DATA	NO DATA	NO DATA	1.74E-06
CU 64	NO DATA	8.33E-08	3.91E-08	NO DATA	2.10E-07	NO DATA	7.10E-06
ZN 65	4.84E-06	1.54E-05	6.96E-06	NO DATA	1.03E-05	NO DATA	9.70E-06
ZN 69	1.03E-08	1.97E-08	1.37E-09	NO DATA	1.28E-08	NO DATA	2.96E-09
BR 83	NO DATA	NO DATA	4.02E-08	NO DATA	NO DATA	NO DATA	5.79E-08
BR 84	NO DATA	NO DATA	5.21E-08	NO DATA	NO DATA	NO DATA	4.09E-13
BR 85	NO DATA	NO DATA	2.14E-09	NO DATA	NO DATA	NO DATA	LT E-24
RB 86	NO DATA	2.11E-05	9.83E-06	NO DATA	NO DATA	NO DATA	4.16E-06
RB 88	NO DATA	6.05E-08	3.21E-08	NO DATA	NO DATA	NO DATA	8.36E-19
RB 89	NO DATA	4.01E-08	2.82E-08	NO DATA	NO DATA	NO DATA	2.33E-21
SR 89	3.08E-04	NO DATA	8.84E-06	NO DATA	NO DATA	NO DATA	4.94E-05
SR 90	7.58E-03	NO DATA	1.86E-03	NO DATA	NO DATA	NO DATA	2.19E-04
SR 91	5.67E-06	NO DATA	2.29E-07	NO DATA	NO DATA	NO DATA	2.70E-05
SR 92	2.15E-06	NO DATA	9.30E-08	NO DATA	NO DATA	NO DATA	4.26E-05
Y 90	9.62E-09	NO DATA	2.58E-10	NO DATA	NO DATA	NO DATA	1.02E-04
Y 91M	9.09E-11	NO DATA	3.52E-12	NO DATA	NO DATA	NO DATA	2.67E-10
Y 91	1.41E-07	NO DATA	3.77E-09	NO DATA	NO DATA	NO DATA	7.76E-05
Y 92	8.45E-10	NO DATA	2.47E-11	NO DATA	NO DATA	NO DATA	1.48E-05
Y 93	2.68E-09	NO DATA	7.40E-11	NO DATA	NO DATA	NO DATA	8.50E-05
ZR 95	3.04E-08	9.75E-09	6.60E-09	NO DATA	1.53E-08	NO DATA	3.09E-05
ZR 97	1.68E-09	3.39E-10	1.55E-10	NO DATA	5.12E-10	NO DATA	1.05E-04
NB 95	6.22E-09	3.46E-09	1.86E-09	NO DATA	3.42E-09	NO DATA	2.10E-05
MO 99	NO DATA	4.31E-06	8.20E-07	NO DATA	9.76E-06	NO DATA	9.99E-06
TC 99M	2.47E-10	6.98E-10	8.89E-09	NO DATA	1.06E-08	3.42E-10	4.13E-07

* Values in Table 2.2-3 are taken from Ref. 4, Table E-11.

Table 2.2-3

ADULT INGESTION DOSE FACTORS*
(mrem/pCi ingested)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
TC101	2.54E-10	3.66E-10	3.59E-09	NO DATA	6.59E-09	1.87E-10	1.10E-21
RU103	1.85E-07	NO DATA	7.97E-08	NO DATA	7.06E-07	NO DATA	2.16E-05
RU105	1.54E-08	NU DATA	6.08E-09	NO DATA	1.99E-07	NO DATA	9.42E-06
RU106	2.75E-06	NO DATA	3.48E-07	NO DATA	5.31E-06	NO DATA	1.78E-04
AG110M	1.60E-07	1.48E-07	8.79E-08	NO DATA	2.91E-07	NO DATA	6.04E-05
TE125M	2.68E-06	9.71E-07	3.59E-07	8.06E-07	1.09E-05	NO DATA	1.07E-05
TE127M	6.77E-06	2.42E-06	8.25E-07	1.73E-06	2.75E-05	NO DATA	2.27E-05
TE127	1.10E-07	3.95E-08	2.38E-08	8.15E-08	4.48E-07	NO DATA	8.68E-06
TE129M	1.15E-05	4.29E-06	1.82E-06	3.95E-06	4.80E-05	NO DATA	5.79E-05
TE129	3.14E-08	1.18E-08	7.65E-09	2.41E-08	1.32E-07	NO DATA	2.37E-08
TE131M	1.73E-06	8.46E-07	7.05E-07	1.34E-06	8.57E-06	NO DATA	8.40E-05
TE131	1.97E-08	8.23E-09	6.22E-09	1.62E-08	8.63E-08	NO DATA	2.79E-09
TE132	2.52E-06	1.63E-06	1.53E-06	1.80E-06	1.57E-05	NO DATA	7.71E-05
I 130	7.56E-07	2.23E-06	8.80E-07	1.89E-04	3.48E-06	NO DATA	1.92E-06
I 131	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	NO DATA	1.57E-06
I 132	2.03E-07	5.43E-07	1.90E-07	1.90E-05	8.65E-07	NO DATA	1.02E-07
I 133	1.42E-06	2.47E-06	7.53E-07	3.63E-04	4.31E-06	NO DATA	2.22E-06
I 134	1.06E-07	2.88E-07	1.03E-07	4.99E-06	4.58E-07	NO DATA	2.51E-10
I 135	4.43E-07	1.16E-06	4.28E-07	7.65E-05	1.86E-06	NO DATA	1.31E-06
CS134	6.22E-05	1.48E-04	1.21E-04	NO DATA	4.79E-05	1.59E-05	2.59E-06
CS136	6.51E-06	2.57E-05	1.85E-05	NO DATA	1.43E-05	1.96E-06	2.92E-06
CS137	7.97E-05	1.09E-04	7.14E-05	NO DATA	3.70E-05	1.23E-05	2.11E-06
CS138	5.52E-08	1.09E-07	5.40E-08	NO DATA	8.01E-08	7.91E-09	4.65E-13
BA139	9.70E-08	6.91E-11	2.84E-09	NO DATA	6.46E-11	3.92E-11	1.72E-07
BA140	2.03E-05	2.55E-08	1.33E-06	NO DATA	8.67E-09	1.46E-08	4.18E-05
BA141	4.71E-08	3.56E-11	1.59E-09	NO DATA	3.31E-11	2.02E-11	2.22E-17
BA142	2.13E-08	2.19E-11	1.34E-09	NO DATA	1.85E-11	1.24E-11	3.00E-26
LA140	2.50E-09	1.26E-09	3.33E-10	NO DATA	NO DATA	NO DATA	9.25E-05
LA142	1.28E-10	5.82E-11	1.45E-11	NO DATA	NO DATA	NO DATA	4.25E-07
CE141	9.36E-09	6.33E-09	7.18E-10	NO DATA	2.94E-09	NO DATA	2.42E-05
CE143	1.65E-09	1.22E-06	1.35E-10	NO DATA	5.37E-10	NO DATA	4.56E-05
CE144	4.88E-07	2.04E-07	2.62E-08	NO DATA	1.21E-07	NO DATA	1.65E-04
PR143	9.20E-09	3.69E-09	4.56E-10	NO DATA	2.13E-09	NO DATA	4.03E-05
PR144	3.01E-11	1.25E-11	1.53E-12	NO DATA	7.05E-12	NO DATA	4.33E-18
ND147	6.29E-09	7.27E-09	4.35E-10	NO DATA	4.25E-09	NO DATA	3.49E-05
W 187	1.03E-07	8.61E-08	3.01E-08	NO DATA	NO DATA	NO DATA	2.82E-05
NP239	1.19E-09	1.17E-10	6.45E-11	NO DATA	3.65E-10	NO DATA	2.40E-05

* Values in Table 2.2-3 are taken from Ref. 4, Table E-11.

2.3 DEFINITIONS OF LIQUID EFFLUENT TERMS

Term		Definition	Section of Initial Use
A	=	Adjustment factor which will allow the setpoint to be established in a practical manner for convenience and to prevent spurious alarms.	(2.1.1.1)
A_{it}	=	the site related fish and invertebrate consumption dose commitment factor to the total body or any organ t for each identified principal gamma and beta emitter listed in Table 2.2-1 [mrem/hr per uCi/ml].	(2.2)
BF_i	=	Bioaccumulation factor for radionuclide i, in fish [pCi/kg per pCi/l] from Table 2.2-2.	(2.2)
BI_i	=	Bioaccumulation factor for radionuclide i, in invertebrates [pCi/kg per pCi/l] from Table 2.2-2.	(2.2)
c	=	the setpoint [uCi/ml] of the radioactivity monitor measuring the radioactivity concentration in the effluent line prior to dilution and subsequent release.	(2.1.1)
C_a	=	the concentration of alpha emitters in liquid waste as measured in the most recent QUARTERLY composite sample for the tank under consideration [uCi/ml].	(2.1.1.1)

Term		Definition	Section of Initial Use
C_f	=	the measured concentration of Fe-55 in liquid waste as observed in the most recent QUARTERLY composite sample for the tank under consideration [uCi/ml].	(2.1.1.1)
C_g	=	the concentration of each measured gamma emitter observed by gamma-ray spectroscopy of each waste sample [uCi/ml].	(2.1.1.1)
C_i	=	the measured concentration of C_g, C_a, C_s, C_f and C_t.	(2.1.1.1)
C_{il}	=	the average concentration of radionuclide i, in undiluted liquid effluent during time Δt_l from any liquid release, [uCi/ml].	(2.2)
C_{MPC}	=	the effluent concentration limit (Specification 3.11.1.1) implementing 10CFR20 for the site, corresponding to the specific mix of radionuclides in the effluent stream being considered for discharge [uCi/ml].	(2.1.1.1)
C_s	=	the measured concentrations of Sr-89 and Sr-90 in liquid waste as observed in the most recent QUARTERLY composite sample for the tank under consideration [uCi/ml].	(2.1.1.1)
C_t	=	the measured concentration of H-3 in liquid waste as determined from analysis of the most recent QUARTERLY composite sample for the tank under consideration [uCi/ml].	(2.1.1.1)

Term	Definition	Section of Initial Use
DF =	dilution factor; ratio of total dilution flow rate to tank flow rate required to assure that the limiting concentrations of 10CFR20, Appendix B, Table II, Column 2 are met at the point of discharge to the Delaware River.	(2.1.1.1)
DF' =	the greatest value for DF from DF_1, DF_2, DF_3 ..., used in the determination of the monitor setpoint when liquid radwaste tanks are releasing simultaneously.	(2.1.1.2)
DF_i =	Dose conversion factor for radionuclide i, for adults in preselected organ t [mrem/pCi] from Table 2.2-3.	(2.2)
D_t =	the cumulative dose commitment to the total body or any organ t, due to radioactivity in liquid effluents for the total time period $\sum_{l=1}^{m} \Delta t_l$, [mrem].	(2.2)
f =	the flow setpoint as determined at the radiation monitor location, in volume per unit time, but in the same units as F, below.	(2.1.1)
F =	the dilution water flow setpoint as determined prior to the release point, in volume per unit time.	(2.1.1)
F_d =	the setpoint for minimum dilution flowrate	(2.1.1.1)

Term		Definition	Section of Initial Use
F_{d}'	=	the setpoint for minimum dilution flowrate, considering the buildup of radioactivity from plant operations in the Cooling Tower Blowdown Basin.	(2.1.1.1)
f_e	=	maximum permissible effluent discharge flow rate.	(2.1.1.1)
F_l	=	the near field average dilution factor during any liquid effluent release [unitless].	(2.2)
f_s	=	the sum of the expected flow rates for all waste tanks releasing simultaneously.	(2.1.1.2)
f_t	=	the expected flow rate of liquid waste tank discharge. The maximum discharge capacities for the liquid waste tanks at HCGS are presented in Table 2.1-2.	(2.1.1.1)
K_o	=	Units conversion factor, 1.14 E+5	(2.2)
MPC	=	MPC_g, MPC_a, MPC_s, MPC_f, and MPC_t are limiting concentrations of the appropriate radionuclides from 10CFR20, Appendix B, Table II, Column 2. For dissolved or entrained noble gases, the concentration shall be limited to the specific MPC values presented in Table 2.1-1.	(2.1.1.1)

Term		Definition	Section of Initial Use
SF	=	the safety factor; a conservative factor used to compensate for statistical fluctuations and errors of measurements.	(2.1.1.1)
Δt_l	=	the length of the lth time period over which C_{il} and Fl are averaged for all liquid releases, [hours].	(2.2)
U_F	=	Adult fish consumption (21 kg/yr).	(2.2)
U_I	=	Adult invertebrate consumption (5 kg/yr).	(2.2)
Z	=	10, which is the applicable dilution factor for the receiving water body at the Hope Creek Generating Station.	(2.2)

Section 3.0
ROUTINE GASEOUS EFFLUENTS

3.1 GASEOUS EFFLUENT MONITOR SETPOINT CALCULATIONS

Technical Specification 3.3.7.11 states, in part:

The radioactive gaseous effluent monitoring instrumentation channels shown in Table 3.3.7.11-1 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Specification 3.11.2.1 are not exceeded.

Since, according to Section 5.1.1 of Ref. 6, "It is not considered practicable to apply instantaneous alarm/trip setpoints to integrating radiation monitors sensitive to radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases," only noble gas monitor setpoints need be specified by the ODCM.

The noble gas limits established by Specification 3.11.2.1 are quoted below in Section 3.2.1; they are instantaneous dose rates of 500 mrem/yr to the total body, and 3000 mrem/yr to the skin at any point outside the Site Boundary. The three noble gas effluent monitors listed in Technical Specification Table 3.3.7.11-1 are the following:

RE4811A - the Filtration, Recirculation, and Ventilation System noble gas monitor
RE4814A - the South Plant Vent noble gas monitor
RE4875A - the North Plant Vent noble gas monitor

The methodology of this Section applies to setpoints for these three monitors. The setpoints calculated according to this Section are regarded as upper bounds for the actual

monitor setpoints. That is, setpoint adjustments are not required to be performed if the existing setpoint level corresponds to a lower count rate than the new calculated value. If no radioactive discharge is planned for a given release point, the monitor setpoint for that release point should be established as close to background as practical to prevent spurious alarms, and yet alarm should an inadvertant release occur.

Two methods are given. The first (Section 3.1.1) is the method which is used normally. The second (Section 3.1.2) is used during startups when the concentrations of all plant-generated noble gases in the most recent sample for a given release point are all undetectable. Setpoints calculated by the two methods may be used on different monitors simultaneously; only those release points for which the most recent sample yielded no detectable plant-generated noble gases will have their monitor setpoint established according to Section 3.1.2.

3.1.1 Normal Setpoint Method

The following method applies to the normal circumstance that one or more plant-generated noble gases in the most recent sample for a given release point are detectable. In this case, for the purpose of satisfying Technical Specification 3.3.7.11, the setpoints of each of the three station vent monitors are established as follows:

S_v = the lower of S_{vt} or S_{vs}, where

$$S_{vt} = \frac{500 \quad a_v \quad SF \quad \sum_i X_{iv}}{F_v \quad (\overline{X/Q}) \quad \sum_i [K_i \quad X_{iv}]}$$

$$S_{vs} = \frac{3000 \quad a_v \quad SF \quad \sum_i X_{iv}}{F_v \quad (\overline{X/Q}) \quad \sum_i [(L_i + 1.1\ M_i) \quad X_{iv}]}$$

and where:

S_{vt} = the candidate setpoint for vent v, based upon the total body dose rate limit of 500 mrem/yr [uCi/cc].

S_{vs} = the candidate setpoint for vent v, based upon the skin dose rate limit of 3000 mrem/yr [uCi/cc].

500 = the whole body dose rate limit [mrem/yr].

3000 = the skin dose rate limit [mrem/yr].

a_v = the administrative allocation factor for vent v [unitless], which is the fraction of the station site boundary dose rate limit which is assigned to vent v. Allocation factors may be changed as necessary. However, normally, each allocation factor should be between 0.0 and 0.5 inclusive, and the sum of the three allocation factors should be less than or equal to 0.5. (This limitation to 0.5 is to ensure that the combined releases from the Hope Creek and Salem Stations remain within the regulatory limits at the common Site Boundary.) Any increase in this total allocation factor above 0.5 will be coordinated with the Salem Generating Station to ensure

that the total allocation factor for all units does not exceed 1.0.

F_v = the expected flow rate in vent v [cc/sec]. Flow rates in cfm may be converted to cc/sec by multiplying them by 472.

SF = the safety factor; a conservative factor used to compensate for statistical fluctuations and errors of measurements. The actual value will be determined in implementing procedures.

$\overline{X/Q}$ = the highest annual average relative concentration at the site boundary in any sector.

= 1.0×10^{-5} sec/m^3. Site boundary distances were determined from Figure 2.1-1 of Ref. 2. The listed value, in the SE sector, is the highest annual average X/Q at the Site Boundary.

K_i = total body dose factor for gamma emissions from noble gas radionuclide i [mrem/yr per uCi/m^3], from Table 3.1-1.

X_{iv} = the measured concentration of noble gas radionuclide i in the last grab sample analyzed for vent v [uCi/cc]. For the North Plant Vent and the South Plant Vent, such samples are taken at least monthly. For purges of containment through the FRVS, a grab sample will be taken prior to intentionally initiating each such release, or as soon as possible after such a release is initiated automatically.

L_i = skin dose factor for beta emissions from noble gas radionuclide i [mrem/yr per uCi/m^3], from Table 3.1-1.

from Table 3.1-1.

M_i = air dose factor for gamma emissions from noble gas radionuclide i [mrad/yr per uCi/m^3], from Table 3.1-1.

1.1 = a factor to convert absorbed dose in air due to gamma radiation, to dose equivalent in skin [mrem/mrad].

The monitor setpoint S_v established by the method above shall be entered into the radiation monitoring system, along with the sample assay data (the X_{iv}) that were used to calculate it. The operational value of the setpoint should contain an allowance for the monitor's background count rate and its variation. However, effluent monitors at the Station will be maintained such that they are sensitive to radiation at the levels at which it is emitted from the effluent streams.

3.1.2 Startup Setpoint Method

The following method applies to the special circumstance that the assay of plant-generated noble gases in the most recent sample for a given release point yields no detectable radionuclides. It is conservative because it assumes that all the noble gas detected by the monitor is Kr-89, the most conservative radionuclide in Table 3.1-1. Thus, this method results in the overestimation of the true dose delivered by the actual noble gas mixture being released. It is therefore recommended that this method not be used except when it is necessary due to the undetectability of the noble gases in the sample from a particular release

point.

In this case, for the purpose of satisfying Technical Specification 3.3.7.11, the setpoints of any of the three station vent monitors may be established as follows:

S_v' = the lower of S_{vt}' or S_{vs}', where

$$S_{vt}' = \frac{500 \quad a_v \quad SF}{F_v \quad (\overline{X/Q}) \quad K_{Kr-89}}$$

$$S_{vs}' = \frac{3000 \quad a_v \quad SF}{F_v \quad (\overline{X/Q}) \quad (L_{Kr-89} + 1.1\ M_{Kr-89})}$$

where S_v' is the conservative setpoint for startup [uCi/cc], L_{Kr-89} and M_{Kr-89} are dose factors for Kr-89 from Table 3.1-1, and other terms are as defined above.

The monitor setpoint S_v' established by the method above will be entered into the radiation monitoring system. For the sample assay data, the LLD for Kr-89 in the most recent sample for the particular release point will be entered into the radiation monitoring system. The operational value of the setpoint should contain an allowance for the monitor's background count rate and its variation. However, effluent monitors at the Station will be maintained such that they are sensitive to radiation at the levels at which it is emitted from the effluent streams.

Table 3.1-1
DOSE FACTORS FOR EXPOSURE TO A SEMI-INFINITE CLOUD
OF NOBLE GASES*

	Dose to People +		Dose to Air #	
Nuclide	Gamma-Body (K)	Beta-Skin (L)	Gamma (M)	Beta (N)
Kr-83m	0.08	----	19.3	288
Kr-85m	1,170	1,460	1,230	1,970
Kr-85	16.1	1,340	17.2	1,950
Kr-87	5,920	9,730	6,170	10,300
Kr-88	14,700	2,370	15,200	2,930
Kr-89	16,600	10,100	17,300	10,600
Kr-90	15,600	7,290	16,300	7,830
Xe-131m	91.5	476	156	1,110
Xe-133m	251	994	327	1,480
Xe-133	294	306	353	1,050
Xe-135m	3,120	711	3,360	739
Xe-135	1,810	1,860	1,920	2,460
Xe-137	1,420	12,200	1,510	12,700
Xe-138	8,830	4,130	9,210	4,750
Ar-41	8,840	2,690	9,300	3,280

Notes:

* -- Values taken from Ref. 4, Table B-1.

\# -- mrad/yr per uCi/m^3

\+ -- mrem/yr per uCi/m^3

3.2 GASEOUS EFFLUENT DOSE CALCULATIONS

3.2.1 Site Boundary Dose

Technical Specification 3.11.2.1 states:

The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY shall be limited to the following:

a. For noble gases: Less than or equal to 500 mrems/yr to the total body and less than or equal to 3000 mrems/yr to the skin, and

b. For iodine-131, iodine-133, tritium, and for all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to 1500 mrems/yr to any organ.

The following two subsections give the methods by which dose computations are performed for the purpose of demonstrating compliance with this Technical Specification.

3.2.1.a Dose due to Noble Gases

For the purpose of implementation of Technical Specification 3.11.2.1.a, the dose at the Site Boundary due to noble gases is calculated as follows:

$\dot{D}_t$ = current site boundary total body dose rate [mrem/yr]

$$= \overline{X/Q} \sum_i [K_i \; \dot{Q}_i]$$

$\dot{D}_s$ = current site boundary skin dose rate [mrem/yr]

$$= \overline{X/Q} \sum_i [(L_i + 1.1 M_i) \; \dot{Q}_i]$$

where:

$\dot{Q}_i$ = the release rate of noble gas radionuclide i as determined from the concentration measured in the analysis of the appropriate sample required by the Technical Specification Table 4.11-2 [uCi/sec].

$\overline{X/Q}$ = the highest annual average concentration in any sector, at the site boundary (for value, see Section 3.1.1) [sec/m^3]. For post-release computations, the actual X/Q for the period of the release (calculated according to Section 3.3 of this ODCM) may be substituted for $\overline{X/Q}$.

3.2.1.b Dose due to Radionuclides other than Noble Gases

For the purpose of implementation of Technical Specification 3.11.2.1.b, the dose at the Site Boundary due to radioiodines, tritium, and radionuclides in particulate form with half-lives greater than 8 days is calculated as follows:

$\dot{D}_o^{sb}$ = current site boundary dose rate to organ o [mrem/yr]

$$= \overline{X/Q} \sum_i [P_{io} \dot{Q}_i']$$

where:

$\dot{Q}_i'$ = the release rate of non-noble gas radionuclide i as determined from the concentration measured in the analysis of the appropriate sample required by the Technical Specification Table 4.11-2 [uCi/sec].

$\overline{X/Q}$ = the highest annual average concentration in any sector, at the site boundary (for value, see Section 3.1.1) [sec/m^3]. For post-release calculations, the actual site boundary X/Q in the affected sector for the period of the release may be substituted.

P_{io} = dose parameter for radionuclide i and organ o, for inhalation, from Table 3.2-1 [mrem/yr per uCi/m^3].

3.2.2 Air Dose

Technical Specification 3.11.2.2 states:

The air dose due to noble gases released in gaseous effluents, from each reactor unit, to areas at and beyond the SITE BOUNDARY shall be limited to the following:

a. During any calendar quarter: Less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation, and

b. During any calendar year: Less than or equal to 10 mrads for gamma radiation and less than or equal to 20 mrads for beta radiation.

For the purpose of demonstrating compliance with this Technical Specification, the air dose at the Site Boundary is determined as follows:

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

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

where:

D_g = the site boundary air dose due to gamma emissions from noble gas radionuclides [mrad].

D_b = the site boundary air dose due to beta emissions from noble gas radionuclides [mrad].

3.17×10^{-8} = the fraction of one year which is one second.

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

$\overline{X/Q}$ = the highest annual average concentration in any sector, at the site boundary (for value, see Section 3.1.1) [sec/m^3]. For post-release calculations, the actual site boundary X/Q in the affected sector for the period of the release may be substituted.

N_i = air dose factor for beta emissions from noble gas radionuclide i [mrad/yr per uCi/m^3], from Table 3.1-1.

3.2.3 Dose to a Member of the Public

Technical Specification 3.11.2.3 states:

The dose to a MEMBER OF THE PUBLIC from iodine-131, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released, from each reactor unit, to areas at and beyond the SITE BOUNDARY shall be limited to the following:

a. During any calendar quarter: Less than or equal to 7.5 mrems to any organ, and

b. During any calendar year: Less than or equal to 15 mrems to any organ.

For the purpose of demonstrating compliance with this Technical Specification, a Maximum Exposed Individual is defined. This person has those residence and consumption patterns of real Members of the Population in the environment of HCGS which lead to the highest computed doses. Technical Specification 3.11.2.3 is then satisfied if the calculated doses for the Maximum Exposed Individual are less than the limits of the Tech Spec. The dose to the Maximum Exposed Individual is calculated as follows:

D_o^{mp} = dose to organ o of a Member of the Public, from radioiodines, tritium, and radionuclides in particulate form with half-lives greater than 8 days [mrem]

$$= 3.17 \times 10^{-8} \sum_{ij} [R_{ijo} \; W_{ij}' \; \tilde{Q}_i']$$

where:

W_{ij}' = relative concentration or relative deposition for the Maximum Exposed Individual, as appropriate for exposure pathway j and radionuclide i. W_{ij}' is defined as follows, (where the selection of the numerical values is explained in the Note to Table 3.2-5):

= $\overline{X/Q}'$ for inhalation and all tritium pathways, 1.1 E-07 sec/m^3, and

= $\overline{D/Q}'$ for other pathways and non-tritium nuclides, 4.9 E-10 m^{-2}.

R_{ijo} = dose factor for organ o due to radionuclide i and pathway j, from Table 3.2-2 [mrem/yr per uCi/m^3, or m^2 - mrem/yr per uCi/sec]. For the purpose of this calculation, the Site Maximum Exposed Individual is a hypothetical infant consuming the milk of a cow pastured at 5.0 miles in the SE sector.

$\tilde{Q}_i$' = cumulative release of non-noble gas radionuclide i over the period of interest [uCi].

Table 3.2-1
PATHWAY DOSE FACTORS FOR SECTION 3.2.1.b (P_{io})*

Page 1 of 7: Dose Factors for Total Body

ISOTOPE	INHALATION
H-3	1.125E+03
C-14	6.734E+03
NA-24	1.610E+04
P-32	9.879E+04
CR-51	1.543E+02
MN-54	9.509E+03
MN-56	3.119E-01
FE-55	7.770E+03
FE-59	1.669E+04
CO-58	3.164E+03
CO-60	2.264E+04
NI-63	2.797E+04
NI-65	1.643E-01
CU-64	1.073E+00
ZN-65	7.030E+04
ZN-69	8.917E-03
BR-83	4.736E+02
BR-84	5.476E+02
BR-85	2.531E+01
RB-86	1.143E+05
RB-88	3.663E+02
RB-89	2.897E+02
SR-89	1.724E+0[illegible]
SR-90	6.438E+06
SR-91	4.588E+00
SR-92	5.254E-01
Y-90	1.106E+02
Y-91M	1.843E-02
Y-91	2.438E+04
Y-92	5.809E-01
Y-93	5.106E+00
ZR-95	3.700E+04
ZR-97	1.598E+01
NB-95	6.549E+03
MO-99	4.255E+01
TC-99M	5.772E-02
TC-101	1.077E-03
RU-103	1.073E+03
RU-105	5.550E-01
RU-106	1.691E+04
AG-110M	9.139E+03
TE-125M	9.139E+02
TE-127M	3.019E+03
TE-127	6.105E-01
TE-129M	3.041E+03
TE-129	2.383E-02
TE-131M	5.069E+01
TE-131	6.586E-03
TE-132	2.634E+02
I-130	8.436E+03
I-131	2.727E+04
I-132	1.876E+03
I-133	7.696E+03
I-134	9.953E+02
I-135	4.144E+03
CS-134	2.246E+05
CS-136	1.162E+05
CS-137	1.284E+05
CS-138	5.550E+02
BA-139	5.365E-02
BA-140	4.329E+03
BA-141	6.364E-03
BA-142	2.790E-03
LA-140	7.548E+01
LA-142	1.291E-01
CE-141	2.897E+03
CE-143	2.875E+01
CE-144	3.615E+05
PR-143	9.139E+02
PR-144	2.997E-03
ND-147	6.808E+02
W-187	4.329E+00
NP-239	2.350E+01

* -- See Note, page 3.0-21

Units: mrem/yr per uCi/m^3

Table 3.2-1

PATHWAY DOSE FACTORS FOR SECTION 3.2.1.b $(P_{io})^{*}$

Page 2 of 7: Dose Factors for Bone

ISOTOPE	INHALATION	ISOTOPE	INHALATION	ISOTOPE	INHALATION
H-3	0.000E+00	SR-92	1.310E+01	I-131	4.810E+04
C-14	3.589E+04	Y-90	4.107E+03	I-132	2.116E+03
NA-24	1.610E+04	Y-91M	5.069E-01	I-133	1.658E+04
P-32	2.605E+06	Y-91	9.139E+05	I-134	1.173E+03
CR-51	0.000E+00	Y-92	2.935E+01	I-135	4.921E+03
MN-54	0.000E+00	Y-93	1.865E+02	CS-134	6.512E+05
MN-56	0.000E+00	ZR-95	1.898E+05	CS-136	6.512E+04
FE-55	4.736E+04	ZR-97	1.876E+02	CS-137	9.065E+05
FE-59	2.068E+04	NB-95	2.350E+04	CS-138	6.327E+02
CO-58	0.000E+00	MO-99	0.000E+00	BA-139	1.843E+00
CO-60	0.000E+00	TC-99M	1.780E-03	BA-140	7.400E+04
NI-63	8.214E+05	TC-101	8.103E-05	BA-141	1.957E-01
NI-65	2.990E+00	RU-103	2.794E+03	BA-142	4.995E-02
CU-64	0.000E+00	RU-105	1.528E+00	LA-140	6.438E+02
ZN-65	4.255E+04	RU-106	1.362E+05	LA-142	1.295E+00
ZN-69	6.697E-02	AG-110M	1.687E+04	CE-141	3.922E+04
BR-83	0.000E+00	TE-125M	6.734E+03	CE-143	3.659E+02
BR-84	0.000E+00	TE-127M	2.486E+04	CE-144	6.771E+06
BR-85	0.000E+00	TE-127	2.771E+00	PR-143	1.846E+04
RB-86	0.000E+00	TE-129M	1.920E+04	PR-144	5.957E-02
RB-88	0.000E+00	TE-129	9.768E-02	ND-147	1.080E+04
RB-89	0.000E+00	TE-131M	1.343E+02	W-187	1.632E+01
SR-89	5.994E+05	TE-131	2.172E-02	NP-239	4.662E+02
SR-90	1.010E+08	TE-132	4.810E+02		
SR-91	1.214E+02	I-130	8.177E+03		

* -- See Note, page 3.0-21

Units: mrem/yr per uCi/m^3

Table 3.2-1
PATHWAY DOSE FACTORS FOR SECTION 3.2.1.b (P_{io})*

Page 3 of 7: Dose Factors for Liver

ISOTOPE	INHALATION
H-3	1.125E+03
C-14	6.734E+03
NA-24	1.610E+04
P-32	1.143E+05
CR-51	0.000E+00
MN-54	4.292E+04
MN-56	1.658E+00
FE-55	2.516E+04
FE-59	3.345E+04
CO-58	1.772E+03
CO-60	1.314E+04
NI-63	4.625E+04
NI-65	2.956E-01
CU-64	1.994E+00
ZN-65	1.132E+05
ZN-69	9.657E-02
BR-83	0.000E+00
BR-84	0.000E+00
BR-85	0.000E+00
RB-86	1.983E+05
RB-88	5.624E+02
RB-89	3.452E+02
SR-89	0.000E+00
SR-90	0.000E+00
SR-91	0.000E+00

ISOTOPE	INHALATION
SR-92	0.000E+00
Y-90	0.000E+00
Y-91M	0.000E+00
Y-91	0.000E+00
Y-92	0.000E+00
Y-93	0.000E+00
ZR-95	4.181E+04
ZR-97	2.716E+01
NB-95	9.176E+03
MO-99	1.7[illegible]4E+02
TC-99M	3.482E-03
TC-101	8.510E-05
RU-103	0.000E+00
RU-105	0.000E+00
RU-106	0.000E+00
AG-110M	1.140E+04
TE-125M	2.327E+03
TE-127M	8.547E+03
TE-127	9.509E-01
TE-129M	6.845E+03
TE-129	3.497E-02
TE-131M	5.920E+01
TE-131	8.436E-03
TE-132	2.723E+02
I-130	1.639E+04

ISOTOPE	INHALATION
I-131	4.810E+04
I-132	4.0[illegible]9E+03
I-133	2.031E+04
I-134	2.161E+03
I-135	8.732E+03
CS-134	1.014E+06
CS-136	1.709E+05
CS-137	8.251E+05
CS-138	8.399E+02
BA-139	9.842E-04
BA-140	6.475E+01
BA-141	1.092E-04
BA-142	3.600E-05
LA-140	2.250E+02
LA-142	4.107E-01
CE-141	1.954E+04
CE-143	1.987E+02
CE-144	2.116E+06
PR-143	5.550E+03
PR-144	1.846E-02
ND-147	8.732E+03
W-187	9.657E+00
NP-239	3.345E+01

* -- See Note, page 3.0-21

Units: mrem/yr per uCi/m^3

Table 3.2-1
PATHWAY DOSE FACTORS FOR SECTION 3.2.1.b $(P_{io})^*$

Page 4 of 7: Dose Factors for Thyroid

ISOTOPE	INHALATION	ISOTOPE	INHALATION	ISOTOPE	INHALATION
H-3	1.125E+03	SR-92	0.000E+00	I-131	1.624E+07
C-14	6.734E+03	Y-90	0.000E+00	I-132	1.935E+05
NA-24	1.610E+04	Y-91M	0.000E+00	I-133	3.848E+06
P-32	0.000E+00	Y-91	0.000E+00	I-134	5.069E+04
CR-51	8.547E+01	Y-92	0.000E+00	I-135	7.918E+05
MN-54	0.000E+00	Y-93	0.000E+00	CS-134	0.000E+00
MN-56	0.000E+00	ZR-95	0.000E+00	CS-136	0.000E+00
FE-55	0.000E+00	ZR-97	0.000E+00	CS-137	0.000E+00
FE-59	0.000E+00	NB-95	0.000E+00	CS-138	0.000E+00
CO-58	0.000E+00	MO-99	0.000E+00	BA-139	0.000E+00
CO-60	0.000E+00	TC-99M	0.000E+00	BA-140	0.000E+00
NI-63	0.000E+00	TC-101	0.000E+00	BA-141	0.000E+00
NI-65	0.000E+00	RU-103	0.000E+00	BA-142	0.000E+00
CU-64	0.000E+00	RU-105	0.000E+00	LA-140	0.000E+00
ZN-65	0.000E+00	RU-106	0.000E+00	LA-142	0.000E+00
ZN-69	0.000E+00	AG-110M	0.000E+00	CE-141	0.000E+00
BR-83	0.000E+00	TE-125M	1.924E+03	CE-143	0.000E+00
BR-84	0.000E+00	TE-127M	6.068E+03	CE-144	0.000E+00
BR-85	0.000E+00	TE-127	1.961E+00	PR-143	0.000E+00
RB-86	0.000E+00	TE-129M	6.327E+03	PR-144	0.000E+00
RB-88	0.000E+00	TE-129	2.141E-02	ND-147	0.000E+00
RB-89	0.000E+00	TE-131M	9.768E+01	W-187	0.000E+00
SR-89	0.000E+00	TE-131	1.698E-02	NP-239	0.000E+00
SR-90	0.000E+00	TE-132	3.175E+02		
SR-91	0.000E+00	I-130	1.846E+06		

* -- See Note, page 3.0-21

Units: mrem/yr per uCi/m^3

Table 3.2-1
PATHWAY DOSE FACTORS FOR SECTION 3.2.1.b $(P_{io})^*$

Page 5 of 7: Dose Factors for Kidney

ISOTOPE	INHALATION
H-3	1.125E+03
C-14	6.734E+03
NA-24	1.610E+04
P-32	0.000E+00
CR-51	2.431E+01
MN-54	1.003E+04
MN-56	1.672E+00
FE-55	0.000E+00
FE-59	0.000E+00
CO-58	0.000E+00
CO-60	0.000E+00
NI-63	0.000E+00
NI-65	0.000E+00
CU-64	6.031E+00
ZN-65	7.141E+04
ZN-69	5.846E-02
BR-83	0.000E+00
BR-84	0.000E+00
BR-85	0.000E+00
RB-86	0.000E+00
RB-88	0.000E+00
RB-89	0.000E+00
SR-89	0.000E+00
SR-90	0.000E+00
SR-91	0.000E+00

ISOTOPE	INHALATION
SR-92	0.000E+00
Y-90	0.000E+00
Y-91M	0.000E+00
Y-91	0.000E+00
Y-92	0.000E+00
Y-93	0.000E+00
ZR-95	5.957E+04
ZR-97	3.885E+01
NB-95	8.621E+03
MO-99	3.922E+02
TC-99M	5.069E-02
TC-101	1.450E-03
RU-103	7.030E+03
RU-105	1.343E+00
RU-106	1.839E+05
AG-110M	2.124E+04
TE-125M	0.000E+00
TE-127M	6.364E+04
TE-127	7.067E+00
TE-129M	5.032E+04
TE-129	2.568E-01
TE-131M	3.996E+02
TE-131	5.883E-02
TE-132	1.772E+03
I-130	2.446E+04

ISOTOPE	INHALATION
I-131	7.881E+04
I-132	6.253E+03
I-133	3.378E+04
I-134	3.300E+03
I-135	1.339E+04
CS-134	3.304E+05
CS-136	9.546E+04
CS-137	2.823E+05
CS-138	6.216E+02
BA-139	8.621E-04
BA-140	2.113E+01
BA-141	9.472E-05
BA-142	2.912E-05
LA-140	0.000E+00
LA-142	0.000E+00
CE-141	8.547E+03
CE-143	8.362E+01
CE-144	1.173E+06
PR-143	3.001E+03
PR-144	9.768E-03
ND-147	4.810E+03
W-187	0.000E+00
NP-239	9.731E+01

* -- See Note, page 3.0-21

Units: mrem/yr per uCi/m^3

Table 3.2-1
PATHWAY DOSE FACTORS FOR SECTION 3.2.1.b $(P_{io})^*$

Page 6 of 7: Dose Factors for Lung

ISOTOPE	INHALATION
H-3	1.125E+03
C-14	6.734E+03
NA-24	1.610E+04
P-32	0.000E+00
CR-51	1.698E+04
MN-54	1.576E+06
MN-56	1.314E+04
FE-55	1.110E+05
FE-59	1.269E+06
CO-58	1.106E+06
CO-60	7.067E+06
NI-63	2.749E+05
NI-65	8.177E+03
CU-64	9.583E+03
ZN-65	9.953E+05
ZN-69	1.421E+03
BR-83	0.000E+00
BR-84	0.000E+00
BR-85	0.000E+00
RB-86	0.000E+00
RB-88	0.000E+00
RB-89	0.000E+00
SR-89	2.157E+06
SR-90	1.476E+07
SR-91	5.328E+04
SR-92	2.401E+04
Y-90	2.616E+05
Y-91M	2.812E+03
Y-91	2.627E+06
Y-92	2.390E+04
Y-93	7.437E+04
ZR-95	2.231E+06
ZR-97	1.132E+05
NB-95	6.142E+05
MO-99	1.354E+05
TC-99M	9.509E+02
TC-101	5.846E+02
RU-103	6.623E+05
RU-105	1.591E+04
RU-106	1.432E+07
AG-110M	5.476E+06
TE-125M	4.773E+05
TE-127M	1.480E+06
TE-127	1.003E+04
TE-129M	1.761E+06
TE-129	2.934E+03
TE-131M	2.057E+05
TE-131	2.054E+03
TE-132	3.774E+05
I-130	0.000E+00
I-131	0.000E+00
I-132	0.000E+00
I-133	0.000E+00
I-134	0.000E+00
I-135	0.000E+00
CS-134	1.210E+05
CS-136	1.454E+04
CS-137	1.040E+05
CS-138	6.808E+01
BA-139	5.772E+03
BA-140	1.743E+06
BA-141	2.919E+03
BA-142	1.643E+03
LA-140	1.829E+05
LA-142	8.695E+03
CE-141	5.439E+05
CE-143	1.154E+05
CE-144	1.195E+07
PR-143	4.329E+05
PR-144	1.565E+03
ND-147	3.282E+05
W-187	4.107E+04
NP-239	5.809E+04

* -- See Note, page 3.0-21

Units: mrem/yr per uCi/m^3

Table 3.2-1
PATHWAY DOSE FACTORS FOR SECTION 3.2.1.b $(P_{io})^{*}$

Page 7 of 7: Dose Factors for GI-LLI

ISOTOPE	INHALATION
H-3	1.125E+03
C-14	6.734E+03
NA-24	1.610E+04
P-32	4.218E+04
CR-51	1.084E+03
MN-54	2.290E+04
MN-56	1.232E+05
FE-55	2.868E+03
FE-59	7.067E+04
CO-58	3.437E+04
CO-60	9.620E+04
NI-63	6.327E+03
NI-65	8.399E+04
CU-64	3.670E+04
ZN-65	1.632E+04
ZN-69	1.018E+04
BR-83	0.000E+00
BR-84	0.000E+00
BR-85	0.000E+00
RB-86	7.992E+03
RB-88	1.724E+01
RB-89	1.891E+00
SR-89	1.672E+05
SR-90	3.434E+05
SR-91	1.739E+05
SR-92	2.424E+05
Y-90	2.679E+05
Y-91M	1.717E+03
Y-91	1.839E+05
Y-92	2.390E+05
Y-93	3.885E+05
ZR-95	6.105E+04
ZR-97	3.511E+05
NB-95	3.700E+04
MO-99	1.265E+05
TC-99M	4.810E+03
TC-101	1.632E+01
RU-103	4.477E+04
RU-105	9.953E+04
RU-106	4.292E+05
AG-110M	1.003E+05
TE-125M	3.378E+04
TE-127M	7.141E+04
TE-127	5.624E+04
TE-129M	1.817E+05
TE-129	2.549E+04
TE-131M	3.078E+05
TE-131	1.332E+03
TE-132	1.376E+05
I-130	5.106E+03
I-131	2.842E+03
I-132	3.201E+03
I-133	5.476E+03
I-134	9.546E+02
I-135	4.440E+03
CS-134	3.848E+03
CS-136	4.181E+03
CS-137	3.619E+03
CS-138	2.697E+02
BA-139	5.772E+04
BA-140	1.018E+05
BA-141	2.753E+02
BA-142	2.742E+00
LA-140	2.257E+05
LA-142	7.585E+04
CE-141	5.661E+04
CE-143	1.273E+05
CE-144	3.885E+05
PR-143	9.731E+04
PR-144	1.968E+02
ND-147	8.214E+04
W-187	9.102E+04
NP-239	6.401E+04

* -- See Note, page 3.0-21

Units: mrem/yr per uCi/m^3

NOTE: The P_{io} values of Table 3.2-1 were calculated according to the methods of Ref. 6, Section 5.2.1, for the child age group. The values used for the various parameters, and the origins of those values, are given below in Table 3.2-3.

Table 3.2-2

PATHWAY DOSE FACTORS FOR SECTION 3.2.3 $(R_{ijo})^*$

Page 1 of 21: Dose Factors for Total Body

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
H-3	6.468E+02	0.000E+00	2.353E+03
C-14	5.306E+03	0.000E+00	7.948E+08
NA-24	1.056E+04	1.194E+07	2.453E+07
P-32	7.742E+04	0.000E+00	9.880E+09
CR-51	8.946E+01	4.659E+06	2.565E+05
MN-54	4.984E+03	1.386E+09	1.406E+07
MN-56	2.212E-01	9.035E+05	8.641E-03
FE-55	3.332E+03	0.000E+00	3.712E+07
FE-59	9.478E+03	2.727E+08	2.457E+08
CO-58	1.820E+03	3.811E+08	9.634E+07
CO-60	1.177E+04	2.152E+10	3.311E+08
NI-63	1.161E+04	0.000E+00	1.929E+09
NI-65	1.231E-01	2.970E+05	2.871E-01
CU-64	2.742E-01	6.067E+05	1.366E+05
ZN-65	3.108E+04	7.463E+08	1.397E+10
ZN-69	7.182E-03	0.000E+00	5.596E-12
BR-83	3.808E+02	4.871E+03	1.486E+00
BR-84	4.004E+02	2.026E+05	1.998E-22
BR-85	2.044E+01	0.000E+00	0.000E+00
RB-86	8.820E+04	8.984E+06	1.749E+10
RB-88	2.870E+02	3.307E+04	1.634E-44
RB-89	2.058E+02	1.230E+05	3.741E-52
SR-89	1.141E+04	2.162E+04	5.743E+08
SR-90	2.590E+06	0.000E+00	4.925E+10
SR-91	3.458E+00	2.148E+06	1.564E+04

* -- See Note, page 3.0-43

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 3.2-2
PATHWAY DOSE FACTORS FOR SECTION 3.2.3 (R_{ijo})*

Page 2 of 21: Dose Factors for Total Body

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
SR-92	3.906E-01	7.768E+05	2.742E-01
Y-90	8.820E+01	4.491E+03	2.906E+01
Y-91M	1.386E-02	1.002E+05	3.051E-20
Y-91	1.568E+04	1.073E+06	3.104E+03
Y-92	4.606E-01	1.804E+05	2.404E-05
Y-93	4.074E+00	1.852E+05	9.745E-02
ZR-95	2.030E+04	2.466E+08	1.871E+03
ZR-97	1.170E+01	2.960E+06	5.065E-01
NB-95	3.780E+03	1.409E+08	2.270E+05
MO-99	3.234E+01	3.995E+06	6.453E+07
TC-99M	3.774E-02	1.841E+05	1.161E+03
TC-101	8.120E-04	2.034E+04	4.525E-50
RU-103	6.790E+02	1.084E+08	4.615E+03
RU-105	4.102E-01	6.363E+05	4.315E-03
RU-106	1.088E+04	4.208E+08	3.781E+04
AG-110M	4.998E+03	3.445E+09	2.965E+08
TE-125M	6.580E+02	1.552E+06	3.243E+07
TE-127M	2.072E+03	9.165E+04	8.108E+07
TE-127	4.886E-01	2.994E+03	2.214E+03
TE-129M	2.226E+03	1.972E+07	1.364E+08
TE-129	1.876E-02	2.600E+04	7.798E-10
TE-131M	3.626E+01	8.026E+06	1.785E+06
TE-131	4.998E-03	2.919E+04	1.530E-32
TE-132	1.764E+02	4.223E+06	1.546E+07
I-130	5.572E+03	5.511E+06	4.987E+06

* -- See Note, page 3.0-43

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

Table 3.2-2
PATHWAY DOSE FACTORS FOR SECTION 3.2.3 $(R_{ijo})^*$

Page 3 of 21: Dose Factors for Total Body

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
I-131	1.960E+04	1.721E+07	2.242E+09
I-132	1.259E+03	1.245E+06	1.648E+00
I-133	5.600E+03	2.451E+06	2.460E+07
I-134	6.650E+02	4.467E+05	2.039E-11
I-135	2.772E+03	2.526E+06	1.296E+05
CS-134	7.448E+04	6.863E+09	1.093E+10
CS-136	5.292E+04	1.502E+08	3.442E+09
CS-137	4.550E+04	1.030E+10	6.792E+09
CS-138	3.976E+02	3.589E+05	1.051E-22
BA-139	4.298E-02	1.061E+05	2.089E-08
BA-140	2.898E+03	2.053E+07	1.976E+07
BA-141	4.970E-03	4.172E+04	2.085E-46
BA-142	1.960E-03	4.445E+04	0.000E+00
LA-140	5.152E+01	1.923E+07	6.551E+00
LA-142	9.044E-02	7.602E+05	2.418E-11
CE-141	1.988E+03	1.366E+07	4.953E+03
CE-143	2.212E+01	2.312E+06	4.778E+01
CE-144	1.764E+05	6.946E+07	2.073E+05
PR-143	6.986E+02	0.000E+00	1.172E+02
PR-144	2.408E-03	1.837E+03	5.215E-54
ND-147	4.998E+02	8.408E+06	8.833E+01
W-187	3.122E+00	2.360E+06	2.340E+04
NP-239	1.876E+01	1.706E+06	2.923E+00

* -- See Note, page 3.0-43

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

Table 3.2-2

PATHWAY DOSE FACTORS FOR SECTION 3.2.3 (R_{ijo})*

Page 4 of 21: Dose Factors for Bone

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
H-3	0.000E+00	0.000E+00	0.000E+00
C-14	2.646E+04	0.000E+00	3.722E+09
NA-24	1.056E+04	1.194E+07	2.453E+07
P-32	2.030E+06	0.000E+00	2.549E+11
CR-51	0.000E+00	4.659E+06	0.000E+00
MN-54	0.000E+00	1.386E+09	0.000E+00
MN-56	0.000E+00	9.035E+05	0.000E+00
FE-55	1.974E+04	0.000E+00	2.150E+08
FE-59	1.357E+04	2.727E+08	3.569E+08
CO-58	0.000E+00	3.811E+08	0.000E+00
CO-60	0.000E+00	2.152E+10	0.000E+00
NI-63	3.388E+05	0.000E+00	5.558E+10
NI-65	2.394E+00	2.970E+05	5.576E+00
CU-64	0.000E+00	6.067E+05	0.000E+00
ZN-65	1.932E+04	7.463E+08	8.833E+09
ZN-69	5.390E-02	0.000E+00	4.177E-11
BR-83	0.000E+00	4.871E+03	0.000E+00
BR-84	0.000E+00	2.026E+05	0.000E+00
BR-85	0.000E+00	0.000E+00	0.000E+00
RB-86	0.000E+00	8.984E+06	0.000E+00
RB-88	0.000E+00	3.307E+04	0.000E+00
RB-89	0.000E+00	1.230E+05	0.000E+00
SR-89	3.976E+05	2.162E+04	2.002E+10
SR-90	4.088E+07	0.000E+00	1.934E+11
SR-91	9.562E+01	2.148E+06	4.320E+05

* -- See Note, page 3.0-43

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 3.2-2
PATHWAY DOSE FACTORS FOR SECTION 3.2.3 (R_{ijo})*

Page 5 of 21: Dose Factors for Bone

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
SR-92	1.058E+01	7.768E+05	7.385E+00
Y-90	3.290E+03	4.491E+03	1.084E+03
Y-91M	4.074E-01	1.002E+05	8.954E-19
Y-91	5.880E+05	1.073E+06	1.165E+05
Y-92	1.638E+01	1.804E+05	8.554E-04
Y-93	1.498E+02	1.852E+05	3.527E+00
ZR-95	1.154E+05	2.446E+08	1.082E+04
ZR-97	1.498E+02	2.960E+06	6.462E+00
NB-95	1.568E+04	1.409E+08	9.532E+05
MO-99	0.000E+00	3.995E+06	0.000E+00
TC-99M	1.397E-03	1.841E+05	4.372E+01
TC-101	6.510E-05	2.034E+04	3.630E-59
RU-103	2.016E+03	1.084E+08	1.380E+04
RU-105	1.224E+00	6.363E+05	1.281E-02
RU-106	8.680E+04	4.208E+08	3.027E+05
AG-110M	9.982E+03	3.445E+09	6.139E+08
TE-125M	4.760E+03	1.552E+06	2.399E+08
TE-127M	1.666E+04	9.165E+04	6.700E+08
TE-127	2.226E+00	2.994E+03	1.030E+04
TE-129M	1.414E+04	1.972E+07	8.856E+08
TE-129	7.882E-02	2.600E+04	3.340E-09
TE-131M	1.067E+02	8.026E+06	5.372E+06
TE-131	1.736E-02	2.919E+04	5.452E-32
TE-132	3.724E+02	4.223E+06	3.346E+07
I-130	6.356E+03	5.511E+06	5.646E+06

* -- See Note, page 3.0-43

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

Table 3.2-2
PATHWAY DOSE FACTORS FOR SECTION 3.2.3 $(R_{ijo})^*$

Page 6 of 21: Dose Factors for Bone

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
I-131	3.794E+04	1.721E+07	4.327E+09
I-132	1.694E+03	1.245E+06	2.280E+00
I-133	1.324E+04	2.451E+06	5.768E+07
I-134	9.212E+02	4.467E+05	2.799E-11
I-135	3.864E+03	2.526E+06	1.786E+05
CS-134	3.962E+05	6.863E+09	5.803E+10
CS-136	4.830E+04	1.502E+08	3.135E+09
CS-137	5.488E+05	1.030E+10	8.187E+10
CS-138	5.054E+02	3.589E+05	1.334E-22
BA-139	1.484E+00	1.061E+05	7.219E-07
BA-140	5.600E+04	2.053E+07	3.835E+08
BA-141	1.568E-01	4.172E+04	6.613E-45
BA-142	3.976E-02	4.445E+04	0.000E+00
LA-140	5.054E+02	1.923E+07	6.460E+01
LA-142	1.030E+00	7.602E+05	2.751E-10
CE-141	2.772E+04	1.366E+07	6.899E+04
CE-143	2.926E+02	2.312E+06	6.313E+02
CE-144	3.192E+06	6.946E+07	3.699E+06
PR-143	1.400E+04	0.000E+00	2.365E+03
PR-144	4.788E-02	1.837E+03	1.035E-52
ND-147	7.938E+03	8.408E+06	1.404E+03
W-187	1.296E+01	2.360E+06	9.738E+04
NP-239	3.710E+02	1.706E+06	5.784E+01

* -- See Note, page 3.0-43

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 3.2-2
PATHWAY DOSE FACTORS FOR SECTION 3.2.3 (R_{ijo})*

Page 7 of 21: Dose Factors for Liver

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
H-3	6.468E+02	0.000E+00	2.353E+03
C-14	5.306E+03	0.000E+00	7.948E+08
NA-24	1.056E+04	1.194E+07	2.453E+07
P-32	1.124E+05	0.000E+00	1.499E+10
CR-51	0.000E+00	4.659E+06	0.000E+00
MN-54	2.534E+04	1.386E+09	6.205E+07
MN-56	1.540E+00	9.035E+05	5.013E-02
FE-55	1.175E+04	0.000E+00	1.389E+08
FE-59	2.352E+04	2.727E+08	6.234E+08
CO-58	1.219E+03	3.811E+08	3.862E+07
CO-60	8.022E+03	2.152E+10	1.402E+08
NI-63	2.044E+04	0.000E+00	3.436E+09
NI-65	2.842E-01	2.970E+05	6.312E-01
CU-64	1.876E+00	6.067E+05	2.951E+05
ZN-65	6.258E+04	7.463E+08	3.029E+10
ZN-69	9.674E-02	0.000E+00	7.521E-11
BR-83	0.000E+00	4.871E+03	0.000E+00
BR-84	0.000E+00	2.026E+05	0.000E+00
BR-85	0.000E+00	0.000E+00	0.000E+00
RB-86	1.904E+05	8.984E+06	3.540E+10
RB-88	5.572E+02	3.307E+04	2.982E-44
RB-89	3.206E+02	1.230E+05	5.431E-52
SR-89	0.000E+00	2.162E+04	0.000E+00
SR-90	0.000E+00	0.000E+00	0.000E+00
SR-91	0.000E+00	2.148E+06	0.000E+00

* -- See Note, page 3.0-43

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

Table 3.2-2

PATHWAY DOSE FACTORS FOR SECTION 3.2.3 $(R_{ijo})^*$

Page 8 of 21: Dose Factors for Liver

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
SR-92	0.000E+00	7.768E+05	0.000E+00
Y-90	0.000E+00	4.491E+03	0.000E+00
Y-91M	0.000E+00	1.002E+05	0.000E+00
Y-91	0.000E+00	1.073E+06	0.000E+00
Y-92	0.000E+00	1.804E+05	0.000E+00
Y-93	0.000E+00	1.852E+05	0.000E+00
ZR-95	2.786E+04	2.446E+08	2.638E+03
ZR-97	2.562E+01	2.960E+06	1.109E+00
NB-95	6.426E+03	1.409E+08	3.926E+05
MO-99	1.652E+02	3.995E+06	3.309E+08
TC-99M	2.884E-03	1.841E+05	9.017E+01
TC-101	8.232E-05	2.034E+04	4.573E-59
RU-103	0.000E+00	1.084E+08	0.000E+00
RU-105	0.000E+00	6.363E+05	0.000E+00
RU-106	0.000E+00	4.208E+08	0.000E+00
AG-110M	7.224E+03	3.445E+09	4.481E+08
TE-125M	1.988E+03	1.552E+06	8.019E+07
TE-127M	6.902E+03	9.165E+04	2.222E+08
TE-127	9.534E-01	2.994E+03	3.450E+03
TE-129M	6.090E+03	1.972E+07	3.038E+08
TE-129	3.472E-02	2.600E+04	1.151E-09
TE-131M	5.502E+01	8.026E+06	2.163E+06
TE-131	8.218E-03	2.919E+04	2.013E-32
TE-132	2.366E+02	4.223E+06	1.657E+07
I-130	1.387E+04	5.511E+06	1.242E+07

* -- See Note, page 3.0-43

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 3.2-2
PATHWAY DOSE FACTORS FOR SECTION 3.2.3 $(R_{ijo})^*$

Page 9 of 21: Dose Factors for Liver

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
I-131	4.438E+04	1.721E+07	5.098E+09
I-132	3.542E+03	1.245E+06	4.629E+00
I-133	1.918E+04	2.451E+06	8.399E+07
I-134	1.876E+03	4.467E+05	5.733E-11
I-135	7.602E+03	2.526E+06	3.553E+05
CS-134	7.028E+05	6.863E+09	1.082E+11
CS-136	1.345E+05	1.502E+08	9.219E+09
CS-137	6.118E+05	1.030E+10	9.583E+10
CS-138	7.812E+02	3.589E+05	2.169E-22
BA-139	9.842E-04	1.061E+05	4.785E-10
BA-140	5.600E+01	2.053E+07	3.835E+05
BA-141	1.078E-04	4.172E+04	4.528E-48
BA-142	3.304E-05	4.445E+04	0.000E+00
LA-140	2.002E+02	1.923E+07	2.547E+01
LA-142	3.766E-01	7.602E+05	1.010E-10
CE-141	1.666E+04	1.366E+07	4.207E+04
CE-143	1.932E+02	2.312E+06	4.189E+05
CE-144	1.211E+06	6.946E+07	1.514E+06
PR-143	5.236E+03	0.000E+00	8.844E+02
PR-144	1.848E-02	1.837E+03	4.006E-53
ND-147	8.134E+03	8.408E+06	1.442E+03
W-187	9.016E+00	2.360E+06	6.772E+04
NP-239	3.318E+01	1.796E+06	5.174E+00

* -- **See** Note, page 3.Ø-43

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

Table 3.2-2

PATHWAY DOSE FACTORS FOR SECTION 3.2.3 $(R_{ijo})^*$

Page 10 of 21: Dose Factors for Thyroid

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
H-3	6.468E+02	0.000E+00	2.353E+03
C-14	5.306E+03	0.000E+00	7.948E+08
NA-24	1.056E+04	1.194E+07	2.453E+07
P-32	0.000E+00	0.000E+00	0.000E+00
CR-51	5.754E+01	4.659E+06	1.674E+05
MN-54	0.000E+00	1.386E+09	0.000E+00
MN-56	0.000E+00	9.035E+05	0.000E+00
FE-55	0.000E+00	0.000E+00	0.000E+00
FE-59	0.000E+00	2.727E+08	0.000E+00
CO-58	0.000E+00	3.811E+08	0.000E+00
CO-60	0.000E+00	2.152E+10	0.000E+00
NI-63	0.000E+00	0.000E+00	0.000E+00
NI-65	0.000E+00	2.970E+05	0.000E+00
CU-64	0.000E+00	6.067E+05	0.000E+00
ZN-65	0.000E+00	7.463E+08	0.000E+00
ZN-69	0.000E+00	0.000E+00	0.000E+00
BR-83	0.000E+00	4.871E+03	0.000E+00
BR-84	0.000E+00	2.026E+05	0.000E+00
BR-85	0.000E+00	0.000E+00	0.000E+00
RB-86	0.000E+00	8.984E+06	0.000E+00
RB-88	0.000E+00	3.307E+04	0.000E+00
RB-89	0.000E+00	1.230E+05	0.000E+00
SR-89	0.000E+00	2.162E+04	0.000E+00
SR-90	0.000E+00	0.000E+00	0.000E+00
SR-91	0.000E+00	2.140E+06	0.000E+00

* -- See Note, page 3.0-43

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 3.2-2

PATHWAY DOSE FACTORS FOR SECTION 3.2.3 $(R_{ijo})^*$

Page 11 of 21: Dose Factors for Thyroid

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
SR-92	0.000E+00	7.768E+05	0.000E+00
Y-90	0.000E+00	4.491E+03	0.000E+00
Y-91M	0.000E+00	1.002E+05	0.000E+00
Y-91	0.000E+00	1.073E+06	0.000E+00
Y-92	0.000E+00	1.804E+05	0.000E+00
Y-93	0.000E+00	1.852E+05	0.000E+00
ZR-95	0.000E+00	2.446E+08	0.000E+00
ZR-97	0.000E+00	2.960E+06	0.000E+00
NB-95	0.000E+00	1.409E+08	0.000E+00
MO-99	0.000E+00	3.995E+06	0.000E+00
TC-99M	0.000E+00	1.841E+05	0.000E+00
TC-101	0.000E+00	2.034E+04	0.000E+00
RU-103	0.000E+00	1.084E+08	0.000E+00
RU-105	0.000E+00	6.363E+05	0.000E+00
RU-106	0.000E+00	4.208E+08	0.000E+00
AG-110M	0.000E+00	3.445E+09	0.000E+00
TE-125M	1.624E+03	1.552E+06	8.071E+07
TE-127M	4.872E+03	9.165E+04	1.935E+08
TE-127	1.848E+00	2.994E+03	8.382E+03
TE-129M	5.474E+03	1.972E+07	3.401E+08
TE-129	6.748E-02	2.600E+04	2.799E-09
TE-131M	8.932E+01	8.026E+06	4.383E+06
TE-131	1.582E-02	2.919E+04	4.863E-32
TE-132	2.786E+02	4.223E+06	2.445E+07
I-130	1.596E+06	5.511E+06	1.393E+09

* -- See Note, page 3.0-43

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 3.2-2
PATHWAY DOSE FACTORS FOR SECTION 3.2.3 (R_{ijo})*

Page 12 of 21: Dose Factors for Thyroid

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
I-131	1.484E+07	1.721E+07	1.675E+12
I-132	1.694E+05	1.245E+06	2.170E+02
I-133	3.556E+06	2.451E+06	1.527E+10
I-134	4.452E+04	4.467E+05	1.337E-09
I-135	6.958E+05	2.526E+06	3.185E+07
CS-134	0.000E+00	6.863E+09	0.000E+00
CS-136	0.000E+00	1.502E+08	0.000E+00
CS-137	0.000E+00	1.030E+10	0.000E+00
CS-138	0.000E+00	3.589E+05	0.000E+00
BA-139	0.000E+00	1.061E+05	0.000E+00
BA-140	0.000E+00	2.053E+07	0.000E+00
BA-141	0.000E+00	4.172E+04	0.000E+00
BA-142	0.000E+00	4.445E+04	0.000E+00
LA-140	0.000E+00	1.923E+07	0.000E+00
LA-142	0.000E+00	7.602E+05	0.000E+00
CE-141	0.000E+00	1.366E+07	0.000E+00
CE-143	0.000E+00	2.312E+06	0.000E+00
CE-144	0.000E+00	6.946E+07	0.000E+00
PR-143	0.000E+00	0.000E+00	0.000E+00
PR-144	0.000E+00	1.837E+03	0.000E+00
ND-147	0.000E+00	8.408E+06	0.000E+00
W-187	0.000E+00	2.360E+06	0.000E+00
NP-239	0.000E+00	1.706E+06	0.000E+00

* -- See Note, page 3.0-43

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

Table 3.2-2

PATHWAY DOSE FACTORS FOR SECTION 3.2.3 (R_{ijo})*

Page 13 of 21: Dose Factors for Kidney

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
H-3	6.468E+02	0.000E+00	2.353E+03
C-14	5.306E+03	0.000E+00	7.948E+08
NA-24	1.056E+04	1.194E+07	2.453E+07
P-32	0.000E+00	0.000E+00	0.000E+00
CR-51	1.323E+01	4.659E+06	3.657E+04
MN-54	4.984E+03	1.386E+09	1.375E+07
MN-56	1.100E+00	9.035E+05	4.308E-02
FE-55	0.000E+00	0.000E+00	0.000E+00
FE-59	0.000E+00	2.727E+08	0.000E+00
CO-58	0.000E+00	3.811E+08	0.000E+00
CO-60	0.000E+00	2.152E+10	0.000E+00
NI-63	0.000E+00	0.000E+00	0.000E+00
NI-65	0.000E+00	2.970E+05	0.000E+00
CU-64	3.976E+00	6.067E+05	4.990E+05
ZN-65	3.248E+04	7.463E+08	1.469E+10
ZN-69	4.018E-02	0.000E+00	3.125E-11
BR-83	0.000E+00	4.871E+03	0.000E+00
BR-84	0.000E+00	2.026E+05	0.000E+00
BR-85	0.000E+00	0.000E+00	0.000E+00
RB-86	0.000E+00	8.984E+06	0.000E+00
RB-88	0.000E+00	3.307E+04	0.000E+00
RB-89	0.000E+00	1.230E+05	0.000E+00
SR-89	0.000E+00	2.162E+04	0.000E+00
SR-90	0.000E+00	0.000E+00	0.000E+00
SR-91	0.000E+00	2.148E+06	0.000E+00

* -- See Note, page 3.0-43

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 3.2-2
PATHWAY DOSE FACTORS FOR SECTION 3.2.3 (R_{ijo})*

Page 14 of 21: Dose Factors for Kidney

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
SR-92	0.000E+00	7.768E+05	0.000E+00
Y-90	0.000E+00	4.491E+03	0.000E+00
Y-91M	0.000E+00	1.002E+05	0.000E+00
Y-91	0.000E+00	1.073E+06	0.000E+00
Y-92	0.000E+00	1.804E+05	0.000E+00
Y-93	0.000E+00	1.852E+05	0.000E+00
ZR-95	3.108E+04	2.446E+08	2.843E+03
ZR-97	2.590E+01	2.960E+06	1.118E+00
NB-95	4.718E+03	1.409E+08	2.814E+05
MO-99	2.646E+02	3.995E+06	4.944E+08
TC-99M	3.108E-02	1.841E+05	9.700E+02
TC-101	9.786E-04	2.034E+04	5.437E-50
RU-103	4.242E+03	1.084E+08	2.871E+04
RU-105	8.988E-01	6.363E+05	9.420E-02
RU-106	1.065E+05	4.208E+08	3.580E+05
AG-110M	1.092E+04	3.445E+09	6.410E+08
TE-125M	0.000E+00	1.552E+06	0.000E+00
TE-127M	3.752E+04	9.165E+04	1.649E+09
TE-127	4.858E+00	2.994E+03	2.513E+04
TE-129M	3.178E+04	1.972E+07	2.214E+09
TE-129	1.750E-01	2.600E+04	8.315E-09
TE-131M	2.646E+02	8.026E+06	1.488E+07
TE-131	3.990E-02	2.919E+04	1.394E-31
TE-132	1.035E+03	4.223E+06	1.036E+08
I-130	1.526E+04	5.511E+06	1.364E+07

* -- See Note, page 3.0-43

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 3.2-2
PATHWAY DOSE FACTORS FOR SECTION 3.2.3 (R_{ijo})*

Page 15 of 21: Dose Factors for Kidney

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
I-131	5.180E+04	1.721E+07	5.954E+09
I-132	3.948E+03	1.245E+06	5.165E+00
I-133	2.240E+04	2.451E+06	9.876E+07
I-134	2.086E+03	4.467E+05	6.410E-11
I-135	8.470E+03	2.526E+06	3.961E+05
CS-134	1.904E+05	6.863E+09	2.786E+10
CS-136	5.642E+04	1.502E+08	3.674E+09
CS-137	1.722E+05	1.030E+10	2.572E+10
CS-138	4.102E+02	3.589E+05	1.082E-22
BA-139	5.922E-04	1.061E+05	2.876E-10
BA-140	1.343E+01	2.053E+07	9.104E+04
BA-141	6.496E-05	4.172E+04	2.723E-48
BA-142	1.904E-05	4.445E+04	0.000E+00
LA-140	0.000E+00	1.923E+07	0.000E+00
LA-142	0.000E+00	7.602E+05	0.000E+00
CE-141	5.250E+03	1.366E+07	1.297E+04
CE-143	5.642E+01	2.312E+06	1.220E+02
CE-144	5.376E+05	6.946E+07	6.120E+05
PR-143	1.974E+03	0.000E+00	3.287E+02
PR-144	6.720E-03	1.837E+03	1.451E-53
ND-147	3.150E+03	8.408E+06	5.559E+02
W-187	0.000E+00	2.360E+06	0.000E+00
NP-239	6.622E+01	1.706E+06	1.032E+01

* -- See Note, page 3.0-43

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

Table 3.2-2
PATHWAY DOSE FACTORS FOR SECTION 3.2.3 $(R_{ijo})^*$

Page 16 of 21: Dose Factors for Lung

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
H-3	6.468E+02	0.000E+00	2.353E+03
C-14	5.306E+03	0.000E+00	7.948E+08
NA-24	1.056E+04	1.194E+07	2.453E+07
P-32	0.000E+00	0.000E+00	0.000E+00
CR-51	1.284E+04	4.659E+06	3.257E+05
MN-54	9.996E+05	1.386E+09	0.000E+00
MN-56	1.253E+04	9.035E+05	0.000E+00
FE-55	8.694E+04	0.000E+00	6.789E+07
FE-59	1.015E+06	2.727E+08	1.842E+08
CO-58	7.770E+05	3.811E+08	0.000E+00
CO-60	4.508E+06	2.152E+10	0.000E+00
NI-63	2.086E+05	0.000E+00	0.000E+00
NI-65	8.120E+03	2.970E+05	0.000E+00
CU-64	9.296E+03	6.067E+05	0.000E+00
ZN-65	6.468E+05	7.463E+08	0.000E+00
ZN-69	1.470E+03	0.000E+00	0.000E+00
BR-83	0.000E+00	4.871E+03	0.000E+00
BR-84	0.000E+00	2.026E+05	0.000E+00
BR-85	0.000E+00	0.000E+00	0.000E+00
RB-86	0.000E+00	8.984E+06	0.000E+00
RB-88	0.000E+00	3.307E+04	0.000E+00
RB-89	0.000E+00	1.230E+05	0.000E+00
SR-89	2.030E+06	2.162E+04	0.000E+00
SR-90	1.124E+07	0.000E+00	0.000E+00
SR-91	5.264E+04	2.148E+06	0.000E+00

* -- See Note, page 3.0-43

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

Table 3.2-2
PATHWAY DOSE FACTORS FOR SECTION 3.2.3 $(R_{ijo})^*$

Page 17 of 21: Dose Factors for Lung

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
SR-92	2.380E+04	7.768E+05	0.000E+00
Y-90	2.688E+05	4.491E+03	0.000E+00
Y-91M	2.786E+03	1.002E+05	0.000E+00
Y-91	2.450E+06	1.073E+06	0.000E+00
Y-92	2.450E+04	1.804E+05	0.000E+00
Y-93	7.644E+04	1.852E+05	0.000E+00
ZR-95	1.750E+06	2.446E+08	0.000E+00
ZR-97	1.103E+05	2.960E+06	0.000E+00
NB-95	4.788E+05	1.409E+08	0.000E+00
MO-99	1.348E+05	3.995E+06	0.000E+00
TC-99M	8.106E+02	1.841E+05	4.713E+01
TC-101	5.838E+02	2.034E+04	2.494E-59
RU-103	5.516E+05	1.084E+08	0.000E+00
RU-105	1.568E+04	6.363E+05	0.000E+00
RU-106	1.156E+07	4.208E+08	0.000E+00
AG-110M	3.668E+06	3.445E+09	0.000E+00
TE-125M	4.466E+05	1.552E+06	0.000E+00
TE-127M	1.312E+06	9.165E+04	0.000E+00
TE-127	1.035E+04	2.994E+03	0.000E+00
TE-129M	1.680E+06	1.972E+07	0.000E+00
TE-129	2.996E+03	2.600E+04	0.000E+00
TE-131M	1.988E+05	8.026E+06	0.000E+00
TE-131	2.058E+03	2.919E+04	0.000E+00
TE-132	3.402E+05	4.223E+06	0.000E+00
I-130	0.000E+00	5.511E+06	0.000E+00

* -- See Note, page 3.Ø-43

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

Table 3.2-2
PATHWAY DOSE FACTORS FOR SECTION 3.2.3 $(R_{ijo})^*$

Page 18 of 21: Dose Factors for Lung

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
I-131	0.000E+00	1.721E+07	0.000E+00
I-132	0.000E+00	1.245E+06	0.000E+00
I-133	0.000E+00	2.451E+06	0.000E+00
I-134	0.000E+00	4.467E+05	0.000E+00
I-135	0.000E+00	2.526E+06	0.000E+00
CS-134	7.966E+04	6.863E+09	1.142E+10
CS-136	1.176E+04	1.502E+08	7.512E+08
CS-137	7.126E+04	1.030E+10	1.041E+10
CS-138	6.538E+01	3.589E+05	1.689E-23
BA-139	5.950E+03	1.061E+05	2.901E-10
BA-140	1.596E+06	2.053E+07	2.355E+05
BA-141	2.968E+03	4.172E+04	2.754E-48
BA-142	1.554E+03	4.445E+04	0.000E+00
LA-140	1.680E+05	1.923E+07	0.000E+00
LA-142	8.218E+03	7.602E+05	0.000E+00
CE-141	5.166E+05	1.366E+07	0.000E+00
CE-143	1.162E+05	2.312E+06	0.000E+00
CE-144	9.842E+06	6.946E+07	0.000E+00
PR-143	4.326E+05	0.000E+00	0.000E+00
PR-144	1.610E+03	1.837E+03	0.000E+00
ND-147	3.220E+05	8.408E+06	0.000E+00
W-187	3.962E+04	2.360E+06	0.000E+00
NP-239	5.950E+04	1.706E+06	0.000E+00

* -- See Note, page 3.0-43

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

Table 3.2-2
PATHWAY DOSE FACTORS FOR SECTION 3.2.3 $(R_{ijo})^{*}$

Page 19 of 21: Dose Factors for GI-LLI

ISOTOPE	INHALATION	GROUND PLANE	GPS/COW/MILK
H-3	6.468E+02	0.000E+00	2.353E+03
C-14	5.306E+03	0.000E+00	7.948E+08
NA-24	1.056E+04	1.194E+07	2.453E+07
P-32	1.610E+04	0.000E+00	3.448E+09
CR-51	3.570E+02	4.659E+06	7.478E+06
MN-54	7.056E+03	1.386E+09	2.279E+07
MN-56	7.168E+04	9.035E+05	4.554E+00
FE-55	1.095E+03	0.000E+00	1.763E+07
FE-59	2.478E+04	2.727E+08	2.978E+08
CO-58	1.113E+04	3.811E+08	9.623E+07
CO-60	3.192E+04	2.152E+10	3.337E+08
NI-63	2.422E+03	0.000E+00	1.709E+08
NI-65	5.012E+04	2.970E+05	4.805E+01
CU-64	1.498E+04	6.067E+05	6.056E+06
ZN-65	5.138E+04	7.463E+08	2.559E+10
ZN-69	1.322E+04	0.000E+00	6.133E-09
BR-83	0.000E+00	4.871E+03	0.000E+00
BR-84	0.000E+00	2.026E+05	0.000E+00
BR-85	0.000E+00	0.000E+00	0.000E+00
RB-86	3.038E+03	8.984E+06	9.059E+08
RB-88	3.388E+02	3.307E+04	2.904E-44
RB-89	6.818E+01	1.230E+05	1.850E-52
SR-89	6.398E+04	2.162E+04	4.116E+08
SR-90	1.310E+05	0.000E+00	2.415E+09
SR-91	7.336E+04	2.140E+06	5.115E+05

* -- See Note, page 3.0-43

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

Table 3.2-2

PATHWAY DOSE FACTORS FOR SECTION 3.2.3 $(R_{ijo})^*$

Page 20 of 21: Dose Factors for GI-LLI

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
SR-92	1.400E+05	7.268E+05	7.962E+01
Y-90	1.040E+05	4.491E+03	1.496E+06
Y-91M	2.352E+03	1.002E+05	2.985E-15
Y-91	7.028E+04	1.073E+06	8.354E+06
Y-92	1.266E+05	1.804E+05	1.633E+01
Y-93	1.666E+05	1.852E+05	2.826E+04
ZR-95	2.170E+04	2.446E+08	1.314E+06
ZR-97	1.400E+05	2.960E+06	7.073E+04
NB-95	1.267E+04	1.409E+08	3.314E+08
MO-99	4.872E+04	3.995E+06	1.090E+08
TC-99M	2.030E+03	1.841E+05	2.618E+04
TC-101	8.442E+02	2.034E+04	7.771E-57
RU-103	1.610E+04	1.084E+08	1.678E+05
RU-105	4.844E+04	6.363E+05	5.096E+00
RU-106	1.638E+05	4.208E+08	2.299E+06
AG-110M	3.304E+04	3.445E+09	2.324E+10
TE-125M	1.291E+04	1.552E+06	1.143E+08
TE-127M	2.730E+04	9.165E+04	2.703E+08
TE-127	2.436E+04	2.994E+03	2.162E+05
TE-129M	6.902E+04	1.972E+07	5.287E+08
TE-129	2.632E+04	2.600E+04	2.670E-07
TE-131M	1.191E+05	8.026E+06	3.640E+07
TE-131	8.218E+03	2.919E+04	2.202E-30
TE-132	4.410E+04	4.223E+06	6.130E+07
I-130	1.988E+03	5.511E+06	2.663E+06

* -- See Note, page 3.0-43

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 3.2-2

PATHWAY DOSE FACTORS FOR SECTION 3.2.3 $(R_{ijo})^*$

Page 21 of 21: Dose Factors for GI-LLI

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK
I-131	1.058E+03	1.721E+07	1.820E+08
I-132	1.904E+03	1.245E+06	3.750E+00
I-133	2.156E+03	2.451E+06	1.421E+07
I-134	1.289E+03	4.467E+05	5.927E-11
I-135	1.834E+03	2.526E+06	1.286E+05
CS-134	1.334E+03	6.863E+09	2.940E+08
CS-136	1.428E+03	1.502E+08	1.400E+08
CS-137	1.334E+03	1.030E+10	2.996E+08
CS-138	8.764E+02	3.589E+05	3.468E-22
BA-139	5.096E+04	1.061E+05	4.572E-05
BA-140	3.836E+04	2.053E+07	9.418E+07
BA-141	4.746E+03	4.172E+04	8.075E-44
BA-142	6.930E+02	4.445E+04	0.000E+00
LA-140	8.484E+04	1.923E+07	2.991E+05
LA-142	5.950E+04	7.602E+05	1.716E-05
CE-141	2.156E+04	1.366E+07	2.174E+07
CE-143	4.970E+04	2.312E+06	2.444E+06
CE-144	1.484E+05	6.946E+07	2.123E+08
PR-143	3.724E+04	0.000E+00	1.248E+06
PR-144	4.284E+03	1.837E+03	1.863E-48
ND-147	3.122E+04	8.408E+06	9.137E+05
W-187	3.556E+04	2.360E+06	3.929E+06
NP-239	2.492E+04	1.786E+06	1.496E+05

* -- See Note, page 3.0-43

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

NOTE: The R_{ijo} values of Table 3.2-2 were calculated according to the methods of Ref. 6, Section 5.3, for the pathways and age group of the designated Maximum Exposed Individual. The values used for the various parameters required for the calculations, and the origins of those values, are given below in Table 3.2-3. The selection of the designated Maximum Exposed Individual is explained in the Notes to Tables 3.2-4 and 3.2-5.

Table 3.2-3
PARAMETERS USED IN DOSE FACTOR CALCULATIONS

Parameter	Value	Orgin of Value: Table in R.G. 1.1Ø9	Orgin of Value: Section of NUREG-Ø133
	For P_i		
DFA	Each Radionuclide	E-9	
BR	37ØØ m^3/yr	E-5	
	For R_i (Inhalation)		
BR	Each age group	E-5	
DFA_i	Each age group, nuclide and organ	E-9 and E-1Ø	
	For Ri (Ground Plane)		
SF	Ø.7	E-15	
DFG_i	Each radionuclide (Note 4)	E-6	
t	4.73 E+Ø8 sec		5.3.1.2

Table 3.2-3
PARAMETERS USED IN DOSE FACTOR CALCULATIONS

Parameter	Value	Orgin of Value: Table in R.G. 1.109	Orgin of Value: Section of NUREG-0133
	For R_i (Vegetation)		
r	Each element type	E-1	
Y_v	2.0 kg/m²	E-15	
λ_w	5.73 E-7 sec^{-1}		5.3.1.3
DFL_i	Each age group, organ, and nuclide	E-13 and E-14	
U_aL	Each age group	E-5	
f_L	1.0		5.3.1.5
t_L	8.6 E+04 sec	E-15	
U_aS	Each age group	E-5	
f_g	0.76		5.3.1.5
th	5.18 E+06 sec	E-15	
H	8.1 gm/m³	***Note 1***	
	For R_i (Grass/Cow/Milk)		
QF	50 kg/day	E-3	
U_{ap}	Each age group	E-5	
λ_w	5.73 E-07 sec^{-1}		5.3.1.3
F_m	Each element	E-1	

Table 3.2-3
PARAMETERS USED IN DOSE FACTOR CALCULATIONS

Parameter	Value	Origin of Value: Table in R.G. 1.109	Origin of Value: Section of NUREG-0133
r	Each element type	E-15	
t_h	5.18 E+06 sec	E-15	
H	8.1 gm/m^3	***Note 1***	
DFL_i	Each age group, organ, and nuclide	E-13 and E-14	
Y_p	0.44 kg/m^2	***Note 2***	
Y_s	2.0 kg/m^2	E-15	
t_f	1.73 E+05 sec	E-15	
f_p	1.0		5.3.1.2
f_s	1.0		5.3.1.2
	For R_i (Grass/Cow/Meat)		
		Note 3	
Q_F	50 kg/day	E-3	
U_{ap}	Each age group	E-5	
F_f	Each element	E-1	
r	Each element type	E-15	
t_h	5.18 E+06 sec	E-15	
H	8.1 gm/m3	***Note 1***	
DFL_i	Each age group, organ, and nuclide	E-13 and E-14	
Y_p	0.44 kg/m^2	***Note 2***	

Table 3.2-3
PARAMETERS USED IN DOSE FACTOR CALCULATIONS

Parameter	Value	Origin of Value: Table in R.G. 1.109	Origin of Value: Section of NUREG-0133
Y_s	2.0 kg/m^2	E-15	
t_f	1.73 E+05 sec	E-15	
f_p	1.0		5.3.1.2
f_s	1.0		5.3.1.2
λ_w	5.73 E-07 sec^{-1}		5.3.1.3

Notes

1. Site-specific annual average absolute humidity, from Ref. 3, Section 2.1.3.4.

2. Site specific areal productivity of pasture feed grass, from Ref. 3, Section 2.1.3.4.

3. No evidence was found in any land use or demographic information that animals are kept for meat within 5 miles of the Station. These values are included for reference only, should the need for them arise.

4. The "Total Body" dose factors from the referenced table were applied to all organs.

Table 3.2-4
CONTROLLING RECEPTORS, LOCATIONS, AND PATHWAYS*

SECTOR	(MILES/METERS)	PATHWAYS@	AGE GROUP
N +,#	---		
NNE	5.0 / 8,000	Vegetation, Grass/Cow/Milk	Child
NE #	4.5 / 7,200	Vegetation	Child
ENE #	3.4 / 5,500	Vegetation	Child
E #	3.3 / 5,300	---	Child
ESE +,#	---		
SE +	---		
**	5.0 / 8,000	Grass/Cow/Milk	Infant
SSE +,#	---		
S #	4.2 / 6,800	Vegetation	Child
SSW #	5.0 / 8,000	Vegetation	Child
SW #	4.3 / 6,900	Vegetation	Child
WSW #	4.4 / 7,100	Vegetation	Child
W	4.9 / 7,900	Grass/Cow/Milk	Infant
WNW #	3.4 / 5,500	Vegetation	Child
NW #	4.0 / 6,400	Vegetation	Child
NNW #	4.3 / 6,900	Vegetation	Child

---

* -- See Note on following page for the method of choice of these controlling receptors.

@ -- Listed pathways are in addition to inhalation and ground plane exposure.

+ -- This sector is uninhabited within 5 miles of the Station.

-- If a cow were located at 5.0 miles (8,000 meters) in this sector, an infant consuming its milk would receive a greater total radiation dose than would the real receptor listed.

** - This hypothetical infant exposed to the Grass/Cow/Milk pathway represents the Maximum Exposed Individual for the Site.

Note: The controlling receptor in each sector was identified in the following way. Receptor locations and associated pathways were obtained from Table 2.1-8 of Ref. 3, as updated by Appendix F of Ref. 7. A child was assumed at each location, except that where a milk cow was listed, an infant was also assumed. In addition, as a safeguard against underestimation of dose to people just beyond the 5-mile zone, a hypothetical Grass/Cow/Milk pathway was assumed at 5 miles from the Site, in each sector which does not have an actual Grass/Cow/Milk pathway within 5 miles (see Ref. 6, Section 5.3.1).

Annual average X/Q and D/Q values for each receptor were obtained by interpolation of values generated by USNRC Staff executions of the program XOQDOQ. These are the same parameters used by NRC Staff in the preparation of Ref. 8.

Expected annual releases of each nuclide were taken from Table 3.5-22 of Ref. 3.

The pathway dose factors given below in Tables 4.3-1 and 4.3-2 were then used in the methodology of Section 3.2.3 of this Manual to compute estimated annual doses to each candidate receptor location for the pathways existing at that location. The controlling receptor for each sector was then chosen as the candidate receptor with the highest estimated total annual dose of any given receptor in the given sector. The Maximum Exposed Individual for the Site was selected as the candidate receptor with the highest estimated total annual dose of all candidates in any sector.

Table 3.2-5
ATMOSPHERIC DISPERSION PARAMETERS FOR
CONTROLLING RECEPTOR LOCATIONS*

SECTOR	(MILES/METERS)	$\overline{X/Q}$ (sec/m^3)	$\overline{D/Q}$ (m^{-2})
N +	---		
NNE	5.0 / 8,000	8.6 E-08	2.4 E-10
NE	4.5 / 7,200	1.0 E-07	3.1 E-10
ENE	3.4 / 5,500	1.4 E-07	5.6 E-10
E	3.3 / 5,300	1.6 E-07	8.2 E-10
ESE +	---		
SE +	---		
SE **	5.0 / 8,000	1.1 E-07	4.9 E-10
SSE +	---		
S	4.2 / 6,800	1.6 E-07	4.2 E-10
SSW	5.0 / 8,000	8.8 E-08	2.2 E-10
SW	4.3 / 6,900	1.2 E-07	2.9 E-10
WSW	4.4 / 7,100	9.4 E-08	1.8 E-10
W	4.9 / 7,900	7.6 E-08	1.3 E-10
WNW	3.4 / 5,500	1.3 E-07	2.6 E-10
NW	4.0 / 6,400	1.6 E-07	5.8 E-10
NNW	4.3 / 6,900	1.1 E-07	4.0 E-10

* -- Annual average relative dispersion and deposition values for the locations in Table 3.2-4. (All receptors represent real pathways, except as noted.) X/Q and D/Q values were obtained, and analysis performed, as described in the Note to Table 3.2-4 of this Manual. The Maximum Exposed Individual for the site was identified as a hypothetical infant consuming the milk of a cow pastured at 5.0 miles in the SE sector.

Therefore, the Site $\overline{X/Q}$' and $\overline{D/Q}$' (Section 3.2.3) are those from this Table for that location. [The real receptor with the highest estimated exposure would be a child consuming the milk of a cow pastured at 5.0 miles in the NNE sector, and eating the vegetables grown there.]

+ -- This sector is uninhabited within 5 miles of the Station.

** - This hypothetical infant exposed to the Grass/Cow/Milk pathway represents the Maximum Exposed Individual for the Site.

3.3 METEOROLOGICAL MODEL

The dose calculation methods for gaseous effluents described in Section 3.2 require the use of annual average relative dispersion (X/Q) and relative deposition (D/Q) parameters. When new or revised values of these parameters must be computed, the method detailed below will be used. All release points are treated as ground level. The computation of the dispersion and deposition parameters is based on the onsite meteorological data, and is implemented in a sector-averaged diffusion model.

3.3.1 Meteorological Input

Joint frequency distributions of wind speed and direction by atmospheric stability class are used for the diffusion calculations. The meteorological tower is located approximately 1.0 mile southeast of HCGS. All meteorological data are from the Artificial Island meteorological tower. The flat, uncomplicated terrain that surrounds the site for a considerable distance in every direction, ensures excellent representation of the regional airflow by the Artifical Island meteorological tower measurements. Wind speed and direction data from the 33-foot tower level are used as input for the joint frequency distributions.

Joint frequency distributions of wind speed and direction by atmospheric stability class are computed for 22.5 degree sectors using the wind speed groups and atmospheric stability classes suggested in Regulatory Guide 1.23. Joint frequency distributions of wind direction, speed, and stability from the 33-foot level are used as input for both vents.

With the exception of the calm and the 25+ mph groups, the median speed from each wind speed group is used to represent the group in the diffusion calculations. For conservatism, a wind speed of 0.38 mph, equal to one-half of the highest threshold of the vane and propeller, is assigned to the calms. A wind speed of 26 mph is used to represent the 25+ mph group.

3.3.2 Source Configuration

Radionuclides are routinely released from two sources, the south and north vents. Their source characteristics are given as follows:

Parameter	South Vent	North Vent
Height above grade, m	35.05	35.05
Exit diameter; m, the equivalent circ diam for for rectangular vents	4.13	2.23
Exit velocity, m/s		
Summer (Apr - Sept)	15.54	5.08
Winter (Oct - Mar)	10.82	5.08

Both vents, pointing upward, are adjacent to the tops of the turbine buildings, below the level of the reactor contaiment dome. Therefore, the vents are affected by the nearby building aerodynamics with moderate to strong winds.

The release is assumed to be at ground level, and a building wake correction factor (reactor building height squared) of 3819 m2 is used in accordance with the methodology of Regulatory Guide 1.111, Revision 1.

The building wake correction factor takes into consideration the initial mixing of the plume within the building cavity.

The exit velocities for the south plant vent are significantly higher than those for the north plant vent. The assumption made in Regulatory Guide 1.111 (Revision 1) about the height of adjacent solid structures (i.e., reactor building dome) is simplistic in the case of effluents released at high exit velocities from vents oriented upward (versus horizontal). With the consideration of the reactor building dome as an adjacent structure, the projected effluent path becomes complicated because the transport wind and associated entrainment will be sector dependent. Therefore, the X/Q and D/Q values are conservative when based on a ground level release.

3.3.3 Site Impact on Vent Releases

The effect of the cooling tower on the relatively low-level vent releases during neutral and unstable atmospheric conditions would be to enhance the vertical diffusion through increased mechanical turbulence, and thus reduce ground-level concentrations. Therefore, to be conservative in the estimation of ground-level concentrations for neutral and unstable conditions, the wake effect of the cooling tower has been neglected.

3.3.4 Diffusion Model

The sector-averaged Gaussian plume equation, as expressed in Regulatory Guide 1.111, Revision 1, is used for all X/Q calculations.

3.3.5 Terrain Correctors

Changes in terrain elevation, though very small in the immediate vicinity of the plant, are applied at each receptor. Terrain heights above plant grade, which is 4 meters mean sea level (MSL), are used in the calculations, where applicable. The terrain height correction applied to any particular receptor is the highest terrain between the source and the receptor.

3.3.6 Atmospheric Stability

Atmospheric stability classes are determined using the vertical temperature difference between the 300 and 33-foot levels of the Artificial Island tower. The seven lapse rate classes for stability classification are those recommended in Regulatory Guide 1.23.

3.3.7 Dispersion Coefficients

The horizontal and vertial dispersion coefficients, sigma y and sigma z for each turbulence class, are computed using analytical approximations to the P-G sigma curves given in Regulatory Guide 1.111, Revision 1. These dispersion coefficients were developed for flat to rolling terrain, similar to that surrounding the Hope Creek site.

3.3.8 Deposition

Relative depletion by dry deposition is estimated in accordance with Regulatory Guide 1.111, Revision 1. The depleted by deposition X/Q values are obtained from the X/Q values by multiplying the X/Q values

by the fraction remaining in the plume. These fractions are determined from Regulatory Guide 1.111, Revision 1, Figure 2.

Relative dry deposition is also estimated in acordance with Regulatory Guide 1.111, Revision 1.

3.3.9 X/Q Model

The following ground level, wake-corrected form of the straight line flow model is used to implement the methods discussed in Sections 3.3.1 - 3.3.8.

X/Q = the sector-averaged annual average relative concentration at any distance in the given sector (sec/m3)

$$= 2.032\, \delta \sum_{ij} \frac{n_{ij}}{N\, r\, u_i\, \Sigma_{zj}}$$

2.032 = $(2/\pi)^{1/2}$ divided by the width in radians of a 22.5-degree sector (0.3927 radians).

δ = plume depletion factor at distance r for the appropriate stability class from Figure 3.3-1.

i = windspeed class.

$n_{i,j}$ = number of hours meteorological conditions are observed to be in a given wind direction, windspeed class i, and atmospheric stability class j.

N = total hours of valid meteorological

data.

r = distance from the contaiment building to location of interest (m)

u_i = wind speed (midpoint of windspeed class i) at ground level (m/sec).

$$\Sigma_z = \text{the lesser of } \begin{cases} (\sigma_z^2 + 3819/2\pi)^{1/2} \\ \text{or} \\ (3\ \sigma_z)^{1/2} \end{cases}$$

where:

σ_z = vertical standard deviation of the plume (in m) at distance r for ground level releases under the stability category indicated by $\Delta T/\Delta Z$, from Figure 3.3-2.

$\Delta T/\Delta Z$ = temperature differential with vertical separation (°K/100m).

3.3.10 D/Q Model

The following relative deposition model for ground level releases is used to implement the mehtods discussed in Sections 3.3.1 - 3.3.8.

D/Q = the sector-averaged annual average relative deposition at any distance in a given sector (m^{-2}).

$$= \frac{2.55\ D_g\ n}{r\ N} \qquad \text{where,}$$

D_g	=	deposition rate for ground-level releases relative to distance (r) from the containment building (from Figure 3.3-3).
2.55	=	the inverse of the number of radians in a 22.5° sector
	=	$\frac{1}{(22.5\ )\ (0.0175 \text{ Radians}/^{\circ})}$
n	=	number of hours wind is in given direction (sector).
N	=	total hours of valid meteorological data.

Figure 3.3-1
Plume Depletion Effect for Ground-Level Releases (5)
(All Atmospheric Stability Classes)

Graph taken from Reference 5, Figure 2

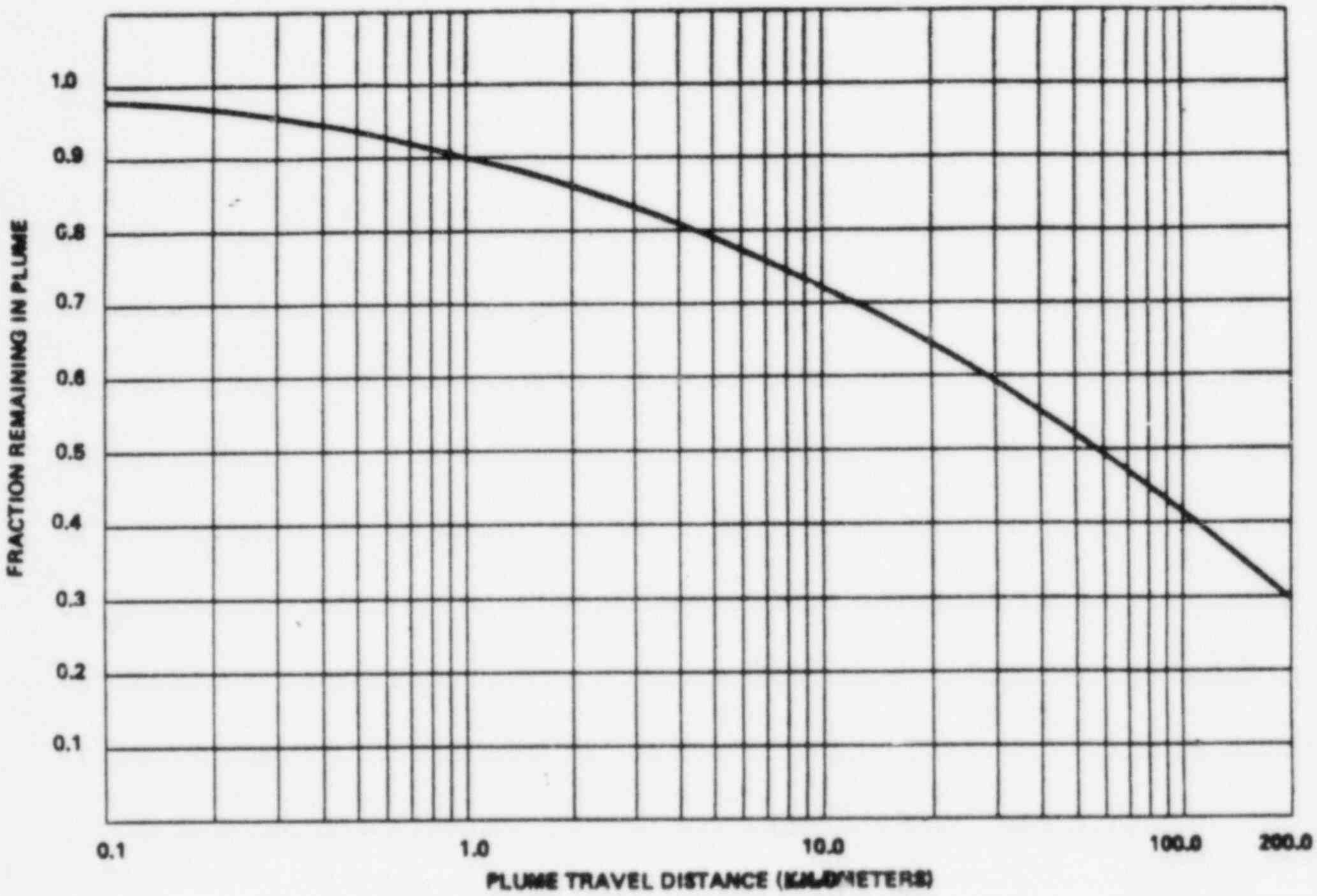
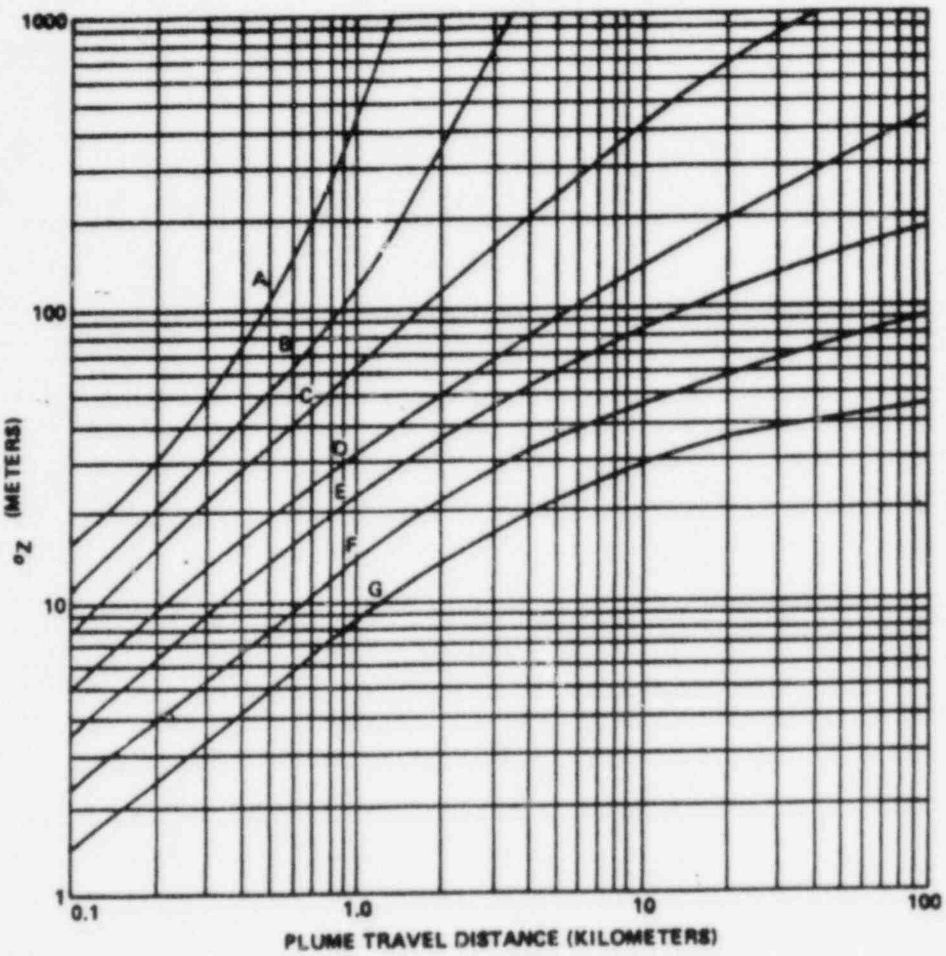


Figure 3.3-2
Vertical Standard Deviation of Material Concentration in a Plume (σ_z)
(Letters denote Pasquill Stability Class)

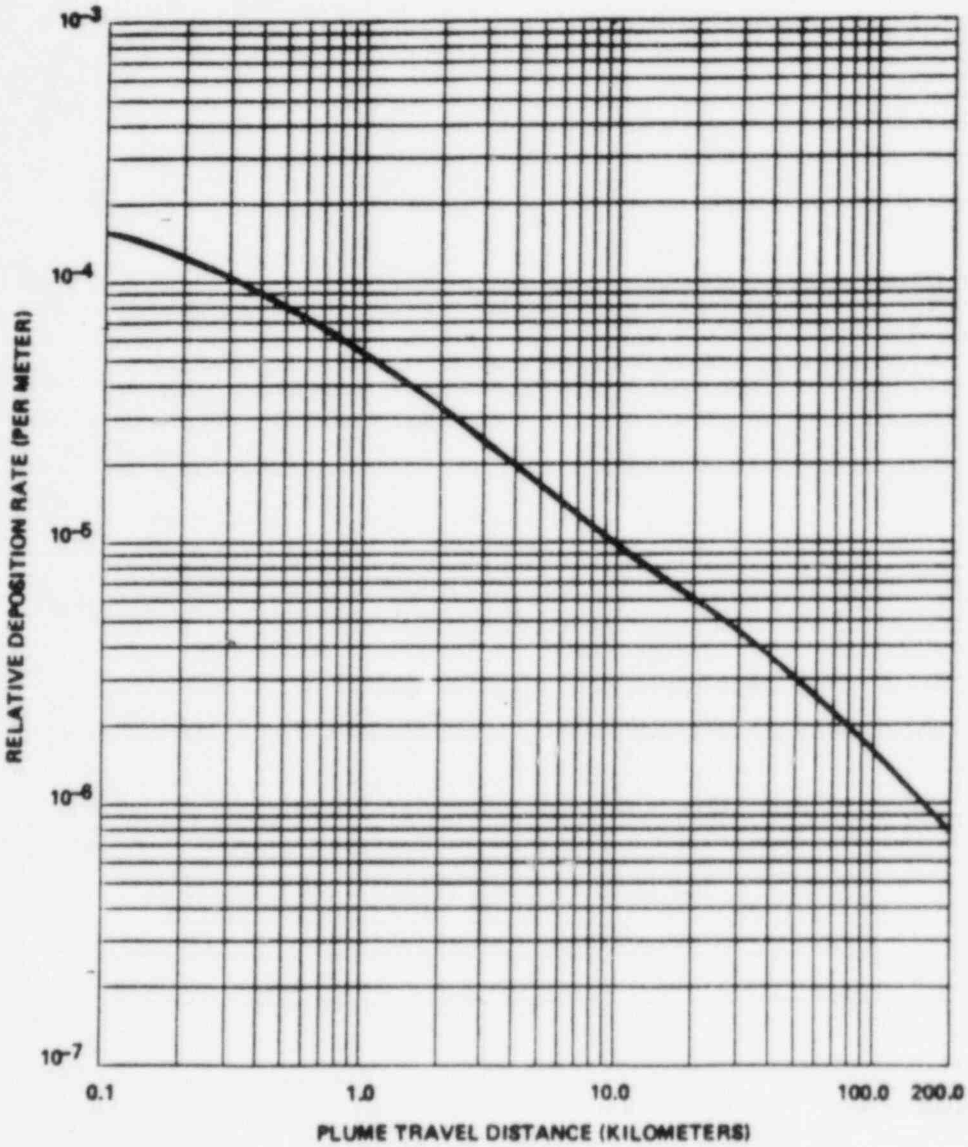
Graph taken from Reference 5, Figure 1



Temperature Change with Height ΔT/ ΔZ (°K/100m)	Pasquill Categories	Stability Classification
< -1.9	A	Extremely Unstable
-1.9 to -1.7	B	Moderately Unstable
-1.7 to -1.5	C	Slightly Unstable
-1.5 to -0.5	D	Neutral
-0.5 to 1.5	E	Slightly Stable
1.5 to 4.0	F	Moderately Stable
> 4.0	G	Extremely Stable

Figure 3.3-3
Relative Deposition for Ground-Level Releases (D_g)
(All Atmospheric Stability Classes)

Graph taken from Reference 5, Figure 6



3.4 DEFINITIONS OF GASEOUS EFFLUENTS TERMS

Term		Definition	Section of Initial Use
a_v	=	the administrative allocation factor for vent v [unitless], which is the fraction of the station site boundary dose rate limit which is assigned to vent v.	(3.1.1)
D_b	=	the site boundary air dose due to beta emissions from noble gas radionuclides [mrad].	(3.2.2)
D_g	=	the site boundary air dose due to gamma emissions from noble gas radionuclides [mrad].	(3.2.2)
D_o^{mp}	=	dose to organ o of a Member of the Public, from radioiodines, tritium, and radionuclides in particulate form with half-lives greater than 8 days [mrem].	(3.2.3)
$\overline{D/Q}'$	=	the annual average relative deposition at the location of the Maximum Exposed Individual [m^{-2}].	(3.2.3)
F_v	=	the expected flow rate in vent v [cc/sec].	(3.1.1)
K_i	=	total body dose factor for gamma emissions from noble gas radionuclide i [mrem/yr per uCi/m^3], from Table 3.1-1.	(3.1.1)

Term		Definition	Section of Initial Use
L_i	=	skin dose factor for beta emissions from noble gas radionuclide i [mrem/yr per uCi/m^3], from Table 3.1-1.	(3.1.1)
M_i	=	air dose factor for gamma emissions from noble gas radionuclide i [mrad/yr per uCi/m^3], from Table 3.1-1.	(3.1.1)
N_i	=	air dose factor for beta emissions from noble gas radionuclide i [mrad/yr per uCi/m^3], from Table 3.1-1.	(3.2.2)
P_{io}	=	dose parameter for radionuclide i and organ o, for inhalation, from Table 3.2-1 [mrem/yr per uCi/m^3].	(3.2.1.b)
$\dot{Q}_i$	=	the release rate of noble gas radionuclide i as determined from the concentration measured in the analysis of the appropriate sample required by the Technical Specification Table 4.11-2 [uCi/sec].	(3.2.1.a)
$\dot{Q}_i'$	=	the release rate of non-noble gas radionuclide i as determined from the concentration measured in the analysis of the appropriate sample required by the Technical Specification Table 4.11-2 [uCi/sec].	(3.2.1.b)

Term		Definition	Section of Initial Use
$\tilde{Q}_i$	=	cumulative release of noble gas radionuclide i over the period of interest [uCi].	(3.2.2)
$\tilde{Q}_i'$	=	cumulative release of non-noble gas radionuclide i over the period of interest [uCi].	(3.2.3)
R_{ijo}	=	dose factor for organ o due to radionuclide i and pathway j, from Table 3.2-2 [mrem/yr per uCi/m^3, or m^2 - mrem/yr per uCi/sec].	(3.2.3)
S_v	=	the normal radiation monitor setpoint for vent v [uCi/cc].	(3.1.1)
S_v'	=	the conservative radiation monitor setpoint for vent v, assuming all noble gas is Kr-89 [uCi/cc].	(3.1.2)
S_{vs}	=	the normal candidate setpoint for vent v, based upon the skin dose rate limit of 3000 mrem/yr [uCi/cc].	(3.1.1)
S_{vs}'	=	the conservative candidate setpoint for vent v, based upon the skin dose rate limit of 3000 mrem/yr, and assuming all noble gas is Kr-89 [uCi/cc].	(3.1.2)
S_{vt}	=	the normal candidate setpoint for vent v, based upon the total body dose rate limit of 500 mrem/yr [uCi/cc].	(3.1.1)

Term	Definition	Section of Initial Use
S_{vt}' =	the conservative candidate setpoint for vent v, based upon the total body dose rate limit of 500 mrem/yr, and assuming all noble gas is Kr-89 [uCi/cc].	(3.1.2)
SF =	the safety factor; a conservative factor used to compensate for statistical fluctuations and errors of measurements.	
W_{ij}' =	relative concentration or relative deposition for the Maximum Exposed Individual, as appropriate for exposure pathway j and radionuclide i. Its value is X/Q' or D/Q', as appropriate.	(3.2.3)
X_{iv} =	the measured concentration of noble gas radionuclide i in the last grab sample analyzed for vent v [uCi/cc].	(3.1.1)
$\overline{X/Q}$ =	the highest annual average relative concentration at the site boundary in any sector [sec/m^3]. For post-release calculations, the actual site boundary X/Q in the affected sector for the period of the release may be substituted.	(3.1.1)
$\overline{X/Q}'$ =	the annual average relative concentration at the location of the Maximum Exposed Individual [sec/m^3].	(3.2.3)

Section 4.0
SPECIAL DOSE CALCULATIONS

Sections 2.0 and 3.0 described calculations which are made in connection with each effluent release. In addition to these calculations, the Technical Specifications (Reference 1) require or imply that certain other types of dose calculations shall be specified in the ODCM. These special dose calculations are described in the present section.

4.1 NECESSITY OF OPERATING EFFLUENT TREATMENT SYSTEMS

4.1.1 Liquid Radwaste Treatment System

Technical Specification 3.11.1.3 reads:

The LIQUID RADWASTE TREATMENT SYSTEM shall be used to reduce the radioactive materials in liquid wastes prior to their discharge when the projected doses due to the liquid effluent, from each reactor unit, to UNRESTRICTED AREAS would exceed 0.06 mrem to the total body or 0.2 mrem to any organ in a 31 day period.

The surveillance requirement for this Specification, which is Technical Specification 4.11.1.3, reads:

Doses due to liquid releases from each reactor unit to UNRESTRICTED AREAS shall be projected at least once per 31 days in accordance with the methodology and parameters in the ODCM.

The Liquid Radwaste Treatment System to which this decision process applies consists of the filters and demineralizers shown schematically in Figure 4.1-1. Prior to rendering the system inoperable, and at least once each 31 days while the system remains inoperable, doses due to liquid effluents shall be projected according to the following guidance:

1. Doses from all liquid effluents from all liquid radioactive waste management components shall be included. For the Hope Creek Generating Station this shall include releases from the Waste Sample Tanks, Floor Drain Sample Tanks, Detergent Drain Tanks, Condensate Storage Tank, and any radioactivity in the Cooling Tower Blowdown Line.

2. The projected release rates used in the dose calculation shall be appropriate to the projected modes of operation of all the liquid radwaste streams. That is, release rates from liquid effluent streams which are projected not to be treated must be based on the analysis of pretreatment samples, and not of samples taken from those streams when the treatment systems are in operation.

3. Doses due to radioactive materials in liquid effluents shall be computed according to the methods of Section 2.2.

4. The projected dose from Step 3 shall be compared to the Technical Specification limits above (0.06 mrem to the total body or 0.2 mrem to any organ). If the projected dose does not exceed the limit, the systems may be operated as assumed in the projection. If the projected dose does exceed the limit, one of two alternative courses must be implemented: a) the treatment systems on some of the streams must be brought into operation until the projected dose does not exceed the limits; or b) all of the Liquid Radwaste Treatment System at the Hope Creek Station must be brought into operation.

4.1.2 Ventilation Exhaust Treatment System

Technical Specification 3.11.2.5 reads:

The VENTILATION EXHAUST TREATMENT SYSTEM shall be used to reduce radioactive materials in gaseous waste prior to their discharge when the projected doses due to gaseous effluent releases, from each reactor unit, to areas at and beyond the SITE BOUNDARY would exceed 0.3 mrem to any organ in a 31 day period.

The surveillance requirement for this Specification, which is Technical Specification 4.11.2.5.1, reads:

Doses due to gaseous releases from the site shall be projected at least once per 31 days in accordance with the ODCM, when the VENTILATION EXHAUST TREATMENT SYSTEM is not in use.

The Ventilation Exhaust Treatment System to which this decision process applies consists of the charcoal and particulate filters shown schematically in Figure 4.1-2. Prior to rendering the system inoperable (other than for routine maintenance), and at least once each 31 days while the system remains inoperable, doses due to gaseous effluents will be projected according to the following guidance:

1. All gaseous effluent pathways from the Hope Creek Station must be included (including those from the Gaseous Radwaste Treatment System).

2. The projected release rates used in the calculation shall be appropriate to the <u>projected</u> modes of operation of all the ventilation exhaust and gaseous radwaste treatment systems at both Stations. That is, release rates from effluent streams which are projected not to be treated must be based on the analysis of pretreatment samples, and not of samples taken from those streams when

the treatment systems are in operation.

3. Dose rates at the Site Boundary shall be computed according to the methods of Section 3.2.1, and multiplied by (31/365 =) 0.0849 to convert them to a projected cumulative dose for 31 days. Doses to the Maximum Exposed Individual shall be computed according to the methods of Section 3.2.3.

4. The projected dose from Step 3 shall be compared to the Tech Spec limit above (0.3 mrem). If the projected dose does not exceed the limit, the systems may be operated as assumed in the projection. If the projected dose does exceed the limit, one of two alternative courses must be implemented: a)the treatment systems on some of the streams must be brought into operation until the projected dose does not exceed the limit; or b)all of the Ventilation Exhaust Treatment System at the Hope Creek Station must be brought into operation.

4.1.3 Gaseous Radwaste Treatment System

Technical Specification 3.11.2.4 reads:

The GASEOUS RADWASTE TREATMENT SYSTEM shall be in operation.

The APPLICABILITY of this Specification is "Whenever the main condenser air ejector system is in operation." The Gaseous Radwaste Treatment System is shown in Figure 4.1-3. No dose projections are required prior to rendering this system inoperable, but this shall not be done unless the main condenser air ejector system is rendered inoperable at the same time.

Figure 4.1-1
LIQUID RADWASTE TREATMENT SYSTEM

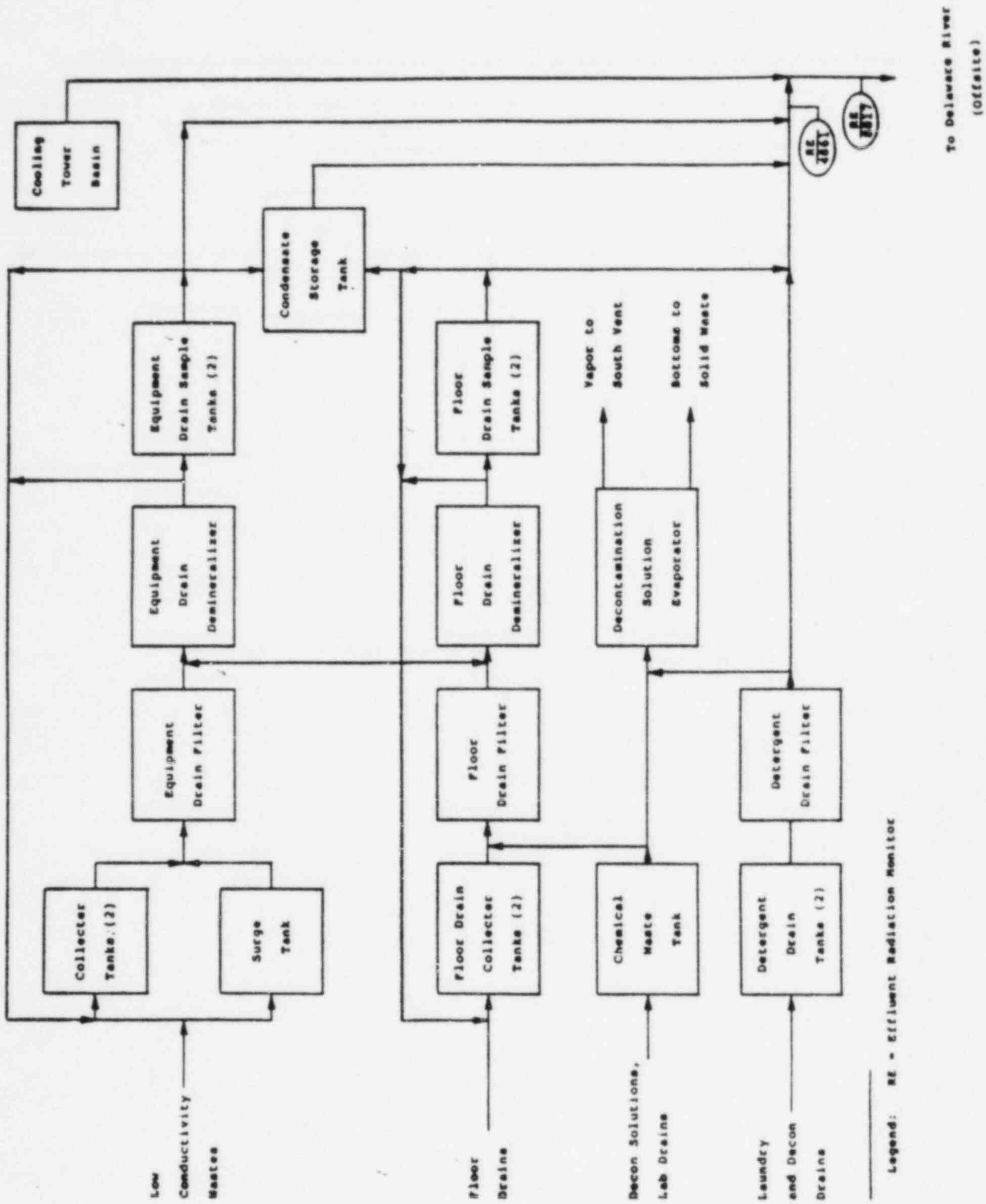
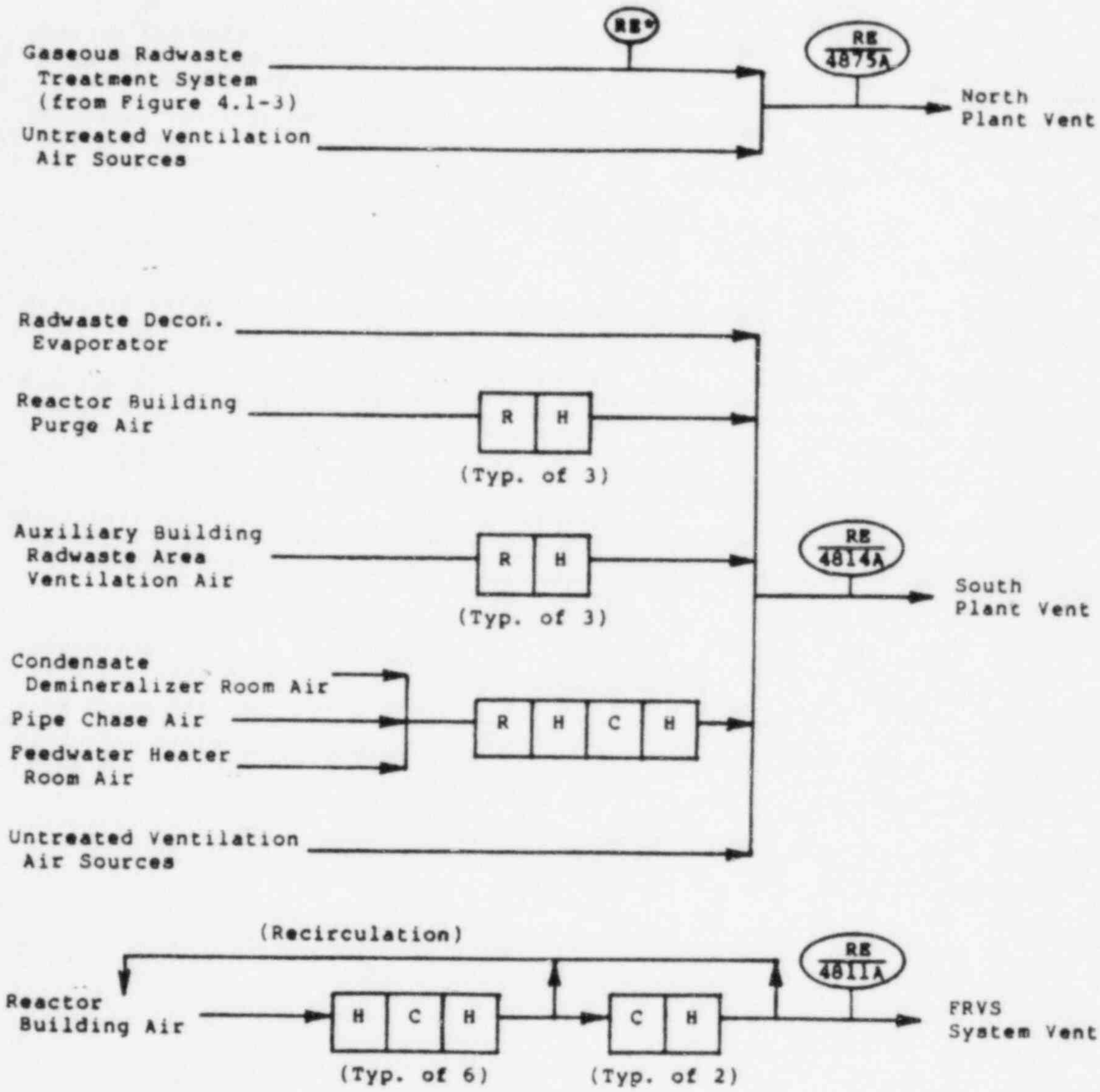
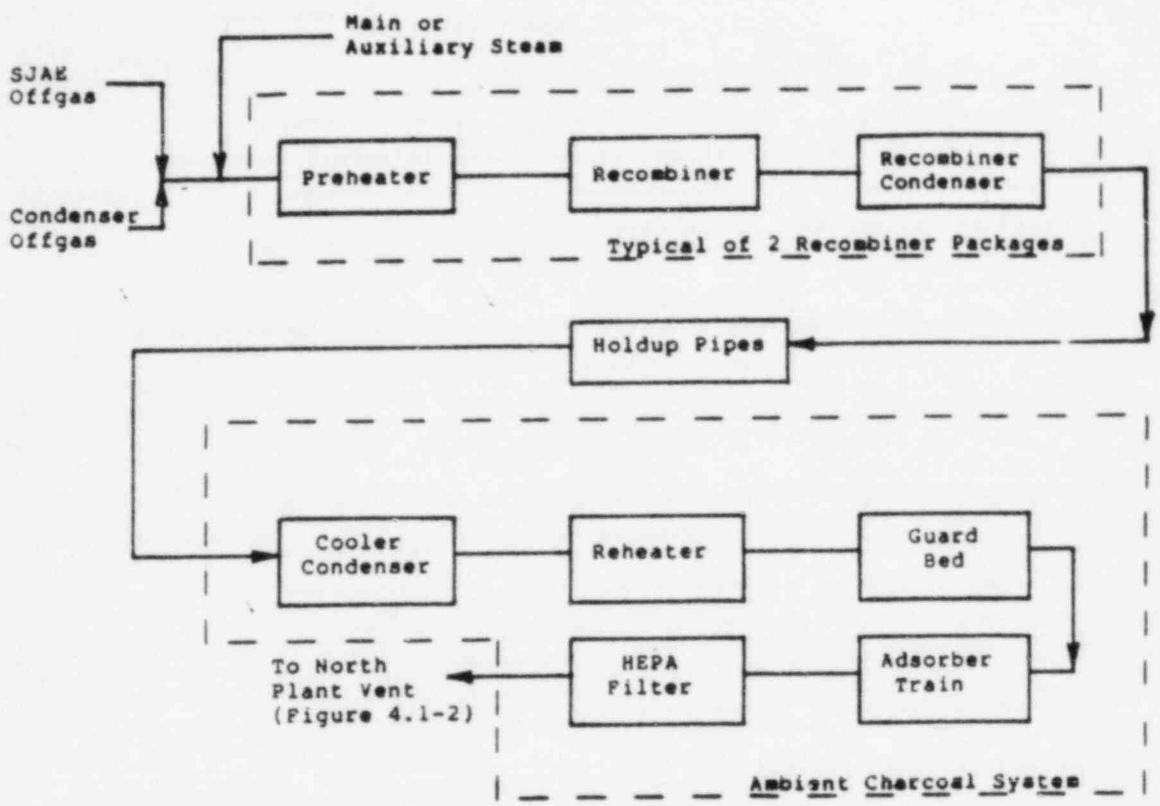


Figure 4.1-2
VENTILATION EXHAUST TREATMENT SYSTEM



Legend:
R = Roughing Filter
C = Charcoal Filter
H = HEPA Filter
RE = Effluent Radiation Monitor
* -- This Post-Treatment Monitor is not an effluent monitor as designated by the RETS.

Figure 4.1-3
GASEOUS RADWASTE TREATMENT SYSTEM



4.2 TOTAL FUEL CYCLE DOSE

Technical Specification 3.11.4 reads in part:

The annual dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

The total annual dose or dose commitment to a Member of the Public will be computed as the sum of the doses due to three components: doses due to radioactivity released in effluents from the Hope Creek Station, doses due to effluents from othe uranium fuel cycle sources, and doses due to direct radiation from fuel cycle sources. When it is necessary to perform an evaluation of the total fuel cycle dose (see Technical Specification 3.11.4.a), it shall be performed according to the following guidance:

1. Doses due to liquid effluents from the Hope Creek Station shall be calculated according to the methods of Section 2.2 of this ODCM, using total releases for the year from all release pathways at the Station.

2. Doses due to gaseous effluents from the Hope Creek Station shall be calculated according to the methods of Section 3.2 of this ODCM, using total releases for the year from all release pathways at the Station.

3. Effluent doses from the Hope Creek Station shall be summed with those from the Salem Station to determine the total dose due to effluents from the uranium fuel cycle.

4. Direct radiation doses from the fuel cycle will be inferred from the evaluation of readings from environmental monitoring devices (see Section 5.1).

4.3 INITIAL EVALUATION OF UNPLANNED GASEOUS RELEASES

For the purpose of initial assessments of the impact of unplanned gaseous releases, dose calculations for the critical receptor in each affected sector may be performed as follows.

For each location, X/Q' and D/Q' will be calculated according to the methods of Section 3.3 of the ODCM, using the measured meteorological parameters for the period of the unplanned release. The location of the critical receptors and the pathways j which should be analyzed for each critical receptor are shown in Table 3.2-4. (For very rough calculations, the annual average X/Q and D/Q for each receptor are given in Table 3.2-5.) The R_{ij} for the appropriate exposure pathways and age groups will be selected from Tables 4.3-1 and 4.3-2.

Table 4.3-1
INFANT PATHWAY DOSE FACTORS FOR SECTION 4.3 (R_{ij})*

Page 1 of 3: Dose Factors for Composite Worst Organ

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
H-3	6.468E+02	0.000E+00	2.353E+03	0.000E+00	0.000E+00
C-14	2.646E+04	0.000E+00	3.722E+09	0.000E+00	0.000E+00
NA-24	1.056E+04	1.385E+07	2.453E+07	0.000E+00	0.000E+00
P-32	2.030E+06	0.000E+00	2.549E+11	0.000E+00	0.000E+00
CR-51	1.284E+04	5.506E+06	7.478E+06	0.000E+00	0.000E+00
MN-54	9.996E+05	1.625E+09	6.205E+07	0.000E+00	0.000E+00
MN-56	7.168E+04	1.068E+06	4.554E+00	0.000E+00	0.000E+00
FE-55	8.694E+04	0.000E+00	2.150E+08	0.000E+00	0.000E+00
FE-59	1.015E+06	3.204E+08	6.234E+08	0.000E+00	0.000E+00
CO-58	7.770E+05	4.464E+08	9.634E+07	0.000E+00	0.000E+00
CO-60	4.508E+06	2.532E+10	3.337E+08	0.000E+00	0.000E+00
NI-63	3.388E+05	0.000E+00	5.558E+10	0.000E+00	0.000E+00
NI-65	5.012E+04	3.451E+05	4.805E+01	0.000E+00	0.000E+00
CU-64	1.498E+04	6.876E+05	6.056E+06	0.000E+00	0.000E+00
ZN-65	6.468E+05	8.583E+08	3.029E+10	0.000E+00	0.000E+00
ZN-69	1.322E+04	0.000E+00	6.133E-09	0.000E+00	0.000E+00
BR-83	3.808E+02	7.079E+03	1.486E+00	0.000E+00	0.000E+00
BR-84	4.004E+02	2.363E+05	1.998E-22	0.000E+00	0.000E+00
BR-85	2.044E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
RB-86	1.904E+05	1.027E+07	3.540E+10	0.000E+00	0.000E+00
RB-88	5.572E+02	3.779E+04	2.982E-44	0.000E+00	0.000E+00
RB-89	3.206E+02	1.476E+05	5.431E-52	0.000E+00	0.000E+00
SR-89	2.030E+06	2.509E+04	2.002E+10	0.000E+00	0.000E+00
SR-90	4.088E+07	0.000E+00	1.934E+11	0.000E+00	0.000E+00
SR-91	7.336E+04	2.511E+06	5.115E+05	0.000E+00	0.000E+00

* -- See Note, page 4.0-16

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 4.3-1

INFANT PATHWAY DOSE FACTORS FOR SECTION 4.3 (R_{ij})*

Page 2 of 3: Dose Factors for Composite Worst Organ

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
SR-92	1.400E+05	8.631E+05	7.962E+01	0.000E+00	0.000E+00
Y-90	2.688E+05	5.308E+03	1.496E+06	0.000E+00	0.000E+00
Y-91M	2.786E+03	1.161E+05	2.985E-15	0.000E+00	0.000E+00
Y-91	2.450E+06	1.207E+06	8.354E+06	0.000E+00	0.000E+00
Y-92	1.266E+05	2.142E+05	1.633E+01	0.000E+00	0.000E+00
Y-93	1.666E+05	2.534E+05	2.826E+04	0.000E+00	0.000E+00
ZR-95	1.750E+06	2.837E+08	1.314E+06	0.000E+00	0.000E+00
ZR-97	1.400E+05	3.445E+06	7.073E+04	0.000E+00	0.000E+00
NB-95	4.788E+05	1.657E+08	3.314E+08	0.000E+00	0.000E+00
MO-99	1.348E+05	4.626E+06	4.944E+08	0.000E+00	0.000E+00
TC-99M	2.030E+03	2.109E+05	2.618E+04	0.000E+00	0.000E+00
TC-101	8.442E+02	2.260E+04	7.771E-57	0.000E+00	0.000E+00
RU-103	5.516E+05	1.265E+08	1.678E+05	0.000E+00	0.000E+00
RU-105	4.844E+04	7.212E+05	5.096E+00	0.000E+00	0.000E+00
RU-106	1.156E+07	5.049E+08	2.299E+06	0.000E+00	0.000E+00
AG-110M	3.668E+06	4.019E+09	2.324E+10	0.000E+00	0.000E+00
TE-125M	4.466E+05	2.128E+06	2.399E+08	0.000E+00	0.000E+00
TE-127M	1.312E+06	1.083E+05	1.649E+09	0.000E+00	0.000E+00
TE-127	2.436E+04	3.293E+03	2.162E+05	0.000E+00	0.000E+00
TE-129M	1.680E+06	2.305E+07	2.214E+09	0.000E+00	0.000E+00
TE-129	2.632E+04	3.076E+04	2.670E-07	0.000E+00	0.000E+00
TE-131M	1.988E+05	9.459E+06	3.640E+07	0.000E+00	0.000E+00
TE-131	8.218E+03	3.450E+07	2.202E-30	0.000E+00	0.000E+00
TE-132	3.402E+05	4.968E+06	1.036E+08	0.000E+00	0.000E+00
I-130	1.596E+06	6.692E+06	1.393E+09	0.000E+00	0.000E+00

* -- See Note, page 4.0-16

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 4.3-1

INFANT PATHWAY DOSE FACTORS FOR SECTION 4.3 (R_{ij})*

Page 3 of 3: Dose Factors for Composite Worst Organ

AGE GROUP	(INFANT)	(N.A.)	(INFANT)	(INFANT)	(INFANT)
ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
I-131	1.484E+07	2.089E+07	1.675E+12	0.000E+00	0.000E+00
I-132	1.694E+05	1.465E+06	2.170E+02	0.000E+00	0.000E+00
I-133	3.556E+06	2.981E+06	1.527E+10	0.000E+00	0.000E+00
I-134	4.452E+04	5.305E+05	1.337E-09	0.000E+00	0.000E+00
I-135	6.958E+05	2.947E+06	3.185E+07	0.000E+00	0.000E+00
CS-134	7.028E+05	8.007E+09	1.082E+11	0.000E+00	0.000E+00
CS-136	1.345E+05	1.702E+08	9.219E+09	0.000E+00	0.000E+00
CS-137	6.118E+05	1.201E+10	9.583E+10	0.000E+00	0.000E+00
CS-138	8.764E+02	4.102E+05	3.468E-22	0.000E+00	0.000E+00
BA-139	5.096E+04	1.194E+05	4.572E-05	0.000E+00	0.000E+00
BA-140	1.596E+06	2.346E+07	3.835E+08	0.000E+00	0.000E+00
BA-141	4.746E+03	4.754E+04	8.075E-44	0.000E+00	0.000E+00
BA-142	1.554E+03	5.064E+04	0.000E+00	0.000E+00	0.000E+00
LA-140	1.680E+05	2.180E+07	2.991E+05	0.000E+00	0.000E+00
LA-142	5.950E+04	9.122E+05	1.716E-05	0.000E+00	0.000E+00
CE-141	5.166E+05	1.540E+07	2.174E+07	0.000E+00	0.000E+00
CE-143	1.162E+05	2.627E+06	2.444E+06	0.000E+00	0.000E+00
CE-144	9.842E+06	8.032E+07	2.123E+08	0.000E+00	0.000E+00
PR-143	4.326E+05	0.000E+00	1.248E+06	0.000E+00	0.000E+00
PR-144	4.284E+03	2.112E+03	1.863E-48	0.000E+00	0.000E+00
ND-147	3.220E+05	1.009E+07	9.137E+05	0.000E+00	0.000E+00
W-187	3.962E+04	2.740E+06	3.979E+06	0.000E+00	0.000E+00
NP-239	5.950E+04	1.976E+06	1.496E+05	0.000E+00	0.000E+00

* -- See Note, page 4.0-16

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 4.3-2

CHILD PATHWAY DOSE FACTORS FOR SECTION 4.3 (R_{ij})*

Page 1 of 3: Dose Factors for Composite Worst Organ

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
H-3	1.129E+03	0.000E+00	1.551E+03	2.312E+02	3.959E+03
C-14	3.589E+04	0.000E+00	1.901E+09	6.100E+08	8.894E+08
NA-24	1.610E+04	1.385E+07	1.408E+07	2.744E-03	3.729E+05
P-32	2.605E+06	0.000E+00	1.237E+11	1.179E+10	3.366E+09
CR-51	1.698E+04	5.506E+06	8.588E+06	7.415E+05	6.213E+06
MN-54	1.576E+06	1.625E+09	3.336E+07	1.275E+07	6.648E+08
MN-56	1.232E+05	1.068E+06	2.966E+00	3.877E-51	2.723E+03
FE-55	1.110E+05	0.000E+00	1.778E+08	7.273E+08	8.012E+08
FE-59	1.269E+06	3.204E+08	3.221E+08	1.008E+09	6.693E+08
CO-58	1.106E+06	4.464E+08	1.126E+08	1.527E+08	3.771E+08
CO-60	7.067E+06	2.532E+10	3.805E+08	6.105E+08	2.095E+09
NI-63	8.214E+05	0.000E+00	4.716E+10	4.633E+10	3.949E+10
NI-65	8.399E+04	3.451E+05	3.037E+01	6.460E-51	1.211E+03
CU-64	3.670E+04	6.876E+05	5.572E+06	2.216E-05	5.159E+05
ZN-65	9.953E+05	8.583E+08	1.752E+10	1.591E+09	2.164E+09
ZN-69	1.018E+04	0.000E+00	1.786E-09	0.000E+00	9.893E-04
BR-83	4.736E+02	7.079E+03	6.999E-01	1.514E-56	5.369E+00
BR-84	5.476E+02	2.363E+05	1.035E-22	0.000E+00	3.822E-11
BR-85	2.531E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00
RB-86	1.983E+05	1.027E+07	1.395E+10	9.171E+08	4.520E+08
RB-88	5.624E+02	3.779E+04	1.138E-44	0.000E+00	4.374E-22
RB-89	3.452E+02	1.476E+05	2.222E-52	0.000E+00	4.695E-26
SR-89	2.157E+06	2.509E+04	1.053E+10	7.661E+08	3.593E+10
SR-90	1.010E+08	0.000E+00	1.777E+11	1.654E+10	1.243E+12
SR-91	1.739E+05	2.511E+06	4.579E+05	8.419E-10	1.157E+06

* -- See Note, page 4.0-16

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 4.3-2

CHILD PATHWAY DOSE FACTORS FOR SECTION 4.3 (R_{ij})*

Page 2 of 3: Dose Factors for Composite Worst Organ

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
SR-92	2.424E+05	8.631E+05	6.577E+01	5.556E-48	1.378E+04
Y-90	2.679E+05	5.308E+03	1.459E+06	7.762E+05	6.569E+07
Y-91M	2.812E+03	1.161E+05	8.269E-16	0.000E+00	1.737E-05
Y-91	2.627E+06	1.207E+06	8.272E+06	3.818E+08	2.484E+09
Y-92	2.390E+05	2.142E+05	1.163E+01	1.107E-34	4.576E+04
Y-93	3.885E+05	2.534E+05	2.502E+04	2.461E-07	4.482E+06
ZR-95	2.231E+06	2.837E+08	1.398E+06	9.715E+08	8.843E+08
ZR-97	3.511E+05	3.445E+06	6.680E+04	1.116E+00	1.248E+07
NB-95	6.142E+05	1.657E+08	3.677E+08	3.621E+09	3.070E+08
MO-99	1.354E+05	4.626E+06	2.764E+08	3.907E+05	1.647E+07
TC-99M	4.810E+03	2.109E+05	2.345E+04	1.100E-17	5.255E+03
TC-101	5.846E+02	2.260E+04	3.054E-58	0.000E+00	2.414E-29
RU-103	6.623E+05	1.265E+08	1.762E+05	6.378E+09	3.971E+08
RU-105	9.953E+04	7.212E+05	3.966E+00	9.362E-25	5.981E+04
RU-106	1.432E+07	5.049E+08	2.286E+06	1.098E+11	1.159E+10
AG-110M	5.476E+06	4.019E+09	2.669E+10	1.073E+09	2.581E+09
TE-125M	4.773E+05	2.128E+06	1.174E+08	9.052E+08	3.506E+08
TE-127M	1.480E+06	1.083E+05	9.437E+08	8.050E+09	3.769E+09
TE-127	5.624E+04	3.293E+03	1.895E+05	2.557E-08	3.903E+05
TE-129M	1.761E+06	2.305E+07	1.266E+09	8.345E+09	2.460E+09
TE-129	2.549E+04	3.076E+04	9.809E-08	0.000E+00	7.204E-02
TE-131M	3.078E+05	9.459E+06	3.570E+07	1.562E+04	2.163E+07
TE-131	2.054E+03	3.450E+07	1.350E-31	0.000E+00	1.349E-14
TE-132	3.774E+05	4.968E+06	7.240E+07	1.484E+07	3.111E+07
I-130	1.846E+06	6.692E+06	6.117E+08	1.075E-03	1.370E+08

* -- See Note, page 4.Ø-16

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

Table 4.3-2

CHILD PATHWAY DOSE FACTORS FOR SECTION 4.3 (R_{ij})*

Page 3 of 3: Dose Factors for Composite Worst Organ

ISOTOPE	INHALATION	GROUND PLANE	GRS/COW/MILK	GRS/COW/MEAT	VEGETATION
I-131	1.624E+07	2.089E+07	6.894E+11	8.755E+09	4.754E+10
I-132	1.935E+05	1.465E+06	9.368E+01	1.421E-56	7.869E+03
I-133	3.848E+06	2.981E+06	6.276E+09	2.074E+02	8.113E+08
I-134	5.069E+04	5.305E+05	5.766E-10	0.000E+00	6.622E-03
I-135	7.918E+05	2.947E+06	1.369E+07	1.653E-14	9.973E+06
CS-134	1.014E+06	8.007E+09	5.910E+10	2.407E+09	2.631E+10
CS-136	1.709E+05	1.702E+08	4.412E+09	7.041E+07	2.247E+0[illegible]
CS-137	9.065E+05	1.201E+10	5.129E+10	2.122E+09	2.392E+10
CS-138	8.399E+02	4.102E+05	8.794E-23	0.000E+00	9.133E-11
BA-139	5.772E+04	1.194E+05	1.958E-05	0.000E+00	2.950E+00
BA-140	1.743E+06	2.346E+07	1.863E+08	6.975E+07	2.767E+08
BA-141	2.919E+03	4.754E+04	3.112E-45	0.000E+00	2.042E-21
BA-142	1.643E+03	5.064E+04	0.000E+00	0.000E+00	4.105E-39
LA-140	2.257E+05	2.180E+07	3.012E+05	8.737E+02	3.166E+07
LA-142	7.585E+04	9.122E+05	8.278E-06	0.000E+00	2.141E+01
CE-141	5.439E+05	1.540E+07	2.165E+07	2.198E+07	4.082E+08
CE-143	1.273E+05	2.627E+06	2.368E+06	4.003E+02	1.364E+07
CE-144	1.195E+07	8.032E+07	2.110E+08	3.011E+08	1.039E+10
PR-143	4.329E+05	0.000E+00	1.234E+06	5.742E+07	1.575E+08
PR-144	1.565E+03	2.112E+03	3.246E-50	0.000E+00	3.829E-23
ND-147	3.282E+05	1.009E+07	9.087E+05	2.394E+07	9.197E+07
W-187	9.102E+04	2.740E+06	3.850E+06	4.438E+00	5.380E+06
NP-239	6.401E+04	1.976E+06	1.454E+05	3.551E+03	1.357E+07

* -- See Note, page 4.0-16

Units: Inhalation - mrem/yr per uCi/m^3

Others - m^2 mrem/yr per uCi/sec

NOTE: The R_{ij} values of Tables 4.3-1 and 4.3-2 were calculated according to the methods of Reference 6, Section 5.3. The values used for the various parameters and the origins of those values are given above in Table 3.2-3, with the following exceptions:

1) Rather than being organ-specific, the ingestion and inhalation dose conversion factors (DFL and DFA) were chosen for a composite worst organ. That is, for each age group and radionuclide, the dose conversion factor used was the highest of any for that age group and radionuclide.

2) The ground plane dose factors (DFG) used were the higher of those given for the total body and the skin in the referenced table of Reg. Guide 1.109.

These R_i values are therefore conservative and are most appropriate for initial or rapid assessments.

4.4 DOSE TO A MEMBER OF THE PUBLIC DUE TO ACTIVITIES INSIDE THE SITE BOUNDARY

In the event that the annual land use census or other information should indicate that individual members of the public may be inside the site boundary for more than a few hours each year, doses to such members of the public shall be calculated according to the methods of Sections 2.2 and 3.2.

Section 5.0
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Technical Specification 3.12.1 states, in part:

The radiological environmental monitoring program shall be conducted as specified in (RETS) Table 3.12.1-1.

A description of the Radiological Environmental Monitoring Program thus specified is presented in this section.

5.1 SAMPLING PROGRAM

The radiological environmental monitoring program will be conducted in accordance with Table 5.1-1 at the locations specified in Figures 5.1-1 and 5.1-2.

NOTE: For the purpose of implementing Technical Specification 3.12.2, sampling locations will be modified as required to reflect the findings of the Land Use Census.

Table 5.1-1
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY	STATION CODE	LOCATION	COLLECTION METHOD	TYPE AND FREQUENCY OF ANALYSIS
I. AIRBORNE				
(a) PARTICULATES	1F1	5.8 mi N of vent	Continuous low volume air sampler. Sample collected every week along with filter change.	Gross beta analysis on each weekly sample. Gamma spectrometry shall be performed if gross beta exceeds ten times the yearly mean of Control Station value.
	2S2	0.4 mi NNE of vent		
	2F2	8.7 mi NNE of vent		
	3H3#	110 mi NE of Station		Gross beta analysis performed > 24 hr. after sampling to allow for Radon and Thoron daughter activity decay.
	10D1	3.9 mi SSW of vent		
	16E1	4.1 mi NNW of vent		Gamma isotopic analysis on quarterly composite.
(b) IODINES	1F1	5.8 mi N of vent	A TEDA-impregnated flow-through charcoal cartridge is connected to air particulate sampler and is collected weekly at filter change.	Iodine-131 analysis performed on each weekly sample.
	2S2	0.4 mi NNE of vent		
	2F2	8.7 mi NNE of vent		
	3H3#	110 mi NE of Station		
	10D1	3.9 mi SSW of vent		
	16E1	4.1 mi NNW of vent		
II. SOIL				
	1F1	5.8 mi N of vent	Soil samples taken in general accordance with procedures outlined in HASL-300 (Rev. 5/73): 10 soil plugs to a depth of 6" over an area of 25 ft2, composited and sealed in a plastic bag at each location. A sample will be collected from each location once every 3 years. If a suitable sample cannot be obtained at a location, a sample shall be obtained from a new location, and NRC shall be notified in writing of the new sample location.	Gamma spectroscopy on each sample at time of collection. Sr-90 analysis on one sample from each location at time of collection.
	2S2	0.4 mi NNE of vent		
	2E1	4.4 mi NNE of vent		
	2F1	5 mi NNE of vent		
	2F2	8.7 mi NNE of vent		
	3G1#	16.6 mi NE of vent		
	3H3#	110 mi NE of Station		
	5D1	3.5 mi E of vent		
	10D1	3.9 mi SSW of vent		
	16E1	4.1 mi NNW of vent		

Control Station

EXPOSURE PATHWAY	STATION CODE	LOCATION	COLLECTION METHOD	TYPE AND FREQUENCY OF ANALYSIS
III. DIRECT				
	1F1	5.8 mi N of vent	2 TLD's collected from each location quarterly.	Gamma dose quarterly
	1G3#	18.5 mi N of vent		
	2S2	0.4 mi NNE of vent		
	2E1	4.4 mi NNE of vent		
	2F2	8.7 mi NNE of vent		
	2F5	7.4 mi NNE of vent		
	2H1#	34 mi NNE of vent		
	3E1	4.1 mi NE of vent		
	3F2	5.1 mi NE of vent		
	3F3	8.6 mi NE of vent		
	3G1#	16.6 mi NE of vent		
	3H1#	32 mi NE of vent		
	3H3#	110 mi NE of vent		
	4D2	3.7 mi ENE of vent		
	5S1	1.0 mi E of vent		
	5D1	3.5 mi E of vent		
	5F1	8.0 mi E of vent		
	6S2	0.2 mi ESE of vent		
	6F1	6.4 mi ESE of vent		
	7S1	0.12 mi SE of vent		
	7F2	9.1 mi SE of vent		
	9E1	4.2 mi S of vent		
	10S1	0.14 mi SSW of vent		
	10D1	3.9 mi SSW of vent		
	10F2	5.8 mi SSW of vent		
	10G1#	11.6 mi SSW of vent		
	11S1	0.09 mi SW of vent		
	11E2	5.0 mi SW of vent		
	11F1	5.2 mi SW of vent		
	12E1	4.4 mi WSW of vent		
	12F1	9.4 mi WSW of vent		
	13E1	4.2 mi W of vent		
	13F1	9.8 mi W of vent		
	13F2	6.5 mi W of vent		
	13F3	9.3 mi W of vent		

Control Station

EXPOSURE PATHWAY	STATION CODE	LOCATION	COLLECTION METHOD	TYPE AND FREQUENCY OF ANALYSIS
III. DIRECT (cont'd)				
	14D1	3.4 mi WNW of vent	2 TLD's collected from each location quarterly.	Gamma dose quarterly.
	14F2	6.6 mi WNW of vent		
	15F3	5.4 mi NW of vent		
	16E1	4.1 mi NNW of vent		
	16F2	8.1 mi NNW of vent		
	16G1#	14.8 mi NNW of vent		
IV. WATER				
(a) SURFACE	7E1	1 mi W of Mad Horse Crk.; 4.5 mi SE of vent	Two-gallon sample to be collected monthly, providing winter icing conditions allow sample collection.	Gamma isotopic analysis monthly.
	11A1	~ 650 ft SW of vent		
	12C1#	2.5 mi WSW of vent		
	16F1	C&D Canal; 6.9 mi NNW of vent		
(b) GROUND	2S3	Onsite	Two-gallon grab sample collected monthly, only if source is likely to be affected.	H-3 analysis on monthly sample.
	3E1#	4.1 mi NE of vent		Gamma isotopic analysis on quarterly composite.
(c) DRINKING	2F3	Salem Water Co. (raw); 8 mi NNE of vent	50 ml aliquot taken daily and composited into a monthly 2 gallon sample.	Gross beta monthly. Gamma isotopic analysis on monthly composite. H-3 on quarterly composite.

Control Station

EXPOSURE PATHWAY	STATION CODE	LOCATION	COLLECTION METHOD	TYPE AND FREQUENCY OF ANALYSIS
V. AQUATIC				
B	7E1	1 mi W of Mad Horse	Sample of benthic organisms	Gamma isotopic and Sr-90 analyses
E		Crk.; 4.5 mi SE of vent	and associated sediment, taken	on each semiannual sample.
N			semiannually.	
T	11A1	~ 650 ft SW of vent		
H				
O	12C1#	2.5 mi WSW of vent		
S				
VI. INGESTION				
(a) M	2F4	6.3 mi NNE of vent	Four-gallon grab sample of	Gamma isotopic and Iodine-131
I	3G1#	16.6 mi NE of vent	fresh milk collected semimonthly	analyses on each sample, on
L	5F2	7.0 mi E of vent	when cows are on pasture,	collection.
K	13E3	4.9 mi W of vent	monthly at other times.	
	14F1	5.5 mi WNW of vent		
(b) F	11A1	Outfall area;	Two key samples of fish sealed	Gamma isotopic analysis on edible
I		~ 650 ft SW of vent	in plastic bag or jar and	portion, on collection.
S			frozen, semiannually or when in	
H	12C1#	West Bank, opposite Artificial Island; 2.5 mi WSW of vent	season.	
(b) C	11A1	Outfall area;	Two key samples of crab sealed	Gamma isotopic analysis on edible
R		~ 650 ft SW of vent	in plastic bag or jar and	portion, on collection.
A			frozen, semiannually or when in	
B	12C1#	West Bank, opposite Artificial Island; 2.5 mi WSW of vent	season.	

Control Station

Table 5.1-1
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY	STATION CODE	LOCATION	COLLECTION METHOD	TYPE AND FREQUENCY OF ANALYSIS
VI. INGESTION (cont'd)				
(d) FRUITS OR VEGETATION	1G1#	10.2 mi N of vent	Samples collected during normal normal harvest season, sealed in plastic, and frozen if perishable. Sufficient sample collected to yield 500 grams of dry weight.	Radioiodine determination on green leafy vegetables, on collection, if any area is irrigated by water into which plant liquid wastes have been discharged. Gamma isotopic analysis on collection, if any area is irrigated by water into which plant liquid wastes have been discharged.
	2E1	4.4 mi NNE of vent		
	2F1	5.0 mi NNE of vent		
(e) GAME	xxx	Station vicinity, E side of estuary	Muskrats skinned and frozen semiannually.	Gamma isotopic analysis on edible portion (only), upon collection.
	xxx#	W side of estuary, 3 - 5 mi from vent		
	xxx	Within 10 mi of Station	Beef portion of cow sampled and frozen semiannually, subject to availability of slaughtered cow.	

# Control Station
xxx = Location to be given at time of collection.

Figure 5.1-1
ONSITE SAMPLING LOCATIONS
ARTIFICIAL ISLAND

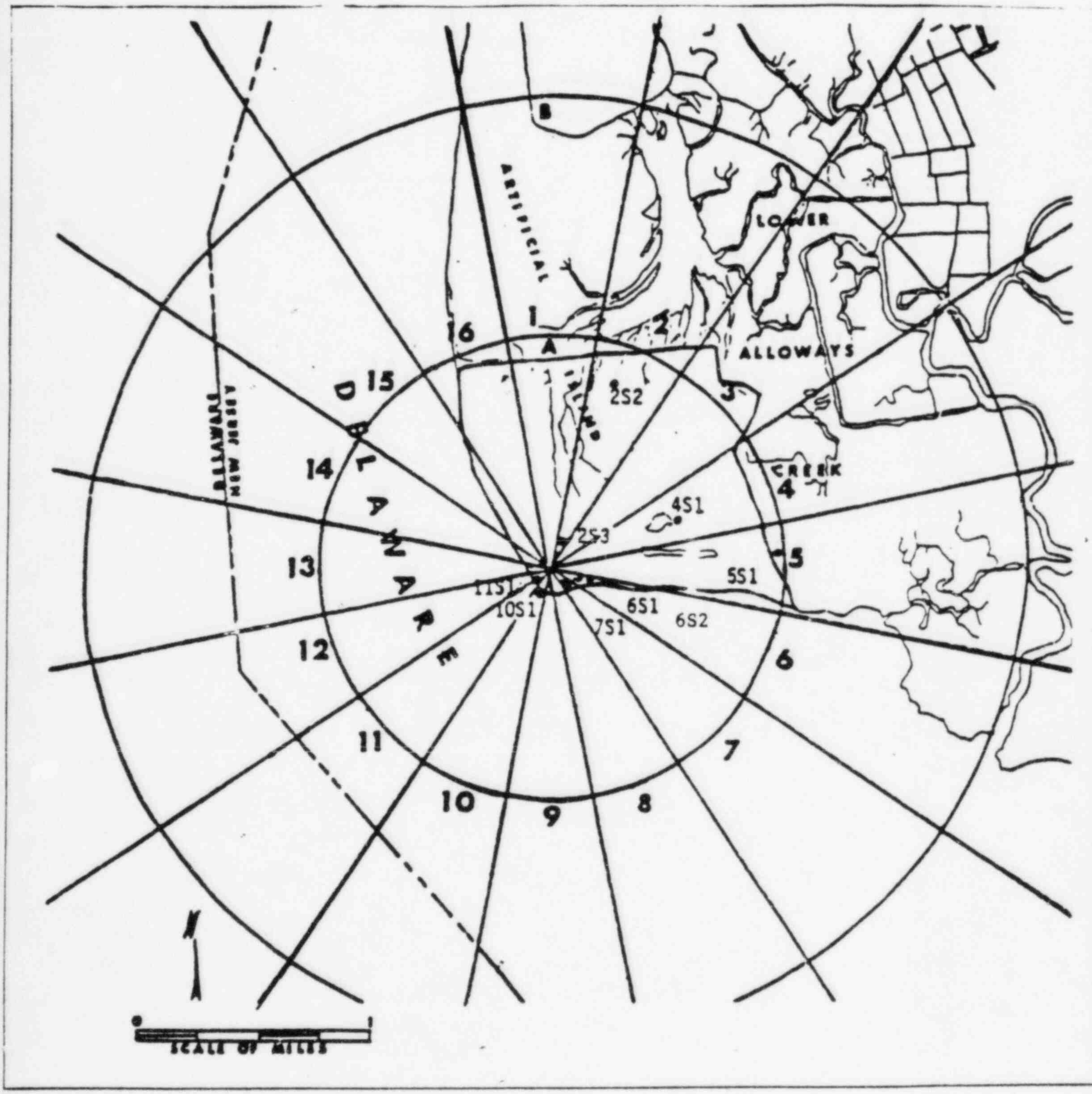
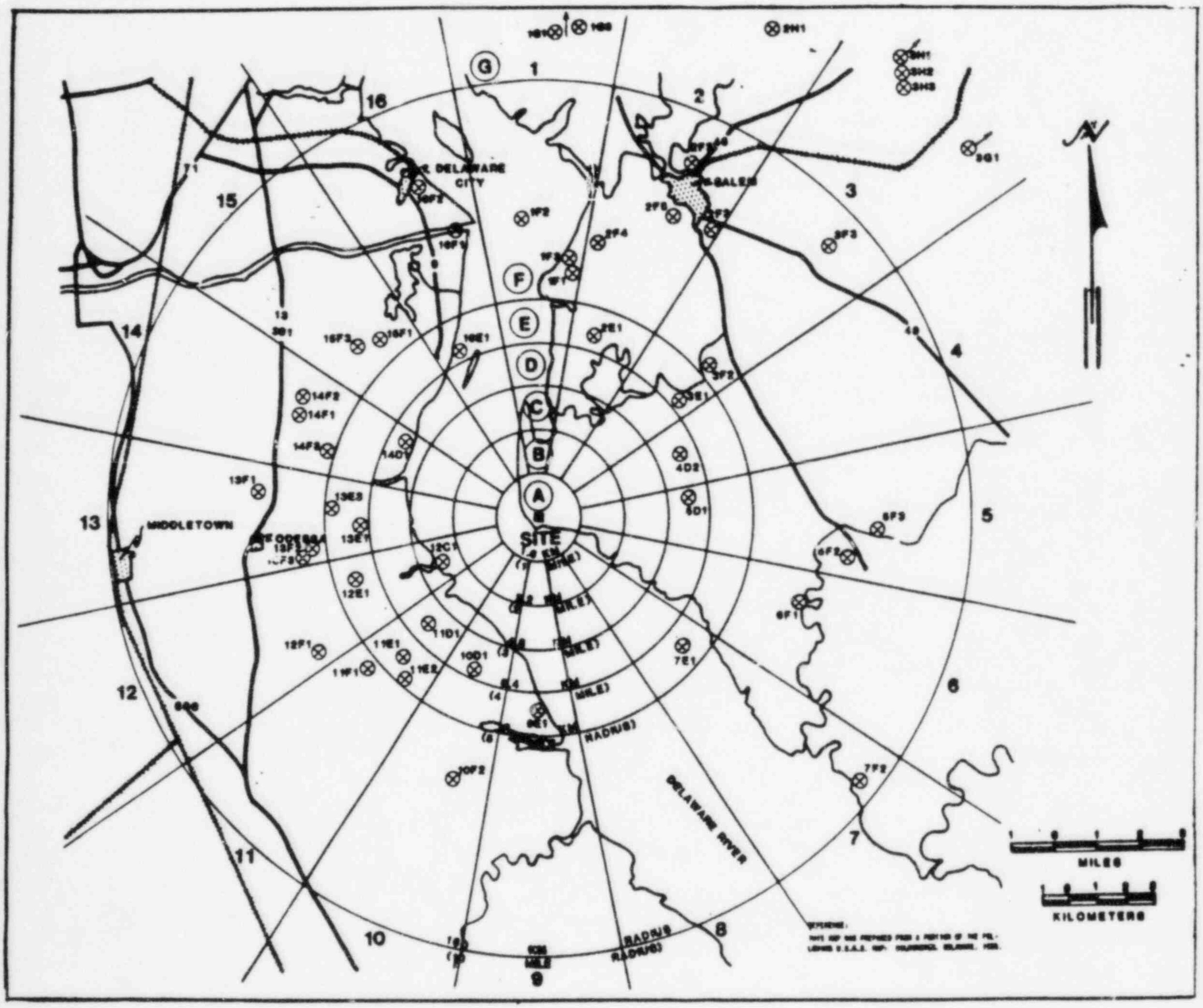


Figure 5.1-2
OFFSITE SAMPLING LOCATIONS
ARTIFICIAL ISLAND



5.2 INTERLABORATORY COMPARISON PROGRAM

Technical Specification 3.12.3 states, in part:

Analyses shall be perfc:med on radioactive materials supplied as part of an Interlaboratory Comparison Program that has been approved by the Commission.

Participation in an approved Interlaboratory Comparison Program ensures that an independent check on the precision and accuracy of the measurements of radioactive materials in environmental sample matrices is performed. This check is performed as part of the QA program for environmental monitoring in order to demonstrate that the results are valid for the purpose of Section IV.B.2 of Appendix I to 10CFR50.

A summary of the Interlaboratory Comparison Program results obtained is required to be included in the Annual Radiological Environmental Operating Report pursuant to Technical Specification 6.9.1.11.