

BRUNSWICK STEAM ELECTRIC PLANT
OFFSITE DOSE CALCULATIONAL MANUAL
(ODCM)

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CAROLINA POWER & LIGHT COMPANY

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1.0 INTRODUCTION

This Offsite Dose Calculation Manual (ODCM) provides the information and methodologies to be used by Brunswick Steam Electric Plant (BSEP) to assure compliance with certain portions of BSEP's operating technical specification. These portions are those related to liquid and gaseous radiological effluents. They are intended to show compliance with 10 CFR 20, 10 CFR 50.36a, and Appendix I of 10 CFR 50.

This ODCM is based on "Radiological Effluent Technical Specifications for BWR's" (NUREG-0473, Draft), "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants" (NUREG-0133), and guidance from the United States Nuclear Regulatory Commission (NRC). Specific plant procedures for implementation of this manual are provided elsewhere. These procedures will be utilized by the operating staff of BSEP to assure compliance with technical specifications.

The ODCM has been prepared as generically as possible in order to minimize the need for future revisions. However, some changes to the ODCM will be expected in the future. Any such changes will be properly reviewed and approved as indicated in the Administrative Control Section, Specification 6.13.2 of the BSEP Technical Specifications.

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2.0 LIQUID EFFLUENTS

2.1 MONITOR ALARM SETPOINT DETERMINATION

This procedure determines the monitor alarm setpoint that indicates if the concentration of radionuclides in the liquid effluent released from the site to unrestricted areas exceeds the concentrations specified in 10CFR20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases or exceeds a concentration of 2×10^{-4} $\mu\text{Ci/ml}$ for dissolved or entrained noble gases.

2.1.1 Setpoint Based on Analysis of Liquid Prior to Discharge

The following method applies to liquid releases when determining the maximum acceptable discharge flow rate prior to dilution and determining the associated high-high alarm setpoint based on this flow rate for the Liquid Waste Effluent Monitor (D12RM-K604) when an analysis of the activity of the principal gamma emitters has been made prior to each batch release.

2.1.1.1 Determine the maximum acceptable discharge flow rate prior to dilution:

a. Determine D (the minimum acceptable dilution factor):

$$D = \sum_i \frac{C_i}{\text{MPC}_i} \quad (2.1-1)$$

C_i = Radioactivity concentration of radionuclide "i" in the liquid effluent prior to dilution ($\mu\text{Ci/ml}$) from analysis of the liquid effluent to be released.

MPC_i = The liquid effluent radioactivity concentration limit for radionuclide "i" ($\mu\text{Ci/ml}$) from Table 2.1-1 or if not listed in Table 2.1-1 from 10CFR20 Appendix B, Table II, Column 2.

- b. Determine f (the maximum acceptable discharge flow rate prior to dilution (gpm)):

$$f = \frac{F}{2D} \quad (2.1-2)$$

F = Dilution water flow rate (gpm)

$$= (n-1) 150,000 \text{ (gpm)}$$

where n = the number of operating circulating water pumps

2 = An engineering factor to prevent spurious alarms caused by deviations in the mixture of radionuclides which affect the monitor response.

- c. The liquid effluent discharge flow rate should be maintained at or below this f value.

2.1.1.2 Determine the monitor high-high alarm setpoint above background.

- a. Determine C.R. (the calculated monitor count rate above background (net cps)).

$$C.R. = C_m E_m \quad (2.1-3)$$

C_m = The total radioactivity concentration of the radionuclides (minus tritium and other radionuclides that do not emit gamma or X-ray radiation) in the liquid effluent prior to dilution ($\mu\text{Ci/ml}$).

E_m = The detection efficiency for the mixture of radionuclides in the liquid effluent prior to dilution (cps/ $\mu\text{Ci/ml}$) from RC&T file 3324.

- b. Determine HHSP (the monitor high-high alarm setpoint with background (cps)).

$$\text{HHSP} = 2 \text{ C.R.} + \text{Bkg.} \quad (2.1-4)$$

2 = An engineering factor to prevent spurious alarms caused by deviations in the mixture of radionuclides which affect the monitor response.

Bkg. = The background count rate (cps) due to internal contamination and the radiation levels in the area in which the monitor is installed when the detector sample chamber is filled with an uncontaminated fluid.

- c. The monitor high-high alarm setpoint including background (cps), shall be set at this HHSP value.

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TABLE 2.1-1

MPC's FOR SELECTED RADIONUCLIDES

<u>RADIONUCLIDE</u>	<u>MPC₁ (μCi/ml)</u>
H-3	3 E-3
Na-24	3 E-5
Cr-51	2 E-3
Mn-54	1 E-4
Co-58	9 E-5
Fe-59	5 E-5
Co-60	3 E-5
Cu-64	2 E-4
Zn-69m	6 E-5
Sr-89	3 E-6
Sr-90	3 E-7
Sr-91	5 E-5
Zr-95	6 E-5
Mo-99	4 E-5
I-131	3 E-7
I-132	8 E-6
I-133	1 E-6
Cs-134	9 E-6
I-134	2 E-5
I-135	4 E-6
Cs-137	2 E-5
La-141	3 E-6
Np-239	1 E-4
Noble Gases	2 E-4

2.2 Compliance with 10 CFR 20 (Liquids)

2.2.1 Batch Releases

2.2.1.1 Prerelease

The radioactivity content of each batch release will be determined prior to release in accordance with Table 2.1-2 of Appendix A of the BSEP's Technical Specifications. The BSEP will show compliance with 10 CFR 20 in the following manner:

The concentration of the various radionuclides in the batch release, determined in accordance with Table 2.1-2 of Appendix A of the BSEP Technical Specifications, is multiplied by the ratio of the maximum release rate of the potential batch release to the minimum dilution flow rate to obtain the concentration at the unrestricted area. This calculation is shown in the following equation:

$$\text{Conc}_i = \frac{C_i R}{\text{MDF}} \quad (2.2-1)$$

where

Conc_i = concentration of radionuclide i at the unrestricted area, $\mu\text{Ci/ml}$;

C_i = concentration of radionuclide i in the potential batch release, $\mu\text{Ci/ml}$;

R = release rate of the batch, gpm;

MDF = minimum dilution flow rate, gpm.

The projected concentration in the unrestricted area is compared to the concentrations in Appendix B, Table II of 10 CFR 20. These concentrations are given in Table 2.1-1. Before a release may occur, Expression 2.2-2 must be met.

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$$\sum_i (\text{Conc}_i / \text{MPC}_i) \leq 1 \quad (2.2-2)$$

where

MPC_i = maximum permissible concentration of radionuclide
i from Appendix B, Table II of 10 CFR 20, $\mu\text{Ci/ml}$

For the BSEP the liquid radwaste discharges go to the circulating water system. Therefore, the minimum dilution flow rate (MDF) is a function of the number of circulating water pumps operating and the number of service water pumps operating. Each unit of the BSEP has 4 circulating water pumps and 5 service water pumps. Each circulating water pump provides 150,000 gpm. Each service water pump provides 7,500 gpm. For each unit, 2 service water pumps provide water to the nuclear header with one operating and the other as a spare. For each unit, 3 service water pumps provide water to the conventional header with 2 operating and the other as a spare. In the prerelease calculations, two circulating water pumps and four service water pumps will be assumed operating. The minimum dilution flow will be given by the following:

$$\begin{aligned} \text{MDF} &= 2 [150,000 + 2(7,500)] \text{ gpm} \\ &= 330,000 \text{ gpm.} \end{aligned}$$

Releases from the BSEP liquid radwaste system may occur from the waste sample tank, floor drain sample tank, waste neutralizer tank and the detergent drain tank. The maximum release rate is 200 gpm from all the release tanks except the detergent drain tank. The release rate for this tank is 50 gpm.

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2.2.1.2 Postrelease

The concentration of each radionuclide following release from a batch tank will be calculated in the unrestricted area in the following manner:

The total activity of radionuclide i released is divided by the actual dilution flow to obtain the concentration in the unrestricted area. This calculation is shown in the following equation:

$$\text{Conc}_{ik} = \frac{C_{ik} V_k}{\text{ADF}_k} \quad (2.2-3)$$

where

Conc_{ik} = the concentration of radionuclide i at the unrestricted area during release k , $\mu\text{Ci/ml}$;

C_{ik} = concentration of radionuclide i in the batch release during release k , $\mu\text{Ci/ml}$;

V_k = volume of liquid effluent released during release k , gal;

ADF_k = actual volume of dilution water during release period k , gal;

To show compliance with 10 CFR 20, the following relationship must hold:

$$\sum_i (\text{Conc}_{ik} / \text{MPC}_i) \leq 1 \quad (2.2-4)$$

The actual dilution water during release k (ADF_k) is calculated by the following equation:

$$\text{ADF}_k = (9.0 \times 10^6 \text{ CW} + 4.5 \times 10^5 \text{ SW}) \Delta t_k \quad (2.2-5)$$

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where

$$9.0 \times 10^6 = 1.5 \times 10^5 \text{ gal/min} \times 60 \text{ min/hr};$$

$$1.5 \times 10^5 = \text{flow rate from a circulating water pump, gpm};$$

$$60 = \text{conversion factor, min/hr};$$

$$CW = \text{total number of circulating water pumps operating at the BSEP};$$

$$4.5 \times 10^5 = 7.5 \times 10^3 \text{ gal/min} \times 60 \text{ min/hr};$$

$$7.5 \times 10^3 = \text{flow rate from a service water pump, gpm};$$

$$SW = \text{total number of service water pumps operating at the BSEP};$$

$$\Delta t_k = \text{duration of release } k, \text{ hours.}$$

It should be noted that the terms CW and SW in Equation 2.2-5 are the total of each particular pump from both units operating during the release.

2.2.2 Continuous

Continuous releases of liquid effluents do not presently occur at the BSEP. If they did occur the concentration of various radionuclides in the unrestricted area would be calculated using Equation 2.2-3 with C_{ik} , the concentration of isotope i in the continuous release. To show compliance with 10 CFR 20, the sum of the concentration in the unrestricted area for both continuous and batch releases divided by MPC must again be less than 1.

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2.3

Compliance With 10 CFR 50

2.3.1

Cumulation of Doses

The dose contribution from the release of liquid effluents will be calculated once per 31 days and a cumulative summation of the total body and organ doses will be maintained for each calendar quarter. Since only batch releases occur at the BSEP the equations in the following sections will pertain only to batch releases. The dose contribution for all batch releases for the quarter will be calculated using the following equation:

$$D_r = \sum_k \sum_i A_{ir} t_k C_{ik} F_k e^{-\lambda_i t_p} \quad (2.3-1)$$

where:

D_r = the cumulative dose commitment to the total body or any organ r , from the liquid effluents for all releases, mrem;

t_k = the length of time of release k over which C_{ik} and F_k are averaged for all liquid releases, hours;

C_{ik} = the average concentration of radionuclide i , in undiluted liquid effluent during release k from any liquid release, $\mu\text{Ci/ml}$;

A_{ir} = the site related ingestion dose commitment factor to the total body or any organ r for each identified principal gamma and beta emitter i , mrem-ml per hr- μCi ;

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λ_i = radiological decay constant for radionuclide i, hours⁻¹;

$$= \frac{.693}{(t_{1/2})_i}$$

$(t_{1/2})_i$ = radiological half life of radionuclide i, hours;

t_p = average transport time to reach the point of exposure, hours;

F_k = the near-field average dilution factor for C_{ik} during any liquid effluent release. Defined as the ratio of the volume of undiluted liquid waste released to the product of the dilution volume from the site discharge structure to unrestricted receiving waters times 1. (1 is the site-specific applicable factor for the mixing effect of the BSEP discharge structure as defined in NUREG -0133.)

$$= \frac{V_k}{ADF_k}$$

where V_k and ADF_k are as defined in Equation 2.2-3.

The dose factor A_{ir} was calculated for an adult for each isotope using the following equation:

$$A_{ir} = 1.14 \times 10^5 (5 BI_i + 21 BF_i) DF_{ir} \quad (2.3-2)$$

where

$$1.14 \times 10^5 = 10^6 \frac{\text{pCi}}{\text{pCi}} \times 10^3 \frac{\text{ml}}{\text{l}} \times \frac{1 \text{ yr}}{8760 \text{ hr}};$$

5 = adult invertebrate consumption rate from Table E-5 of Regulatory Guide 1.109 Rev. 1, kg/yr;

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- BI_i = bioaccumulation factor for radionuclide i in invertebrates from Table A-1 of Regulatory Guide 1.109 Rev. 1, pCi/kg per pCi/l;
- 21 = adult fish consumption rate from Table E-5 of Regulatory Guide 1.109 Rev. 1, kg/yr;
- BF_i = bioaccumulation factor for radionuclide i in fish from Table A-1 of Regulatory Guide 1.109 Rev. 1, pCi/kg per pCi/l;
- DF_{ir} = dose conversion factor for radionuclide i for adults for a particular organ r from Table E-11 of Regulatory Guide 1.109 Rev 1, mrem/pCi.

A_{ir} values for an adult at the BSEP are presented in Table 2.3-1. Table 2.3-2 presents the radiological decay constant for the various radionuclides of Table 2.3-1 along with an evaluation of the term $\exp[-\lambda_i t_p]$ with t_p equal to 24 hours.

The cumulative doses to the total body and all organs from all batch releases for a quarter and for a calendar year are compared respectively to one half the design objective doses and to the design objective doses. Expressions 2.3-3 through 2.3-6 should hold for the BSEP to show compliance with Technical Specification 1.1.3.1 of Appendix A of the BSEP Technical Specifications. It should be noted that because releases from the 2 units cannot be separated, limits are double from what they would be for a single unit.

For the calendar quarter,

$$D_r \leq 3 \text{ mrem total body} \quad (2.3-3)$$

$$D_r \leq 10 \text{ mrem any organ} \quad (2.3-4)$$

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For the calendar year,

$$D_r \leq 6 \text{ mrem total body} \quad (2.3-5)$$

$$D_r \leq 20 \text{ mrem any organ} \quad (2.3-6)$$

The quarterly limits given above represent one half the annual design objective of Section II.A of Appendix I of 10 CFR 50. If any of the limits in Expressions 2.3-3 through 2.3-6 are exceeded a special report pursuant to Section IV.A of Appendix I of 10 CFR 50 must be filed with the NRC.

2.3.2 Projection of Doses

Doses resulting from the release of liquid effluents will be projected once per month. The doses will be projected using Equation 2.3-1 with F_k now based upon the minimum dilution flow rate (MDF) as given in Equation 2.2-1 rather than ADF_k . C_{ik} is based upon the projected releases for the remainder of the calendar quarter.

TABLE 2.3-1
A₁₇ VALUES FOR THE ADULT FOR THE
BROWN SWICK STEAM ELECTRIC PLANT
(CMREM/HR PER MICRO-CI/ML)

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H 3	0.00E-01	2.82E-01	2.82E-01	2.82E-01	2.32E-01	2.92E-01	2.82E-01
C 14	1.45E 04	2.90E 03	2.90E 03	2.90E 03	2.90E 03	2.90E 03	2.90E 03
NA 24	4.57E-01	4.57E-01	4.57E-01	4.57E-01	4.57E-01	4.57E-01	4.57E-01
P 32	1.67E 07	1.04E 06	6.45E 05	0.00E-01	0.00E-01	0.00E-01	1.89E 06
CR 51	0.00E-01	0.00E-01	5.58E 00	3.34E 00	1.23E 00	7.40E 00	1.40E 03
MN 54	0.00E-01	7.06E 03	1.35E 03	0.00E-01	2.10E 03	0.00E-01	2.16E 04
MN 56	0.00E-01	1.78E 02	3.15E 01	0.00E-01	2.26E 02	0.00E-01	5.67E 03
FE 55	5.11E 04	3.53E 04	8.23E 03	0.00E-01	0.00E-01	1.97E 04	2.03E 04
FE 59	8.06E 04	1.90E 05	7.27E 04	0.00E-01	0.00E-01	5.30E 04	6.32E 05
CO 53	0.00E-01	6.03E 02	1.35E 03	0.00E-01	0.00E-01	0.00E-01	1.22E 04
CO 60	0.00E-01	1.73E 03	3.82E 03	0.00E-01	0.00E-01	0.00E-01	3.25E 04
NI 63	4.96E 04	3.44E 03	1.67E 03	0.00E-01	0.00E-01	0.00E-01	7.18E 02
NI 65	2.02E 02	2.62E 01	1.20E 01	0.00E-01	0.00E-01	0.00E-01	6.65E 02
CU 64	0.00E-01	2.14E 02	1.01E 02	0.00E-01	5.40E 02	0.00E-01	1.83E 04
ZN 65	1.61E 05	5.13E 05	2.32E 05	0.00E-01	3.43E 05	0.00E-01	3.23E 05
ZN 69	3.43E 02	6.56E 02	4.56E 01	0.00E-01	4.26E 02	0.00E-01	9.35E 01
BR 83	0.00E-01	0.00E-01	7.25E-02	0.00E-01	0.00E-01	0.00E-01	1.04E-01
BR 84	0.00E-01	0.00E-01	9.39E-02	0.00E-01	0.00E-01	0.00E-01	7.37E-07
BR 85	0.00E-01	0.00E-01	3.86E-03	0.00E-01	0.00E-01	0.00E-01	1.90E-18
RB 86	0.00E-01	6.24E 02	2.91E 02	0.00E-01	0.00E-01	0.00E-01	1.23E 02
RB 88	0.00E-01	1.79E 00	9.49E-01	0.00E-01	0.00E-01	0.00E-01	2.47E-11
RB 89	0.00E-01	1.19E 00	8.34E-01	0.00E-01	0.00E-01	0.00E-01	6.89E-14
SR 89	4.99E 03	0.00E-01	1.43E 02	0.00E-01	0.00E-01	0.00E-01	8.00E 02
SR 90	1.23E 05	0.00E-01	3.01E 04	0.00E-01	0.00E-01	0.00E-01	3.55E 03
SR 91	9.18E 01	0.00E-01	3.71E 00	0.00E-01	0.00E-01	0.00E-01	4.37E 02
SR 92	3.48E 01	0.00E-01	1.51E 00	0.00E-01	0.00E-01	0.00E-01	6.90E 02
Y 90	6.06E 00	0.00E-01	1.63E-01	0.00E-01	0.00E-01	0.00E-01	6.42E 04
Y 91M	5.73E-02	0.00E-01	2.22E-03	0.00E-01	0.00E-01	0.00E-01	1.69E-01
Y 91	8.88E 01	0.00E-01	2.37E 00	0.00E-01	0.00E-01	0.00E-01	4.49E 04
Y 92	5.32E-01	0.00E-01	1.56E-02	0.00E-01	0.00E-01	0.00E-01	9.32E 03
Y 93	1.69E 00	0.00E-01	4.66E-02	0.00E-01	0.00E-01	0.00E-01	5.35E 04

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TABLE 2.3-1 (CONT'D)
A₁ VALUES FOR THE ADULT FOR THE
BRUNSWICK STEAM ELECTRIC PLANT
(MREM/HR PER MICRO-CI/ML)

NUCLIDE	BONE	LIVER	T.BODY	THYROID	KIDNEY	LUNG	GI-LLI
ZR 95	1.59E 01	5.11E 00	3.46E 00	0.00E-01	8.02E 00	0.00E-01	1.62E 04
ZR 97	8.81E-01	1.78E-01	8.13E-02	0.00E-01	2.68E-01	0.00E-01	5.51E 04
NB 95	4.47E 02	2.49E 02	1.34E 02	0.00E-01	2.46E 02	0.00E-01	1.51E 06
MO 99	0.00E-01	1.28E 02	2.43E 01	0.00E-01	2.89E 02	0.00E-01	2.96E 02
TC 99M	1.30E-02	3.66E-02	4.66E-01	0.00E-01	5.56E-01	1.79E-02	2.17E 01
TC101	1.33E-02	1.92E-02	1.88E-01	0.00E-01	3.46E-01	9.81E-03	5.77E-14
RU103	1.07E 02	0.00E-01	4.60E 01	0.00E-01	4.37E 02	0.00E-01	1.25E 04
RU105	8.99E 00	0.00E-01	3.51E 00	0.00E-01	1.15E 02	0.00E-01	5.44E 03
RU106	1.59E 03	0.00E-01	2.01E 02	0.00E-01	3.06E 03	0.00E-01	1.03E 05
AG110M	1.56E 03	1.45E 03	8.60E 02	0.00E-01	2.85E 03	0.00E-01	5.91E 05
TE125M	2.17E 02	7.96E 01	2.91E 01	6.52E 01	8.82E 02	0.00E-01	8.66E 02
TE127M	5.48E 02	1.96E 02	6.68E 01	1.40E 02	2.23E 03	0.00E-01	1.84E 03
TE127	8.90E 00	3.20E 00	1.93E 00	6.60E 00	3.63E 01	0.00E-01	7.03E 02
TE129M	9.31E 02	3.47E 02	1.47E 02	3.20E 02	3.89E 03	0.00E-01	4.69E 03
TE129	2.54E 00	9.55E-01	6.19E-01	1.95E 00	1.07E 01	0.00E-01	1.92E 00
TE131M	1.40E 02	6.85E 01	5.71E 01	1.08E 02	6.94E 02	0.00E-01	6.80E 03
TE131	1.59E 00	6.66E-01	5.03E-01	1.31E 00	6.99E 00	0.00E-01	2.26E-01
TE132	2.04E 02	1.32E 02	1.24E 02	1.46E 02	1.27E 03	0.00E-01	6.24E 03
I 130	3.96E 01	1.17E 02	4.61E 01	9.91E 03	1.82E 02	0.00E-01	1.01E 02
I 131	2.18E 02	3.12E 02	1.79E 02	1.02E 05	5.35E 02	0.00E-01	8.23E 01
I 132	1.06E 01	2.85E 01	9.96E 00	9.96E 02	4.54E 01	0.00E-01	5.35E 00
I 133	7.45E 01	1.30E 02	3.95E 01	1.90E 04	2.26E 02	0.00E-01	1.16E 02
I 134	5.56E 00	1.51E 01	5.40E 00	2.62E 02	2.40E 01	0.00E-01	1.32E-02
I 135	2.32E 01	6.08E 01	2.24E 01	4.01E 03	9.75E 01	0.00E-01	6.87E 01
CS134	6.84E 03	1.63E 04	1.33E 04	0.00E-01	5.27E 03	1.75E 03	2.85E 02
CS136	7.16E 02	2.83E 03	2.04E 03	0.00E-01	1.57E 03	2.16E 02	3.21E 02
CS137	8.77E 03	1.20E 04	7.85E 03	0.00E-01	4.07E 03	1.35E 03	2.32E 02
CS138	6.07E 00	1.20E 01	5.94E 00	0.00E-01	8.81E 00	8.70E-01	5.12E-05
BA139	7.85E 00	5.59E-03	2.30E-01	0.00E-01	5.23E-03	3.17E-03	1.39E 01
BA140	1.64E 03	2.06E 00	1.08E 02	0.00E-01	7.02E-01	1.18E 00	3.38E 03
BA141	3.81E 00	2.88E-03	1.29E-01	0.00E-01	2.68E-03	1.63E-03	1.80E-09

TABLE 2.3-1 (CONT'D)
A. VALUES FOR THE ADULT FOR THE
BRUNSWICK STEAM ELECTRIC PLANT
(CMREN/HR PER MICRO-G/ML)

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	SI-LUI
PA142	1.72E 00	1.77E-03	1.08E-01	0.00E-01	1.50E-03	1.00E-03	2.43E-19
LA140	1.57E 00	7.94E-01	2.10E-01	0.00E-01	0.00E-01	0.00E-01	5.83E 04
LA142	8.06E-02	3.67E-02	9.13E-03	0.00E-01	0.00E-01	0.00E-01	2.68E 02
CE141	3.43E 00	2.32E 00	2.63E-01	0.00E-01	1.08E 00	0.00E-01	8.86E 03
CE143	6.04E-01	4.46E 02	4.94E-02	0.00E-01	1.97E-01	0.00E-01	1.67E 04
CE144	1.79E 02	7.47E 01	9.59E 00	0.00E-01	4.43E 01	0.00E-01	6.04E 04
PR143	5.79E 00	2.32E 00	2.87E-01	0.00E-01	1.34E 00	0.00E-01	2.54E 04
PR144	1.90E-02	7.87E-03	9.64E-04	0.00E-01	4.44E-03	0.00E-01	2.73E-09
ND147	3.96E 00	4.58E 00	2.74E-01	0.00E-01	2.68E 00	0.00E-01	2.20E 04
W 187	9.16E 00	7.66E 00	2.68E 00	0.00E-01	0.00E-01	0.00E-01	2.51E 03
NP239	3.53E-02	3.47E-03	1.91E-03	0.00E-01	1.08E-02	0.00E-01	7.11E 02
F 18	6.66E 00	0.00E-01	7.38E-01	0.00E-01	0.00E-01	0.00E-01	1.97E-01
Sb 124	2.76E 02	5.22E 00	1.09E 02	6.70E-01	0.00E-01	2.15E 02	7.84E 03

TABLE 2.3-2

Values of $e^{-\lambda_i t_p}$ for Liquid Dose Calculations

Radionuclide	$\lambda_i(\text{hr}^{-1})$	$e^{-\lambda_i t_p}^*$	Radionuclide	$\lambda_i(\text{hr}^{-1})$	$e^{-\lambda_i t_p}^*$
H-3	6.43E-6	1.	Zr-95	4.44E-4	9.89E-1
C-14	1.38E-8	1	Zr-97	4.08E-2	3.76E-1
F-18	3.75E-1	1.23E-4	Nb-95	8.25E-4	9.80E-1
Na-24	4.62E-2	3.30E-1	Mo-99	1.03E-2	7.81E-1
P-32	2.02E-3	9.53E-1	Tc-99m	1.16E-1	6.18E-2
Cr-51	1.04E-3	9.75E-1	Tc-101	2.97	0
Mn-54	9.53E-5	9.98E-1	Ru-103	7.29E-4	9.83E-1
Mn-56	2.69E-1	1.57E-3	Ru-105	1.56E-1	2.37E-2
Fe-55	3.04E-5	9.99E-1	Ru-106	7.87E-5	9.98E-1
Fe-59	6.42E-4	9.85E-1	Ag-110m	1.14E-4	9.97E-1
Co-58	4.05E-4	9.90E-1	Sb-124	4.81E-4	9.89E-1
Co-60	1.50E-5	1	Te-125m	4.98E-4	9.88E-1
Ni-63	8.60E-7	1	Te-127m	2.65E-4	9.94E-1
Ni-65	2.71E-1	1.50E-3	Te-127	7.37E-2	1.71E-1
Cu-64	5.42E-2	2.72E-1	Te-129m	8.49E-4	9.80E-1
Zn-65	1.18E-4	9.97E-1	Te-129	6.03E-1	5.19E-7
Zn-69	7.29E-1	2.52E-8	Te-131m	2.31E-2	5.74E-1
Br-83	2.89E-1	9.72E-4	Te-131	1.66	4.99E-18
Br-84	1.31	2.22E-14	Te-132	8.89E-3	8.08E-1
Br-85	1.39E1	0	I-130	5.59E-2	2.61E-1
Rb-86	1.55E-3	9.63E-1	I-131	3.59E-3	9.17E-1
Rb-88	2.33	5.18E-25	I-132	3.01E-1	7.29E-4
Rb-89	2.70	0	I-133	3.30E-2	4.53E-1
Sr-89	5.55E-4	9.87E-1	I-134	8.00E-1	4.59E-9
Sr-90	2.80E-6	1	I-135	1.03E-1	8.44E-2
Sr-91	7.17E-2	1.79E-1	Cs-134	3.86E-5	9.99E-1
Sr-92	2.56E-1	2.15E-3	Cs-136	2.22E-3	9.48E-1
Y-90	1.08E-2	7.72E-1	Cs-137	2.63E-6	1
Y-91m	8.32E-1	2.13E-9	Cs-138	1.29	3.58E-14
Y-91	4.91E-4	9.38E-1	Ba-139	5.02E-1	5.86E-6
Y-92	1.96E-1	9.06E-3	Ba-140	2.26E-3	9.47E-1
Y-93	6.80E-2	1.96E-1	Ba-141	2.31	3.37E-25
Ba-142	3.78	0	Pr-143	2.12E-3	9.50E-1
La-140	1.72E-2	6.62E-1	Pr-144	2.41	0
La-142	4.52E-1	1.94E-5	Nd-147	2.60E-3	9.40E-1
Ce-141	8.75E-4	9.79E-1	W-187	2.90E-2	4.99E-1
Ce-143	2.09E-2	6.06E-1	Np-239	1.23E-2	7.44E-1
Ce-144	1.02E-4	9.98E-1			

* Note: All values less than 1E-25 are reported as 0.

3.0 GASEOUS EFFLUENTS

3.1 MONITOR ALARM SETPOINT DETERMINATION

This procedure determines the monitor alarm setpoint that indicates if the dose rate in the unrestricted areas due to noble gas radionuclides in the gaseous effluent released from the site exceeds 500 mrem/year to the whole body or exceeds 3000 mrem/year to the skin.

If two simultaneous gaseous releases out of one vent occurs, calculate the setpoint for each type of release and use the lowest setpoint obtained.

3.1.1 Setpoint Based on Conservative Radionuclide Mix (Ground and Mixed Mode Releases)

The following method applies to gaseous releases via the Unit 1 & 2 Turbine Building Vents and via the Unit 1 & 2 Reactor Building Vents when determining the high alarm setpoint for the Turbine Building Vent Gas Monitors (1 & 2 VA-AQH-3215) and Reactor Building Vent Gas Monitors (1 & 2 CAC-AQH-1264).

3.1.1.1 Determine the "mix" (noble gas radionuclide composition) of the gaseous effluent:

- a. Determine the gaseous source terms that are representative of the "mix" of the gaseous effluent. Gaseous source terms are the noble gas activities in the effluent.

Gaseous source terms can be obtained from:

Table 3.1-1; Turbine Building Vent Release

Table 3.1-1; Reactor Building Vent Release

- b. Determine S_i (the fraction of the total noble gas radioactivity in the gaseous effluent comprised by noble gas radionuclide "i") for each individual noble gas radionuclide in the gaseous effluent.

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$$S_i = \frac{A_i}{\sum_i A_i} \quad (3.1-1)$$

A_i = The radioactivity of noble gas radionuclide "i" in the gaseous effluent from Table 3.1-1; Turbine Building Vent Release, Table 3.1-1; Reactor Building Vent Release, or from analysis of gaseous effluent.

3.1.1.2 Determine Q_t (the maximum acceptable total release rate of all noble gas radionuclides in the gaseous effluent (Ci/sec)) based upon the whole body exposure limit.

$$Q_t = \frac{500}{(\overline{X/Q}) \sum_i K_i S_i} \quad (3.1-2)$$

$(\overline{X/Q})_{tb}$ = The highest calculated annual average relative concentration of effluents released via the Ventilation Turbine Building Vent for any area at or beyond the site boundary for all sectors (sec/m^3) from Table A-1, Appendix A.

$$= 7.60 \text{ E-6 sec/m}^3$$

$(\overline{X/Q})_{rb}$ = The highest calculated annual average relative concentration of effluents released via the Reactor Building Vent for any area at or beyond the site boundary for all sectors (sec/m^3) from Table A-7, Appendix A..

$$= 1.72 \text{ E-7 sec/m}^3$$

NOTE: Use the X/Q that applies to the monitor for which the alarm setpoint is being calculated.

K_i = The total whole body dose factor due to gamma emissions from noble gas radionuclide "i" ($\text{mrem/year}/\mu\text{Ci/m}^3$) from Table 3.1-2.

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3.1.1.3 Determine Q_t based upon the skin exposure limit.

$$Q_t = \frac{3000}{(\bar{X}/Q) \sum_i (L_i + 1.1 M_i) S_i} \quad (3.1-3)$$

$L_i + 1.1 M_i$ = The total skin dose factor due to emissions from noble gas radionuclide "i" (mrem/year/ $\mu\text{Ci}/\text{m}^3$) from Table 3.1-2.

3.1.1.4 Determine C_t (the maximum acceptable total radioactivity concentration of all noble gas radionuclides in the gaseous effluent ($\mu\text{Ci}/\text{sec}/\text{cfm}$)).

$$C_t = \frac{Q_t}{f} \quad (3.1-4)$$

NOTE: Use the lower of the Q_t values obtained in Sections 3.1.1.2 and 3.1.1.3.

f = The maximum acceptable effluent flow rate at the point of release (cfm) based on design flow rates.

= 15,000 cfm (Turbine Building Vent)

= 172,800 cfm (Reactor Building Vent)

3.1.1.5 Determine the monitor high alarm setpoint above background:

a. Determine C.R. (the calculated monitor count rate above background attributed to the noble gas radionuclides (net cpm)).

$$\text{C.R.} = \frac{C_t}{E_m} \quad (3.1-5)$$

E_m = The detection efficiency of the monitor for the "mix" of noble gas radionuclides in the gaseous effluent ($\mu\text{Ci}/\text{sec}/\text{cfm}$ cpm) from RC&T file 3324.

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- b. Determine HSP (the monitor high alarm setpoint with background (cpm)).

$$\text{HSP} = T_m \text{ C.R.} + \text{Bkg.} \quad (3.1-6)$$

T_m = Fraction of the radioactivity from the site that may be released via the monitored pathway to ensure that the site boundary limit is not exceeded during simultaneous releases from several pathways.

= 0.10 for the Unit 1 Turbine Building Vent Gas Monitor (1 VA-AQH-3215).

= 0.10 for the Unit 2 Turbine Building Vent Gas Monitor (2 VA-AQH-3215).

= 0.20 for the Unit 1 Reactor Building Vent Gas Monitor (1 CAC-AQH-1264).

= 0.20 for the Unit 2 Reactor Building Vent Gas Monitor (2 CAC-AQH-1264).

Bkg. = The background count rate (cpm) due to internal contamination and the radiation levels in the area in which the monitor is installed when the detector sample chamber is filled with an uncontaminated fluid.

- c. The monitor high alarm setpoint including background (cpm), shall be set at or below the HSP value determined above.

3.1.2 Setpoint Based on Conservative Radionuclide Mix (Long Term Elevated Release)

The following method applies to gaseous releases via the Stack when determining the high-high alarm setpoint for the Stack Monitor (D12-RM-K600 A & B) during continuous release via the Stack.

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3.1.2.1 Determine the "mix" (noble gases and composition) of the gaseous effluent:

- a. Determine the gaseous source terms that are representative of the "mix" of the gaseous effluent. Gaseous source terms are the noble gases radionuclide activity concentrations in the effluent.
- b. Determine S_i (the fraction of the total radioactivity in the gaseous effluent comprised by noble gas radionuclide "i") for each individual noble gas radionuclide in the gaseous effluent.

$$S_i = \frac{A_i}{\sum_i A_i} \quad (3.1-7)$$

A_i = The radioactivity of noble gas radionuclide "i" in the gaseous effluent from the stack Table 3.1-1 or from analysis of the gaseous effluent being released.

3.1.2.2 Determine Q_t (the maximum acceptable total release rate of all noble gas radionuclides in the gaseous effluent ($\mu\text{Ci/sec}$)) based upon the whole body exposure limit.

$$Q_t = \frac{500}{\sum_i V_i S_i} \quad (3.1-8)$$

V_i = The constant for noble gas radionuclide "i" accounting for the gamma radiation from the elevated finite plume (mrem/year/ $\mu\text{Ci/sec}$) from Table 3.1-2.

3.1.2.3 Determine Q_t based upon the skin exposure limit.

$$Q_t = \frac{3000}{\sum_i (L_i(X/Q)_s + 1.1 B_i) S_i} \quad (3.1-9)$$

$$L_i (\overline{X/Q})_s + 1.1 B_i =$$

The total skin dose constant for long term releases (greater than 500 hours/year) due to emissions from noble gas radionuclide "i" (mrem/year/ μ Ci/sec) from Table 3.1-2.

- 3.1.2.4 Determine C_t (the total maximum acceptable radioactivity concentration of noble gas radionuclides in the gaseous effluent (μ Ci/sec/cfm)).

$$C_t = \frac{Q_t}{f} \quad (3.1-10)$$

NOTE: Use the lowest of the Q_t values obtained in Sections 3.1.3.2 and 3.1.3.3.

f = The maximum acceptable effluent flow rate at the point of release (cfm) based on design flow rates.

$$= 86,000 \text{ cfm (Stack)}$$

- 3.1.2.5 Determine the monitor high-high alarm setpoint above background:

Determine CR (the calculated monitor count rate above background attributed to the noble gas radionuclides (net cps)).

$$CR = \frac{C_t}{E_m} \quad (3.1-11)$$

E_m = The detection efficiency of the monitor for the "mix" of noble gas radionuclides in the gaseous effluent (μ Ci/sec/cfm \cdot cps) from RC&T file 3324.

- b. Determine HHSP (the monitor high-high alarm setpoint with background (cps)).

$$\text{HHSP} = T_m \text{ CR} + \text{Bkg.} \quad (3.1-12)$$

T_m = Fraction of the radioactivity from the site that may be released via the monitored pathway to ensure that the site boundary limit is not exceeded during simultaneous releases from several pathways.

= 0.40 for the Stack Monitor (D12-RM-K600 A&B).

Bkg. = The background count rate (cps) due to internal contamination and the radiation levels in the area in which the monitor is installed when the detector sample chamber is filled with an uncontaminated fluid.

- c. The monitor high-high alarm setpoint including background (cps), shall be set at or below the HHSP value determined above.

3.1.3 Condenser Air Ejector Monitor Alarm Setpoint Determination

This procedure determines the alarm setpoint for the Condenser Air Ejector Monitor that will provide reasonable assurance that the total body exposure to an individual at the exclusion area boundary will not exceed a fraction of the limits of 10CFR100 in the event of an inadvertent release via the condenser air ejector.

3.1.3.1 The following method applies to gaseous releases via the Unit 1 and 2, Condenser Air Ejectors when determining the high-high alarm setpoint for the Condenser Offgas Radiation Monitors (D12-RM-K601 A&B).

- a. Determine C_m (the total radioactivity concentration of the noble gases) in the condenser air ejector gas ($\mu\text{Ci/sec/cfm}$).

$$C_m = \frac{Q_t}{f} \quad (3.1-13)$$

Q_t = The total release rate ($\mu\text{Ci/sec}$) for the noble gas radionuclides (based on NUREG 0133).

$$= 5.85 \text{ E}+6 \text{ Ci/sec}$$

f = The main condenser air inleakage rate plus the radiolytic gas flow rate.

$$= 122 \text{ scfm}$$

- b. Determine the monitor high-high alarm setpoint above background.

1. Determine M.R. (the calculated monitor response attributed to the noble gas radionuclides (mR/hr)).

$$\text{M.R.} = \frac{C_m}{E_m} \quad (3.1-14)$$

E_m = The detection efficiency of the monitor for the "mix" of noble gas radionuclides in the gaseous stream ($\mu\text{Ci/sec/mR/hr} \cdot \text{cfm}$) from RC&T file 3324.

2. The monitor high-high alarm setpoint (mR/hr) should be set at or below the M.R. value determined above.

TABLE 3.1- 1
GASEOUS SOURCE TERMS¹

RADIONUCLIDE	TURBINE BLDG VENT		REACTOR BLDG VENT		STACK	
	<u>A₁ (Ci/yr)</u>	<u>S₁</u>	<u>A₁ (Ci/yr)</u>	<u>S₁</u>	<u>A₁ (Ci/yr)</u>	<u>S₁</u>
Kr-83m	*	-	*	-	3.0E+4	2.86E-2
Kr-85m	6.8E+1	2.02E-2	6.0E0	1.73E-2	5.8E+4	5.52E-2
Kr-85	*	-	*	-	2.0E+2	1.90E-4
Kr-87	1.3E+2	3.87E-2	6.0E0	1.73E-2	1.7E+5	1.62E-1
Kr-88	2.3E+2	6.85E-2	6.0E0	1.73E-2	1.9E+5	1.81E-1
Kr-89	*	-	*	-	2.0E+3	1.90E-3
Xe-131m	*	-	*	-	1.6E+2	1.52E-4
Xe-133m	*	-	*	-	3.0E+3	2.86E-3
Xe-133	2.5E+2	7.44E-2	1.3E+2	3.75E-1	8.6E+4	8.19E-2
Xe-135m	6.5E+2	1.93E-1	9.2E+1	2.65E-1	7.4E+3	7.05E-3
Xe-135	6.3E+2	1.88E-1	6.8E+1	1.96E-1	2.3E+5	2.19E-1
Xe-137	*	-	*	-	6.8E+3	6.48E-3
Xe-138	1.4E+3	4.17E-1	1.4E+1	4.03E-2	2.7E+5	2.57E-1
Ar-41	*	-	2.5E+1	7.20E-2	*	
Total	3.36E+3		3.47E+2		1.05E+6	

* < 1.0E-1

1. Source terms are based upon GALE code and not actual releases.

TABLE 3.1-2
DOSE FACTORS AND CONSTANTS

RADIONUCLIDE	TOTAL WHOLE BODY DOSE FACTOR (K_i) (mrem/yr/ μ Ci/m ³)	TOTAL SKIN DOSE FACTOR ($L_i + 1.1 M_i$) (mrem/yr/ μ Ci/m ³)	TOTAL BODY DOSE CONSTANT FOR LONG TERM RELEASES (V_i) (mrem/yr/ μ Ci/sec)	TOTAL SKIN DOSE CONSTANT FOR LONG TERM RELEASES ($L_i(X/Q)_s + 1.1 B_i$) (mrem/yr/ μ Ci/sec)
Kr-83m	7.56 E-2	2.12 E+1	1.66 E-9	1.54 E-7
Kr-85m	1.17 E+3	2.81 E+3	9.18 E-5	2.14 E-4
Kr-85	1.61 E+1	1.36 E+3	1.36 E-6	6.12 E-5
Kr-87	5.92 E+3	1.65 E+4	4.17 E-4	1.12 E-3
Kr-88	1.47 E+4	1.91 E+4	1.08 E-3	1.89 E-3
Kr-89	1.66 E+4	2.91 E+4	6.55 E-4	1.53 E-3
Xe-131m	9.15 E+1	6.48 E+2	2.17 E-5	5.84 E-5
Xe-133m	2.51 E+2	1.35 E+3	1.64 E-5	7.30 E-5
Xe-133	2.94 E+2	6.94 E+2	1.72 E-5	4.28 E-5
Xe-135m	3.12 E+3	4.41 E+3	2.17 E-4	3.93 E-4
Xe-135	1.81 E+3	3.97 E+3	1.47 E-4	3.25 E-4
Xe-137	1.42 E+3	1.39 E+4	5.64 E-4	6.30 E-4
Xe-138	8.83 E+3	1.43 E+4	6.61 E-4	1.27 E-3
Ar-41	8.84 E+3	1.29 E+4	7.86 E-4	1.42 E-3

3.2 Compliance With 10 CFR 20 (Gaseous)

3.2.1 Noble Gases

The gaseous effluent monitors setpoints are utilized to show compliance with 10 CFR 20 for noble gases. However, because they are based upon a conservative mix of radionuclides, the possibility exists that the setpoints could be exceeded and yet 10 CFR 20 limits may actually be met. Therefore, the following methodology has been provided in the event that if the alarm trip setpoints are exceeded a determination may be made as to whether the actual releases have exceeded 10 CFR 20.

The dose rate in unrestricted areas resulting from noble gas effluents is limited to 500 mrem/yr to the total body and 3000 mrem/yr to the skin. Based upon NUREG-0133, the following are used to show compliance with 10 CFR 20:

$$\sum_i \left[V_i \dot{Q}_{is} + K_i (\overline{X/Q})_v \dot{Q}_{iv} \right] \leq 500 \text{ mrem/yr} \quad (3.2-1)$$

$$\sum_i \left[\left[L_i (\overline{X/Q})_s + 1.1 B_i \right] \dot{Q}_{is} + (L_i + 1.1 M_i) (\overline{X/Q})_v \dot{Q}_{iv} \right] \leq 3000 \text{ mrem/yr} \quad (3.2-2)$$

where

K_i = the total body dose factor due to gamma emissions for noble gas radionuclide i , mrem/yr per $\mu\text{Ci}/\text{m}^3$;

L_i = the skin dose factor due to beta emissions for noble gas radionuclide i , mrem/yr per $\mu\text{Ci}/\text{m}^3$;

M_i = the air dose factor due to gamma emissions for noble gas radionuclide i , mrad/yr per $\mu\text{Ci}/\text{m}^3$;

- V_i = the constant for each identified noble gas radionuclide i accounting for the gamma radiation from the elevated finite plume, mrem/yr per $\mu\text{Ci/sec}$;
- B_i = the constant for long-term releases (greater than 500 hrs/yr) for each identified noble gas radionuclide i accounting for the gamma radiation from the elevated finite plume in mrad/yr per $\mu\text{Ci/sec}$;
- 1.1 = the ratio of the tissue to air absorption coefficients over the energy range of the photon of interest, mrem/mrad.
- \dot{Q}_{is} = the release rate of noble gas radionuclide i in gaseous effluents from free-standing stack, $\mu\text{Ci/sec}$;
- \dot{Q}_{iv} = the release rate of noble gas radionuclide i in gaseous effluents from all vent releases, $\mu\text{Ci/sec}$.

At the Brunswick Steam Electric Plant (BSEP) gaseous releases may occur from:

1. the turbine building vent
2. the reactor building
3. the stack

Releases from the turbine building are ground level. The source of these releases are steam leakage through valve stems, pump seals, and flanged connections. Releases from the reactor building are considered mixed mode in nature and the sources are also leakage through the valve stems, pump seals, and flanged connections. Releases from the stack are considered elevated. Their sources are the main condenser's steam jet air ejectors, exhaust from the radwaste building ventilation system, mechanical vacuum pump exhausts during startup and gland seal off-gases.

Noble gas releases may occur from all three points. To show compliance with 10 CFR 20, Expressions 3.2-1 and 3.2-2 are now in terms of the actual release points for the BSEP.

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For the total body dose

$$\sum_i V_i \dot{Q}_{i_s} + \sum_i K_i \left[\overline{(X/Q)}_{rb} \dot{Q}_{i_{rb}} + \overline{(X/Q)}_{tb} \dot{Q}_{i_{tb}} \right] \leq 500 \text{ mrem/yr}$$

(3.2-3)

For the skin dose

$$\sum_i \left[L_i \overline{(X/Q)}_s + 1.1B_i \right] \dot{Q}_{i_s} + \sum_i \left[L_i + 1.1M_i \right] \left[\overline{(X/Q)}_{rb} \dot{Q}_{i_{rb}} + \overline{(X/Q)}_{tb} \dot{Q}_{i_{tb}} \right] \leq 3000 \text{ mrem/yr}$$

(3.2-4)

where

\dot{Q}_{i_s} = release rate of radionuclide i from the stack, $\mu\text{Ci/sec}$;

$\dot{Q}_{i_{rb}}$ = release rate of radionuclide i from the two reactor buildings, $\mu\text{Ci/sec}$;

$\dot{Q}_{i_{tb}}$ = release rate of radionuclide i from the two turbine buildings, $\mu\text{Ci/sec}$;

$\overline{(X/Q)}_s$ = annual average relative concentration for releases from the stack, sec/m^3 ;

$\overline{(X/Q)}_{rb}$ = annual average relative concentration for releases from the reactor buildings, sec/m^3 ;

$\overline{(X/Q)}_{tb}$ = annual average relative concentration for releases from the turbine buildings, sec/m^3 .

All other terms remain the same as those defined previously.

The determination of controlling location for implementation of 10 CFR 20 for noble gases is a function of the radionuclide mix, isotopic release rate and the meteorology.

The incorporation of these variables into Expressions 3.2-3 and 3.2-4 result in the following expressions for the controlling location for the BSEP. This location is the ENE site boundary.

For the total body

$$\sum_i V_i \dot{Q}_{i_s} + \sum_i K_i (7.2 \times 10^{-8} \dot{Q}_{i_{rb}} + 4.2 \times 10^{-6} \dot{Q}_{i_{tb}}) \leq 500 \text{ mrem/yr} \quad (3.2-5)$$

For the skin

$$\sum_i (6.3 \times 10^{-9} L_i + 1.1 B_i) \dot{Q}_{i_s} + \sum_i [(L_i + 1.1 M_i) (7.2 \times 10^{-8} \dot{Q}_{i_{rb}} + 4.2 \times 10^{-6} \dot{Q}_{i_{tb}})] \leq 3000 \text{ mrem/yr} \quad (3.2-6)$$

The radionuclide mix was based upon source terms calculated using the NRC GALE code. They were calculated based upon the present operating mode of the BSEP. They are presented in Table 3.2-1 as a function of release point. It should be noted however that the releases in Table 3.2-1 do not reflect the actual BSEP release data to date. The releases to date have been substantially less. This table was used as a calculational tool to determine the controlling location.

The X/Q values utilized in the equations for implementation of 10 CFR 20 are based upon the maximum long-term annual average $\overline{X/Q}$ in the unrestricted area. Table 3.2-2 presents the distances from the reactor and turbine buildings to the nearest unrestricted area for each of the 16 sectors as well as to the nearest residence, vegetable garden, cow, goat, and beef animal. Table 3.2-3 presents the distances and directions from the stack to the same site boundaries of Table 3.2-2. Note that only distance has changed in relation to Table 3.2-2.

Long-term annual average ($\overline{X/Q}$) values for the stack, reactor building, and turbine building release points from the BSEP to the special locations in Table 3.2-2 are presented in Appendix A. A description of their derivation is also provided in this Appendix. $\overline{X/Q}$ values at the limiting site boundary for releases from the turbine building, reactor buildings, and stack were obtained from Tables A-1, A-7, and A-13 respectively of the Appendix.

To determine the controlling location for implementation of 10 CFR 20, the two or three highest site boundary $\overline{X/Q}$ values for each release point were utilized in conjunction with the radionuclide mix and release rate for each release point. Since mixed mode and elevated releases occur from the BSEP their maximum $\overline{X/Q}$ value may not decrease with distance (i.e., the site boundary may not have the highest $\overline{X/Q}$ values). Therefore, long-term annual average $\overline{X/Q}$ values were calculated at the mid-point of the 10 standard distances as given in Table A-4 of the Appendix A. The highest two or three $\overline{X/Q}$ values for each release point at a distance greater than the site boundary were used in conjunction with the radionuclide mix to determine the controlling location. A particular combination of release point mix and meteorology dominates in the determination of the controlling location. For the BSEP, it is the stack and the controlling location is at the ENE site boundary.

Values for K_i , L_i and M_i , which were used in the determination of the controlling location and which are to be used by the BSEP in Expressions 3.2-5 and 3.2-6 to show compliance with 10 CFR 20, are presented in Table 3.2-4. These values originate from NUREG-0472 Revision 0 and were taken from Table B-1 of NRC Regulatory Guide 1.109 Revision 1. The values have been multiplied by 10^6 to convert microcuries to picocuries for use in Expressions 3.2-5 and 3.2-6.

Values for V_i and B_i for the finite plume model can be expressed as shown in Equations 3.2-7 and 3.2-8. They were calculated at the site boundary of each of the 16 sectors using the NRC code RABFIN. Values of V_i and B_i for each of the 16 sectors are presented in Appendix B.

$$B_i = \frac{K}{r_d} \sum_{jkl} \frac{f_{jk} A_{li} \mu_a E_l I}{u_j} \quad (3.2-7)$$

I = the results of numerical integration over the plume spatial distribution of the airborne activity as defined by the meteorological condition of wind speed (u_j) and atmospheric stability class k for a particular wind direction;

K = a numerical constant representing unit conversions,

$$= \frac{260 \text{ mrad(radians)} (m^3) (\text{transformation})}{\text{sec (Mev)} (Ci)} \frac{16 \text{ sectors}}{2\pi \text{ radians}}$$

$$10^{-6} \frac{Ci}{\mu Ci} (3.15 \times 10^7 \frac{\text{sec}}{\text{yr}})$$

$$= 2.1 \times 10^4 \text{ mrad } (m^3) (\text{transformation})/\text{yr(Mev)} (\mu Ci);$$

r_d = the distance from the release point to the receptor location, meters;

u_j = the mean wind speed assigned to the j th wind speed class, meters/sec;

f_{jk} = the joint frequency of occurrence of the j th wind speed class and k th stability class (dimensionless);

A_{li} = the number of photons of energy corresponding to the l th energy group emitted per transformation of the i th radionuclide, number/transformation;

E_l = the energy assigned to the l th energy group, Mev;

μ_a = the energy absorption coefficient in air for photon energy E_l , meters⁻¹.

The V_i factor is computed with conversion from air dose to tissue depth dose, thus;

$$V_i = 1.1 \frac{K}{r_d} \sum_{jkl} \frac{f_{jk} A_{li} \mu_a E_l}{u_j} e^{-\mu_T T_d} \quad (3.2-8)$$

where:

- μ_T = the tissue energy absorption coefficient for photons of energy E_l , cm^2/gm ;
- T_d = the tissue density thickness taken to represent the total body dose ($5 \text{ gm}/\text{cm}^2$);
- 1.1 = the ratio of the tissue to air absorption coefficients over the energy range of photons of interest, mrem/mrad .

3.2.2

Radioiodine and Particulates

The dose rate in unrestricted areas resulting from the release of radioiodines and particulates with half lives greater than 8 days is limited to 1500 mrem/yr to any organ. Based upon NUREG-0133 the following is used to show compliance with 10 CFR 20:

$$\sum_i P_i (W_s \dot{Q}_{is} + W_v \dot{Q}_{iv}) \leq 1500 \text{ mrem/yr} \quad (3.2-9)$$

where

- P_i = dose parameter for radioiodines and particulates with half lives greater than 8 days based upon the critical organ and the most restrictive age group:
- = $\text{mrem/yr per } \mu\text{Ci}/\text{m}^3$ for inhalation pathways and for tritium;
- = $\text{mrem/yr per } \mu\text{Ci}/\text{sec per m}^{-2}$ for food and ground plane pathways;

\dot{Q}_{is} = the release rate of radionuclide i, in gaseous effluents from free-standing stack, $\mu\text{Ci/sec}$;

\dot{Q}_{iv} = the release rate of radionuclide i in gaseous effluents from all vent releases, $\mu\text{Ci/sec}$;

W_v = the highest calculated annual average dispersion parameter for estimating the dose to an individual at the controlling location due to all vent releases;

$W_v = \text{sec/m}^3$ for the inhalation pathway;

$W_v = \text{meters}^{-2}$ for the food and ground plane pathways;

W_s = the highest calculated annual average dispersion parameter for estimating the dose to an individual at the controlling location due to stack releases;

$W_s = \text{sec/m}^3$ for the inhalation pathway;

$W_s = \text{meters}^{-2}$ for the food and ground plane pathways.

Radioiodine and particulates may be released from the stack, reactor buildings and the turbine buildings of the BSEP. To show compliance with 10 CFR 20, Expression 3.2-9 is now modified to incorporate the various release points for the BSEP:

$$\sum_i P_i (W_s \dot{Q}_{is} + W_{rb} \dot{Q}_{rb} + W_{tb} \dot{Q}_{tb}) \leq 1500 \text{ mrem/yr} \quad (3.2-10)$$

where

W_s = the annual average dispersion parameter for the stack;

- W_{rb} = the annual average dispersion parameter for the reactor buildings;
 W_{tb} = annual average dispersion parameter for the turbine buildings;
 $\dot{Q}_{i_{rb}}$ = release of radionuclide i from the two reactor buildings, $\mu\text{Ci/sec}$;
 $\dot{Q}_{i_{tb}}$ = release of radionuclide i from the two turbine buildings, $\mu\text{Ci/sec}$;
 \dot{Q}_{i_s} = release of radionuclide i from the stack, $\mu\text{Ci/sec}$.

All other terms are the same as those defined previously.

In the calculation to show compliance with 10 CFR 20 only the inhalation, ground plane, cow milk, and goat milk pathways are considered for the BSEP. In determining the dose at a particular location, W is a function of pathway. For the food and ground plane pathways W is in terms of D/Q (i.e., deposition). If the inhalation pathway is considered, W is in terms of X/Q. Incorporation of the various pathways into Expression 3.2-10 results in the following:

$$\sum_i P_{i_I} \left[(\overline{X/Q})_s \dot{Q}_{i_s} + (\overline{X/Q})_{rb} \dot{Q}_{i_{rb}} + (\overline{X/Q})_{tb} \dot{Q}_{i_{tb}} \right] + \sum_i (P_{i_G} + P_{i_M}) \left[(\overline{D/Q})_s Q_{i_s} + (\overline{D/Q})_b Q_{i_{rb}} + (\overline{D/Q})_{tb} \dot{Q}_{i_{tb}} \right] \leq 500 \text{ mrem/yr} \quad (3.2-11)$$

where

- P_{i_I} = dose parameter for radionuclide i for the inhalation pathway, $\text{mrem/yr per } \mu\text{Ci/sec}^3$;
 P_{i_G} = dose parameter for radionuclide i for the ground plane pathway, $\text{mrem/yr per } \mu\text{Ci/sec per m}^{-2}$;
 P_{i_M} = dose parameter for radionuclide i for either the cow milk or goat milk pathway, $\text{mrem/yr per } \mu\text{Ci/sec per m}^{-2}$;

$(\overline{X/Q})_{rb}$ = annual average relative concentration for releases from the reactor buildings, sec/m^3 ;

$(\overline{X/Q})_{tb}$ = annual average relative concentration for releases from the turbine buildings, sec/m^3 ;

$(\overline{X/Q})_s$ = annual average relative concentration for releases from the stack, sec/m^3 ;

$(\overline{D/Q})_{rb}$ = annual average deposition for releases from the reactor buildings, m^{-2} ;

$(\overline{D/Q})_{tb}$ = annual average deposition for releases from the turbine buildings, m^{-2} ;

$(\overline{D/Q})_s$ = annual average deposition for releases from the stack, m^{-2} .

In the case of tritium the W parameter for the food pathway (cow or goat milk), is based upon X/Q . Since tritium is a weak beta emitter, the ground plane contribution is zero for tritium. Therefore, the left-hand side of Expression 3.2- can be written as the following:

For tritium

$$\dot{D}_T = (P_{T_I} + P_{T_M}) \left[(\overline{X/Q})_s \dot{Q}_{T_s} + (\overline{X/Q})_{rb} \dot{Q}_{T_{rb}} + (\overline{X/Q})_{tb} \dot{Q}_{T_{tb}} \right] \quad (3.2-12)$$

where

\dot{D}_T = dose rate due to tritium releases, mrem/yr ;

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P_{T_I} = dose parameter for tritium for the inhalation pathway, mrem/yr per $\mu\text{Ci}/\text{m}^3$;

P_{T_M} = dose parameter for tritium for the milk pathway, mrem/yr per $\mu\text{Ci}/\text{m}^3$;

\dot{Q}_{T_s} = release rate of tritium from the stack, $\mu\text{Ci}/\text{sec}$;

$\dot{Q}_{T_{rb}}$ = release rate of tritium from the two reactor buildings, $\mu\text{Ci}/\text{sec}$;

$\dot{Q}_{T_{tb}}$ = release rate of tritium from the two turbine buildings, $\mu\text{Ci}/\text{sec}$.

Since P_{I_I} for tritium equals 647 and P_{I_M} equals 2380, Equation 3.2-12 reduces to:

$$\dot{D}_T = 3.0 \times 10^3 \left[(\bar{X}/\bar{Q})_s \dot{Q}_{T_s} + (\bar{X}/\bar{Q})_{rb} \dot{Q}_{T_{rb}} + (\bar{X}/\bar{Q})_{tb} \dot{Q}_{T_{tb}} \right] \quad (3.2-13)$$

To show compliance with 10 CFR 20, Expressions 3.2-11 and 3.2-13 are evaluated first at the limiting site boundary. It should be noted that the sum of the dose rates from radioiodines and particulates and from tritium must be summed and their combined dose rate less than 1500 mrem/yr to show compliance with 10 CFR 20. If the 1500 mrem/yr limit is exceeded at the limiting site boundary when all pathways are considered present at the site boundary but the inhalation pathway contributes less than 1500 mrem/yr, then Expressions 3.2-11 and 3.2-13 are evaluated at the limiting real pathway location.

The limiting site boundary location is 0.91 miles NE. Expression 3.2-11 becomes:

For radioiodines and particulates:

$$\sum_i P_{I_I} (3.3 \times 10^{-8} \dot{Q}_{I_s} + 1.7 \times 10^{-7} \dot{Q}_{I_{rb}} + 1.9 \times 10^{-6} \dot{Q}_{I_{tb}}) + \sum_i (P_{I_G} + P_{I_M}) (1.3 \times 10^{-9} \dot{Q}_{I_s} + 3.3 \times 10^{-9} \dot{Q}_{I_{rb}} + 1.2 \times 10^{-8} \dot{Q}_{I_{tb}}) \leq 1500 \text{ mrem/yr}$$

(3.2-14)

For the BSEP the limiting real pathway location is the cow milk pathway 0.79 miles SSE. At this location Expression 3.2-11 becomes:

$$\sum_i P_{iI} (1.0 \times 10^{-8} \dot{Q}_{is} + 6.8 \times 10^{-8} \dot{Q}_{irb} + 7.0 \times 10^{-6} \dot{Q}_{itb}) + \sum_i (P_{iG} + P_{iM}) (5.4 \times 10^{-10} \dot{Q}_{is} + 6.0 \times 10^{-10} \dot{Q}_{irb} + 1.4 \times 10^{-8} \dot{Q}_{itb}) \leq 1500 \text{ mrem/yr} \quad (3.2-15)$$

For tritium at the limiting site boundary Equation 3.2-13 becomes:

For tritium:

$$\dot{D}_T = 3.0 \times 10^3 (3.3 \times 10^{-8} \dot{Q}_{Ts} + 1.7 \times 10^{-7} \dot{Q}_{Trb} + 1.9 \times 10^{-6} \dot{Q}_{Ttb}) \quad (3.2-16)$$

At the limiting real pathway location Equation 3.2-13 becomes:

For tritium:

$$\dot{D}_T = 3.0 \times 10^3 (1.0 \times 10^{-8} \dot{Q}_{Ts} + 6.8 \times 10^{-8} \dot{Q}_{Trb} + 7.0 \times 10^{-6} \dot{Q}_{Ttb}) \quad (3.2-17)$$

The determination of controlling location for implementation of 10 CFR 20 for radioiodines and particulates is a function of the same two parameters as for noble gases plus a third, actual receptor pathway location. The incorporation of these parameters into Expression 3.2-11 results in the respective expressions at the controlling locations. The radionuclide mix was again based upon the source terms calculated using the GALE code. The mix and the source terms are presented in Table 3.2-1 as a function of release point.

In the determination of the controlling site boundary location the highest two or three site boundary D/Q values for each release point were utilized in conjunction with the radionuclide mix and the release rate for each release point. At the BSEP the combination of meteorology and release rate which dominates comes from the stack.

In the determination of actual receptor controlling location, the highest two or three D/Q values from each release point to the pathway locations of Table 3.2-2 are utilized in conjunction with the radionuclide mix and release rate for each release point. For the BSEP the controlling location is the cow milk pathway 0.79 miles SSE of the reactor building and turbine buildings.

Values for P_i were calculated for an infant for various radionuclides for the inhalation, ground plane, cow milk, and goat milk pathways using the methodology of NUREG-0133. The P_i values are presented in Table 3.2-5. The values of P_i reflect, for each radionuclide, the maximum P_i value for any organ for each individual pathway of exposure. Because the goat milk pathway is not present at the BSEP, the cow milk pathway P_i values were utilized in the determination of the various controlling locations. For the case of an infant being present at the site boundary or at the real pathway location, the ground plane pathway is not considered as a reasonable exposure pathway for the infant (i.e., $P_G = 0$). However, P_{iG} values are presented in Table 3.2-5 for completeness. Appendix C presents the methodology which was utilized in calculating the P_i values.

Annual average $\overline{D/Q}$ values at the special locations for the stack, reactor building, and the turbine building release points, respectively, which were utilized in Expressions 3.2-14 through 3.2-17 were obtained from the tables presented in Appendix A. The X/Q values in Expressions 3.2-14 through 3.2-17 were also obtained from the tables presented in of Appendix A. D/Q values at the limiting site boundary location and the limiting real pathway location for releases from the turbine buildings, the reactor buildings, and the stack were obtained from Tables A-3, A-9, and A-15 respectively of Appendix A. X/Q values at these same locations for these same release points were obtained from Tables A-1, A-7, and A-13 of Appendix A. A description of the derivation of the X/Q and D/Q values is provided in Appendix A.

TABLE 3.2-1

Releases from Brunswick Steam Electric Plant*
(Ci/yr per unit)

<u>Isotope</u>	<u>Turbine Building (Ground Level)</u>	<u>Reactor Building (Mixed Mode)</u>	<u>Stack (Elevated)</u>
Kr-83m	0	0	3.0E4
Kr-85m	6.8E1	6.0	5.8E4
Kr-85	0	0	2.0E2
Kr-87	1.3E2	6.0	1.7E5
Kr-88	2.3E2	6.0	1.9E5
Kr-89	0	0	2.9E3
Xe-131m	0	0	1.6E2
Xe-133m	0	0	3.0E3
Xe-133	2.5E2	1.3E2	8.8E4
Xe-135m	6.5E2	9.2E1	7.4E3
Xe-135	6.3E2	6.8E1	2.3E5
Xe-137	0	0	7.9E3
Xe-138	1.4E3	1.4E1	2.7E5
Ar-41	0	2.5E1	0
I-131	1.9E-2	3.4E-1	5.1
I-133	7.6E-2	1.4	2.1E1
Cr-51	1.3E-4	6.0E-4	9.0E-3
Mn-54	6.0E-6	6.0E-6	3.0E-2
Fe-59	5.0E-6	8.0E-4	1.5E-2
Co-58	6.0E-6	1.2E-3	4.5E-3
Co-60	2.0E-5	2.0E-2	9.0E-2
Zn-65	2.0E-6	4.0E-3	1.5E-3
Sr-89	6.0E-5	1.8E-4	4.5E-4
Sr-90	2.0E-7	1.0E-5	3.0E-4
Zr-95	1.0E-6	8.0E-4	5.0E-5
Sb-124	3.0E-6	4.0E-4	5.0E-5
Cs-134	3.0E-6	8.0E-3	4.5E-3
Cs-136	5.0E-7	6.0E-4	4.5E-4
Cs-137	6.0E-6	1.1E-2	9.0E-3
Ba-140	1.1E-4	8.0E-4	1.1E-4
Ce-141	6.0E-6	2.0E-4	2.6E-3
C-14	0	0	9.5
H-3	0	3.0E1	0

* Calculations based upon GALE code and not actual releases

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TABLE 3.2-2

Distance to Controlling Locations as Measured from the
Brunswick Plant Center (Mi)

<u>Sector</u>	<u>Site Boundary</u>	<u>Milk Cow</u>	<u>Milk Goat</u>	<u>Meat Animal</u>	<u>Nearest Resident</u>	<u>Nearest Garden</u>
NNE	0.64	-	-	1.10	0.91	1.39
NE	0.91	-	-	-	2.24	-
ENE	0.67	-	-	-	-	-
E	0.68	-	-	-	0.94	-
ESE	0.68	-	-	-	-	-
SE	0.67	-	-	0.79	0.82	0.94
SSE	0.74	0.79	-	0.80	0.79	-
S	1.04	-	-	-	1.48	1.57
SSW	0.96	-	-	-	1.44	1.44
SW	0.89	-	-	1.70	0.89	1.04
WSW	0.74	-	-	-	1.00	1.00
W	0.69	-	-	1.08	0.87	0.87
WNW	0.64	-	-	-	0.79	0.81
NW	0.70	-	-	-	0.80	5.00
NNW	0.64	-	-	-	0.85	0.97
N	0.64	-	-	-	0.88	0.85

TABLE 3.2-3

Distance To Site Boundaries Based Upon Brunswick Plant Center
And Directions From The Stack

<u>Based on Center of Brunswick Plant</u>		<u>From Stack to Site Boundaries of Table 3.2-2</u>	
<u>Direction</u>	<u>Site Boundary Distance (Mi)</u>	<u>Direction</u>	<u>Distance (Mi)</u>
NNE	0.64	NNE	0.74
NE	0.91	NE	0.97
ENE	0.67	ENE	0.69
E	0.68	E	0.66
ESE	0.68	ESE	0.61
SE	0.67	SE	0.57
SSE	0.74	SSE	0.55
S	1.04	S	0.92
SSW	0.96	SSW	0.87
SW	0.89	SW	0.84
WSW	0.74	WSW	0.75
W	0.69	W	0.73
WNW	0.64	WNW	0.72
NW	0.70	NW	0.81
NNW	0.64	NNW	0.76
N	0.64	N	0.76

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TABLE 3.2-4
DOSE FACTORS FOR NOBLE GASES AND DAUGHTERS*

Radionuclide	Total Body Dose Factor K_1 (mrem/yr per $\mu\text{Ci}/\text{m}^3$)	Skin Dose Factor L_1 (mrem/yr per $\mu\text{Ci}/\text{m}^3$)	Gamma Air Dose Factor M_1 (mrad/yr per $\mu\text{Ci}/\text{m}^3$)	Beta Air Dose Factor N_1 (mrad/yr per $\mu\text{Ci}/\text{m}^3$)
Kr-83m	7.56E-02**	---	1.93E+01	2.88E+02
Kr-85m	1.17E+03	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.61E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	5.92E+03	9.73E+03	6.17E+03	1.03E+04
Kr-88	1.47E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.66E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.56E+04	7.29E+03	1.63E+04	7.83E+03
Xe-131m	9.15E+01	4.76E+02	1.56E+02	1.11E+03
Xe-133m	2.51E+02	9.94E+02	3.27E+02	1.48E+03
Xe-133	2.94E+02	3.06E+02	3.53E+02	1.05E+03
Xe-135m	3.12E+03	7.11E+02	3.36E+03	7.39E+02
Xe-135	1.81E+03	1.86E+03	1.92E+03	2.46E+03
Xe-137	1.42E+03	1.22E+04	1.51E+03	1.27E+04
Xe-138	8.83E+03	4.13E+03	9.21E+03	4.75E+03
Ar-41	8.84E+03	2.69E+03	9.30E+03	3.28E+03

*The listed dose factors are for radionuclides that may be detected in gaseous effluents.

**7.56E-02 = 7.56×10^{-2} .

TABLE 3.2-5

P_1 VALUES FOR AN INFANT FOR THE
BRUNSWICK STEAM ELECTRIC PLANT#

<u>Isotope</u>	<u>Inhalation</u>	<u>Ground Plane</u>	<u>Cow Milk</u>	<u>Goat Milk</u>
H-3	6.47E2	0	2.38E3	4.86E3
P-32	2.03E6	0	1.60E11	1.93E11
Cr-51	1.28E4	6.67E6	4.79E6	5.65E5
Mn-54	1.00E6	1.09E9	3.89E7	4.68E6
Fe-59	1.02E6	3.92E8	3.93E8	5.11E6
Co-58	7.77E5	5.29E8	6.06E7	7.28E6
Co-60	4.51E6	4.40E9	2.10E8	2.52E7
Zn-65	6.47E5	6.89E8	1.90E10	2.29E9
Rb-86	1.90E5	1.28E7	2.22E10	2.67E9
Sr-89	2.03E6	3.16E4	1.27E10	2.66E10
Sr-90	4.09E7	-	1.21E11	2.55E11
Y-91	2.45E6	1.52E6	5.26E6	6.32E5
Zr-95	1.75E6	3.48E8	8.28E5	9.95E4
Nb-95	4.79E5	1.95E8	2.06E8	2.48E7
Ru-103	5.52E5	1.55E8	1.05E5	1.27E4
Ru-106	1.16E7	2.99E8	1.44E6	1.73E5
Ag-110m	3.67E6	3.14E9	1.46E10	1.75E9
Te-127m	1.31E6	1.18E5	1.04E9	1.24E8
Te-129m	1.68E6	2.86E7	1.40E9	1.68E8
Cs-134	7.03E5	2.81E9	6.79E10	2.04E11
Cs-136	1.35E5	2.13E8	5.76E9	1.73E10
Cs-137	6.12E5	1.15E9	6.02E10	1.81E11
Ba-140	1.60E6	2.94E7	2.41E8	2.89E7
Ce-141	5.17E5	1.98E7	1.37E7	1.65E6
Ce-144	9.84E6	5.84E7	1.33E8	1.60E7
I-131	1.48E7	2.46E7	1.06E12	1.27E12
I-132	1.69E5	1.78E6	1.39E2	1.64E2
I-133	3.56E6	3.54E6	9.30E9	1.18E10
I-135	6.96E5	3.67E6	2.27E7	2.68E7

Units are mrem/yr per $\mu\text{Ci}/\text{m}^3$ for H-3 and the inhalation pathway and mrem/yr per $\mu\text{Ci}/\text{sec per m}^{-2}$ for the food and ground plane pathways.

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3.3 Compliance With 10 CFR 50 (Gaseous)

3.3.1 Noble Gases

3.3.1.1 Cumulation of Doses

Section II.B.1 of Appendix I of 10 CFR 50 limits the releases of gaseous effluents from each reactor such that the estimated annual gamma air dose is limited to 10 millirad and the beta air dose is limited to 20 millirad. Based upon NUREG-0133, the air dose in the unrestricted area due to noble gases released in gaseous effluents can be determined by the following expressions:

During any calendar quarter, for gamma radiation:

$$3.17 \times 10^{-8} \sum_i \left[M_i \left[\overline{(X/Q)}_V Q_{iv} + \overline{(X/q)}_V q_{iv} \right] + B_i Q_{is} + b_i q_{is} \right] \leq 5 \text{ mrad} \quad (3.3-1)$$

During any calendar quarter, for beta radiation:

$$3.17 \times 10^{-8} \sum_i N_i \left[\overline{(X/Q)}_V Q_{iv} + \overline{(X/q)}_V q_{iv} + \overline{(X/Q)}_S Q_{is} + \overline{(X/q)}_S q_{is} \right] \leq 10 \text{ mrad}, \quad (3.3-2)$$

During any calendar year, for gamma radiation:

$$3.17 \times 10^{-8} \sum_i \left[M_i \left[\overline{(X/Q)}_V Q_{iv} + \overline{(X/q)}_V q_{iv} \right] + B_i Q_{is} + b_i q_{is} \right] \leq 10 \text{ mrad}, \quad (3.3-3)$$

During any calendar year, for beta radiation:

$$3.17 \times 10^{-8} \sum_i N_i \left[\overline{(X/Q)}_V Q_{iv} + \overline{(X/q)}_V q_{iv} + \overline{(X/Q)}_S Q_{is} + \overline{(X/q)}_S q_{is} \right] \leq 20 \text{ mrad} \quad (3.3-4)$$

where:

M_i = The air dose factor due to gamma emissions for each identified noble gas radionuclide i , mrad/yr per $\mu\text{Ci}/\text{m}^3$;

N_i = the air dose factor due to beta emissions for each identified noble gas radionuclide i , mrad/yr per $\mu\text{Ci}/\text{m}^3$;

$(\overline{X/Q})_v$ = the annual average relative concentration for areas at or beyond the unrestricted area boundary for long-term vent releases (greater than 500 hrs/year), sec/m^3 ;

$(\overline{X/q})_v$ = the relative concentration for areas at or beyond the unrestricted area boundary for short-term vent releases (equal to or less than 500 hrs/year), sec/m^3 ;

$(\overline{X/Q})_s$ = the annual average relative concentration for areas at or beyond the unrestricted area boundary for long-term free standing stack releases (greater than 500 hrs/year), sec/m^3 ;

$(\overline{X/q})_s$ = the relative concentration for areas at or beyond the unrestricted area boundary for short-term free standing stack releases (equal to or less than 500 hrs/year), sec/m^3 ;

q_{is} = the average release of noble gas radionuclide i in gaseous effluents for short-term stack releases (equal to or less than 500 hrs/year), μCi ;

q_{iv} = the average release of noble gas radionuclide i in gaseous effluents for short-term vent releases (equal to or less than 500 hrs/year), μCi ;

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Q_{is} = the average release of noble gas radionuclide i in gaseous effluents for long-term free standing stack releases (greater than 500 hrs/year), μCi ;

Q_{iv} = the average release of noble gas radionuclide i in gaseous effluents for long-term vent releases (greater than 500 hrs/yr), μCi ;

B_i = the constant for long-term releases (greater than 500 hrs/yr) for each identified noble gas radionuclide i accounting for the gamma radiation from the elevated finite plume, mrad/yr per $\mu\text{Ci/sec}$;

b_i = the constant for short-term releases (equal to or less than 500 hrs/yr) for each identified noble gas radionuclide i accounting for the gamma radiation from the elevated finite plume, mrad/yr per $\mu\text{Ci/sec}$;

3.17×10^{-8} = the inverse of the number of seconds in a year.

For the BSEP all releases are considered long term. The incorporation of the stack, reactor building and turbine building release points into Expressions 3.3-1 through 3.3-4 results in the following expressions for two units to show compliance with 10 CFR 50:

During any calendar quarter or year-

Gamma Radiation

$$3.17 \times 10^{-8} \sum_i \left[M_i \left[\overline{(X/Q)}_{rb} (Q_{i_{rb1}} + Q_{i_{rb2}}) + \overline{(X/Q)}_{tb} (Q_{i_{tb1}} + Q_{i_{tb2}}) \right] + B_i Q_{is} \right] \leq 10 \text{ mrad (per quarter) or } 20 \text{ mrad (per year)} \quad (3.3-5)$$

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Beta Radiation

$$3.17 \times 10^{-8} \sum_i N_i \left[\overline{(X/Q)}_{rb} (Q_{i_{rb1}} + Q_{i_{rb2}}) + \overline{(X/Q)}_{tb} (Q_{i_{tb1}} + Q_{i_{tb2}}) + \overline{(X/Q)}_s Q_{i_s} \right] \leq 20 \text{ mrad (per quarter) or } 40 \text{ mrad (per year)} \quad (3.3-6)$$

where:

$\overline{(X/Q)}_{rb}$ = annual average relative concentration for releases from the reactor building, sec/m^3 ;

$\overline{(X/Q)}_{tb}$ = annual average relative concentration for releases from the turbine building, sec/m^3 ;

$\overline{(X/Q)}_s$ = annual average relative concentration for releases from the stack, sec/m^3 ;

$Q_{i_{rb1}}, Q_{i_{rb2}}$ = release of radionuclide i from reactor buildings 1 and 2, respectively, μCi ;

$Q_{i_{tb1}}, Q_{i_{tb2}}$ = release of radionuclide i from turbine buildings 1 and 2, respectively, μCi ;

Q_{i_s} = release of radionuclide i from the stack, μCi ;

At the BSEP the limiting location for noble gases is 0.67 miles ENE. Substitution of the appropriate X/Q values into Expressions 3.3-5 and 3.3-6 results in the following:

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During any calendar quarter or year-

Gamma Radiation

$$3.17 \times 10^{-8} \sum_i \left[M_i \left[7.2 \times 10^{-8} (Q_{i_{rb1}} + Q_{i_{rb2}}) + 4.2 \times 10^{-6} (Q_{i_{tb1}} + Q_{i_{tb2}}) \right] + B_i Q_{i_s} \right] \leq 10 \text{ mrad (per quarter) or } 20 \text{ mrad (per year)} \quad (3.3-7)$$

Beta Radiation

$$3.17 \times 10^{-8} \sum_i N_i \left[7.2 \times 10^{-8} (Q_{i_{rb1}} + Q_{i_{rb2}}) + 4.2 \times 10^{-6} (Q_{i_{tb1}} + Q_{i_{tb2}}) + 6.3 \times 10^{-9} Q_{i_s} \right] \leq 20 \text{ mrad (per quarter) or } 40 \text{ mrad (per year)} \quad (3.3-8)$$

The determination of the controlling locations for implementation of 10 CFR 50 is a function of parameters such as radionuclide mix, isotopic release and meteorology.

The incorporation of these parameters into Expressions 3.3-1 through 3.3-4 resulted in the expressions for the controlling locations as presented in Expressions 3.3-7 and 3.3-8. The radionuclide mix was based upon source terms calculated using the NRC GALE Code and is presented in Table 3.2-1 as a function of release point.

The two or three highest site boundary $\overline{X/Q}$ values for each release point were utilized in conjunction with the radionuclide mix and release for each release point to determine the controlling site boundary location. Since mixed mode and elevated releases occur from the BSEP and their maximum $\overline{X/Q}$ values may not decrease with distance (i.e., the site boundary may not have the highest $\overline{X/Q}$ values); $\overline{X/Q}$ values were calculated at the midpoint of 10 standard distance intervals out to a distance of 5 miles. The two or three highest $\overline{X/Q}$ values for those distances, greater than the site boundary, were also considered in conjunction with the radionuclide mix and releases to determine the controlling location.

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In the determination of the controlling location, annual average $\overline{X/Q}$ values are utilized. These values are presented in tables in Appendix A. $\overline{X/Q}$ values at the limiting site boundary location for releases from the turbine buildings, reactor buildings, and stack were obtained from Tables A-1, A-7, and A-13 respectively of A description of the derivation of the X/Q values is also presented in Appendix A.

A particular combination of release point mix and meteorology dominates in the determination of the controlling location. For the BSEP, the controlling release point is the stack.

Values for M_i and N_i , which were used in the determination of the controlling location and which are to be used by the BSEP in Expressions 3.3-7 and 3.3-8 to show compliance with 10 CFR 50 were presented in Table 3.2-4. These values originate from NUREG-0472 Revision 0 and were taken from Table B-1 of NRC Regulatory Guide 1.109 Revision 1. The values have been multiplied by 10^6 to convert from picocuries to microcuries.

The following relationship should hold for the BSEP to show compliance with Radiological Effluent Technical Specification 1.2.3.1.

For the calendar quarter

$$D_\gamma \leq 10 \text{ mrad} \quad (3.3-9)$$

$$D_\beta \leq 20 \text{ mrad} \quad (3.3-10)$$

For the calendar year

$$D_\gamma \leq 20 \text{ mrad} \quad (3.3-11)$$

$$D_\beta \leq 40 \text{ mrad} \quad (3.3-12)$$

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where

D_γ = the air dose from gamma radiation, mrad;

D_β = the air dose from beta radiation, mrad.

The quarterly limits given above represent one-half the annual design objective of Section II.B.1 of Appendix I of 10 CFR 50. If any of the limits of Expressions 3.3-9 through 3.3-12 are exceeded a special report pursuant to Section IV.A of Appendix I of 10 CFR 50 must be filed with the NRC.

3.3.1.2 Projection of Doses

Doses resulting from the release of gaseous effluents will be projected monthly. The doses will be projected using Expressions 3.3-7 and 3.3-8 as appropriate.

3.3.2 Radioiodine and Particulates

3.3.2.1 Cumulation of Doses

Section II.C of Appendix I of 10 CFR 50 limits the release of radioiodines and radioactive material in particulate form from each reactor such that estimated dose or dose commitment to an individual in an unrestricted area from all pathways of exposure is not in excess of 15 mrem to any organ. Based upon NUREG-0133, the dose to an organ of an individual from radioiodines and particulates, with half-lives greater than 8 days in gaseous effluents released to unrestricted areas, can be determined by the following expression:

During any calendar quarter or year-

$$3.17 \times 10^{-8} \sum_i R_i (W_s Q_{is} + w_s q_{is} + W_v Q_{iv} + w_v q_{iv}) \leq \begin{matrix} 7.5 \text{ mrem (per quarter) or} \\ 15 \text{ mrem (per calendar year)} \end{matrix}$$

(3.3-13)

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where:

- Q_{is} = release of radionuclide i for long-term free standing stack releases (greater than 500 hrs/yr), μCi ;
- Q_{iv} = release of radionuclide i for long-term vent releases (greater than 500 hrs/yr), μCi ;
- q_{is} = release of radionuclide i for short-term free standing stack releases (equal to or less than 500 hrs/yr), μCi ;
- q_{iv} = release of radionuclide i for short-term vent releases (equal to or less than 500 hrs/yr), μCi ;
- W_s = dispersion parameter for estimating dose to an individual at the controlling location for long-term free standing stack releases (greater than 500 hrs/yr);
- = sec/m^3 for the inhalation pathway and tritium;
- = meters^{-2} for the food and ground plane pathway;
- W_v = the dispersion parameter for estimating the dose to an individual at the controlling location for long-term vent releases (greater than 500 hrs/yr);
- = sec/m^3 for the inhalation pathway and tritium;
- = meters^{-2} for the food and ground plane pathway;
- w_s = dispersion parameter for estimating the dose to an individual at the controlling location for short-term stack releases (equal to or less than 500 hrs/yr);

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- = sec/m^3 for the inhalation pathway and tritium;
- = meters^{-2} for the food and ground plane pathway;
- w_v = the dispersion parameter for estimating the dose to an individual at the controlling location for short-term vent releases (equal to or less than 500 hrs/yr);
- = sec/m^3 for the inhalation pathway and tritium;
- = meters^{-2} for the food and ground plane pathway;
- 3.17×10^{-8} = the inverse of the number of seconds in a year;
- R_i = the dose factor for each identified radionuclide i , of the organ of interest, mrem/yr per $\mu\text{Ci}/\text{sec}$ per m^{-2} or mrem/yr per $\mu\text{Ci}/\text{m}^3$.

Radioiodines and particulates may be released from the stack, reactor buildings, and turbine buildings of the BSEP. At the BSEP all releases are considered long term in duration. Therefore, incorporating the various release points into Expression 3.3-13 results in the following expression to show compliance with 10 CFR 50, for a particular organ:

$$3.17 \times 10^{-8} \sum_i R_i \left[w_s Q_{i_s} + w_{rb} (Q_{i_{rb1}} + Q_{i_{rb2}}) + w_{tb} (Q_{i_{tb1}} + Q_{i_{tb2}}) \right] \leq 15.0 \text{ mrem (per quarter) or } 30 \text{ mrem (per year)} \quad (3.3-14)$$

where:

- w_s = dispersion parameter for releases from the stack;

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- W_{rb} = dispersion parameter for releases from the reactor building;
- W_{tb} = dispersion parameter for releases from the turbine building;
- Q_{is} = release of radionuclide i from the stack, μCi ;
- Q_{irb1}, Q_{irb2} = release of radionuclide i from reactor buildings 1 and 2, respectively, μCi ;
- Q_{itb1}, Q_{itb2} = release of radionuclide i from turbine buildings 1 and 2, respectively, μCi ;

In determining the dose at a particular location, W , as in Section 3.2.2, is a function of the pathway. For the food and ground plane pathway W is in terms of D/Q . If the inhalation pathway is considered, W is in terms of X/Q . Incorporation of the various pathways into Expression 3.3-14 results in the following:

$$\begin{aligned}
 & 3.17 \times 10^{-8} \sum_i \left[(R_{iG} + R_{iM} + R_{iV} + R_{iB}) \left[(\overline{D/Q})_s Q_{is} + (\overline{D/Q})_{rb} (Q_{irb1} + Q_{irb2}) \right. \right. \\
 & \quad \left. \left. + (\overline{D/Q})_{tb} (Q_{itb1} + Q_{itb2}) \right] + R_{iI} \left[(\overline{X/Q})_s Q_{is} + (\overline{X/Q})_{rb} \right. \right. \\
 & \quad \left. \left. (Q_{irb1} + Q_{irb2}) + (\overline{X/Q})_{tb} (Q_{itb1} + Q_{itb2}) \right] \right] \\
 & \leq 15 \text{ mrem (per quarter) or } 30 \text{ mrem (per year)} \quad (3.3-15)
 \end{aligned}$$

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where:

- R_{iG} = dose factor for an organ for radionuclide i for the ground plane exposure pathway, mrem/yr per $\mu\text{Ci}/\text{sec}$ per m^{-2} ;
- R_{iM} = dose factor for an organ for radionuclide i for either the cow milk or goat milk pathway, mrem/yr per $\mu\text{Ci}/\text{sec}$ per m^{-2} ;
- R_{iV} = dose factor for an organ for radionuclide i for the vegetable pathway, mrem/yr per $\mu\text{Ci}/\text{sec}$ per m^{-2} ;
- R_{iB} = dose factor for an organ for radionuclide i for the meat pathway, mrem/yr per $\mu\text{Ci}/\text{sec}$ per m^{-2} ;
- R_{iI} = dose factor for an organ for radionuclide i for the inhalation pathway, mrem/yr per $\mu\text{Ci}/\text{m}^3$.
- $(\overline{D/Q})_{rb}$ = Annual average deposition for releases from the reactor buildings, m^{-2} ;
- $(\overline{D/Q})_{tb}$ = annual average deposition for releases from the turbine buildings, m^{-2} ;
- $(\overline{D/Q})_s$ = annual average deposition for releases from the stack, m^{-2} .

As discussed in Section 3.2.2, for tritium the parameter W for the food pathway is based upon X/Q. The ground plane pathway is not appropriate for tritium. Therefore, the left hand portion of Expression 3.3-15 may be modified for purposes of implementation of 40 CFR 190 as:

For tritium:

$$D_T = 3.17 \times 10^{-8} (R_{T_M} + R_{T_V} + R_{T_B} + R_{T_I}) \left[(\overline{X/Q})_s Q_{T_s} + (\overline{X/Q})_{rb} (Q_{T_{rb1}} + Q_{T_{rb2}}) + (\overline{X/Q})_{tb} (Q_{T_{tb1}} + Q_{T_{tb2}}) \right] \quad (3.3-16)$$

where:

D_T	=	dose resulting from tritium, mrem;
R_{T_M}	=	dose factor for an organ for tritium for the milk pathway, mrem/yr per $\mu\text{Ci}/\text{sec}^3$;
R_{T_V}	=	dose factor for an organ for tritium for the vegetable pathway, mrem/yr per $\mu\text{Ci}/\text{m}^3$;
R_{T_B}	=	dose factor for an organ for tritium for the beef pathway, mrem/yr per $\mu\text{Ci}/\text{m}^3$;
R_{T_I}	=	dose factor for an organ for tritium for the inhalation pathway, mrem/yr per $\mu\text{Ci}/\text{m}^3$;
Q_{T_s}	=	release of tritium from the stack, μCi ;
$Q_{T_{rb1}}, Q_{T_{rb2}}$	=	release of tritium from reactor buildings 1 and 2 respectively, μCi ;
$Q_{T_{tb1}}, Q_{T_{tb2}}$	=	release of tritium from turbine buildings 1 and 2 respectively, μCi .

Equation 3.3-16 is used to show compliance with 40 CFR 190.

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To show compliance with 10 CFR 50, Expression 3.3-15 is evaluated at the controlling pathway location. At the BSEP the controlling location is a milk cow 0.79 miles in the SSE sector. Expression 3.3-15 becomes:

$$\begin{aligned}
 3.17 \times 10^{-8} \sum_i \left[(R_{i_G} + R_{i_M}) \left[5.4 \times 10^{-10} Q_{i_s} + \right. \right. \\
 \left. 6.0 \times 10^{-10} (Q_{i_{rb1}} + Q_{i_{rb2}}) + 1.4 \times 10^{-8} (Q_{i_{tbl}} + \right. \\
 \left. Q_{i_{tb2}}) \right] + R_{i_I} \left[1.0 \times 10^{-8} Q_{i_s} + 6.8 \times 10^{-8} (Q_{i_{rb1}} + Q_{i_{rb2}}) + \right. \\
 \left. 7.0 \times 10^{-6} (Q_{i_{tbl}} + Q_{i_{tb2}}) \right] \leq 15 \text{ mrem (per quarter) or 30 mrem (per year)} \\
 (3.3-17)
 \end{aligned}$$

For tritium, for implementation of 40 CFR 190, Equation 3.3-16 reduces to:

$$\begin{aligned}
 D_T = 3.17 \times 10^{-8} (R_{T_M} + R_{T_I}) \left[1.0 \times 10^{-8} Q_{T_s} + \right. \\
 \left. 6.8 \times 10^{-8} (Q_{T_{rb1}} + Q_{T_{rb2}}) + 7.0 \times 10^{-6} (Q_{T_{tbl}} + Q_{T_{tb2}}) \right] \\
 (3.3-18)
 \end{aligned}$$

The determination of a controlling location for implementation of 10 CFR 50 for radioiodines and particulates is a function of:

- (1) radionuclide mix and isotopic release
- (2) meteorology
- (3) exposure pathway
- (4) receptor's age.

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The incorporation of these parameters into Expression 3.3-14 results in the respective equations at the controlling location.

In the determination of the controlling location, the radionuclide mix of radioiodines and particulates was based upon the source terms calculated using the GALE Code. This mix was presented in Table 3.2-1 as a function of release point.

In the determination of the controlling location, all of the exposure pathways, as presented in Table 3.2-2, were evaluated. These include cow milk, goat milk, beef and vegetable ingestion and inhalation and ground plane exposure. An infant was assumed to be present at all milk pathway locations. A child was assumed to be present at all vegetable garden and beef animal locations. The ground plane exposure pathway was only considered to be present where an infant was not present. Naturally, inhalation was present everywhere an individual was present.

For the determination of the controlling location, the highest D/Q values for each release point and release mode for the vegetable garden, cow milk, and goat milk pathways were selected. The thyroid dose was calculated at each of these locations using the radionuclide mix and releases of Table 3.2-1. Based upon these calculations, it was determined that the controlling receptor pathway is the cow milk/infant pathway. The ground plane exposure pathway is not appropriate for an infant. However, the R_i value for the ground plane pathway was not omitted from Expression 3.3-16 in the event that a land use census should indicate that a child, a teen, or an adult is the critical receptor at the controlling location. At the BSEP the controlling release point and mix is the stack.

Tables 3.3-1 through 3.3-19 present R_i values for the total body, GI-tract, bone, liver, kidney, thyroid, and lung organs for the ground plane, inhalation, cow milk, goat milk, vegetable, and meat ingestion pathways for the infant, child, teen, and adult age groups as appropriate to the pathways. These values were calculated using the methodology described in NUREG-0133 using a grazing period of 8 months. A discussion of their calculation is presented in Appendix C.

In the determination of the controlling location annual average $\overline{D/Q}$ and $\overline{X/Q}$ values are utilized. D/Q values at the limiting real pathway location for releases from the turbine buildings, reactor buildings and the stack were obtained from Tables A-3, A-9, and A-15 respectively of Appendix A. X/Q values at the same location for these same release points were obtained from Tables A-1, A-7, and A-13 of Appendix A. A description of the derivation of the various X/Q and D/Q values is presented in Appendix A.

Long-term $\overline{D/Q}$ values for the stack, reactor buildings, and the turbine buildings are provided for the midpoints of the following distances:

0.0-0.5 mi., 0.5-1.0 mi., 1.0-1.5 mi., 1.5-2.0 mi., 2.0-2.5 mi., 2.5-3.0 mi., 3.0-3.5 mi., 3.5-4.0 mi., 4.0-4.5 mi., and 4.5-5.0 mi.

These values appear in tables in Appendix A. They may be utilized if an additional special location arises different from those presented in the special locations of Table 3.2-2.

The following relationships should hold for the BSEP to show compliance with BSEP Radiological Effluent Technical Specification 1.2.4.1

For the calendar quarter:

$$D_r \leq 15 \text{ mrem} \quad (3.3-19)$$

For the calendar year:

$$D_r \leq 30 \text{ mrem} \quad (3.3-20)$$

where:

D_r = the dose to any organ r from radiodines and particulates, mrem.

The quarterly limits given above represent one-half the annual design objective of Section IIC of Appendix I of 10 CFR 50. If any of the limits of Expressions 3.3-19 or 3.3-20 are exceeded, a special report pursuant to Section IV.A of Appendix I of 10 CFR 50 must be filed with the NRC.

3.3.2.2 Projection of Doses

Doses resulting from release of radioiodines and particulates will be projected monthly. The doses will be projected using Expression 3.3-17.

TABLE 3.3-1 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = GROUND ACLUIDE T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
CR 51	4.56E 05	4.56E 06	4.56E 05	4.56E 05	4.56E 05	4.56E 05	5.51E 05
CR 54	1.34E 02	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.57E 09
CR 59	2.75E 03	2.75E 08	2.75E 03	2.75E 03	2.75E 03	2.75E 03	3.23E 03
CR 53	3.79E 03	3.79E 08	3.79E 03	3.79E 03	3.79E 03	3.79E 03	4.44E 03
CR 50	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.52E 10
CR 55	7.49E 03	7.49E 08	7.49E 03	7.49E 03	7.49E 03	7.49E 03	8.61E 03
CR 56	8.99E 05	8.99E 05	8.99E 05	8.99E 05	8.99E 05	8.99E 05	1.03E 07
CR 52	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.58E 04
CR 51	1.08E 05	1.08E 05	1.08E 05	1.08E 05	1.08E 05	1.08E 05	1.22E 05
CR 95	2.49E 08	2.49E 08	2.49E 08	2.49E 08	2.49E 08	2.49E 08	2.39E 03
CR 95	1.35E 08	1.35E 03	1.35E 08	1.35E 08	1.35E 08	1.35E 08	1.50E 03
CR 103	1.09E 08	1.09E 04	1.09E 04	1.09E 08	1.09E 08	1.09E 08	1.27E 04
CR 105	4.19E 06	4.19E 03	4.19E 04	4.19E 08	4.19E 04	4.19E 04	5.03E 08
CR 110	3.48E 09	3.48E 09	3.48E 09	3.48E 09	3.48E 09	3.48E 09	4.05E 09
CR 127	9.15E 04	9.15E 04	9.15E 04	9.15E 04	9.15E 04	9.15E 04	1.03E 05
CR 127	2.00E 07	2.00E 07	2.00E 07	2.00E 07	2.00E 07	2.00E 07	2.34E 07
I 131	1.72E 07	1.72E 07	1.72E 07	1.72E 07	1.72E 07	1.72E 07	2.09E 07
I 132	1.24E 06	1.24E 06	1.24E 06	1.24E 06	1.24E 06	1.24E 06	1.45E 05
I 133	2.47E 05	2.47E 05	2.47E 05	2.47E 05	2.47E 05	2.47E 05	3.00E 05
I 135	2.56E 05	2.56E 05	2.56E 05	2.56E 05	2.56E 05	2.56E 05	2.99E 05
CS 134	5.32E 09	5.32E 09	5.32E 09	5.32E 09	5.32E 09	5.32E 09	7.95E 09
CS 136	1.49E 08	1.49E 08	1.49E 08	1.49E 08	1.49E 08	1.49E 08	1.69E 03
CS 137	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.20E 10
CR 140	2.05E 07	2.05E 07	2.05E 07	2.05E 07	2.05E 07	2.05E 07	2.34E 07
CR 141	1.36E 07	1.36E 07	1.36E 07	1.36E 07	1.36E 07	1.36E 07	1.53E 07
CR 144	5.95E 07	5.95E 07	5.95E 07	5.95E 07	5.95E 07	5.95E 07	6.03E 07

*R VALUES IN UNITS OF MBREM/YR PER MICRO-CI/M**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF
 (**2-MBREM/YR PER MICRO-CI/SEC FOR ALL OTHERS

TABLE 3.3-2 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = VEGET AGE GROUP EQUALS ADULT			ADULT							
NUCLIDE		T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN	
H 3	:	2.28E 03	2.28E 03	0.00E-01	2.28E 03	2.28E 03	2.28E 03	2.28E 03	2.28E 03	:
P 32	:	5.91E 07	1.72E 08	1.53E 07	9.51E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01	:
CR 51	:	1.60E 04	1.16E 07	0.00E-01	0.00E-01	1.01E 04	2.75E 04	5.10E 04	0.00E-01	:
IN 54	:	5.83E 07	9.36E 08	0.00E-01	3.05E 08	9.09E 07	0.00E-01	0.00E-01	0.00E-01	:
FE 59	:	1.12E 08	9.75E 08	1.24E 05	2.93E 08	0.00E-01	0.00E-01	5.17E 07	0.00E-01	:
CO 58	:	5.71E 07	6.07E 08	0.00E-01	2.99E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01	:
NO 60	:	3.67E 08	3.12E 09	0.00E-01	1.66E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	:
ZN 66	:	5.77E 08	8.04E 08	4.01E 08	1.28E 09	8.54E 08	0.00E-01	0.00E-01	0.00E-01	:
BR 86	:	1.03E 08	4.36E 07	0.00E-01	2.21E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	:
SR 89	:	2.87E 08	1.60E 09	1.00E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	:
SR 90	:	1.64E 11	1.93E 10	5.70E 11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	:
I 91	:	1.34E 05	2.76E 07	5.01E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	:
SR 95	:	2.51E 05	1.17E 09	1.16E 05	3.71E 05	5.82E 05	0.00E-01	0.00E-01	0.00E-01	:
CS 96	:	4.19E 04	4.73E 08	1.40E 05	7.79E 04	7.70E 04	0.00E-01	0.00E-01	0.00E-01	:
BI103	:	2.04E 06	5.53E 08	4.74E 05	0.00E-01	1.31E 07	0.00E-01	0.00E-01	0.00E-01	:
BI106	:	2.46E 07	1.26E 10	1.91E 08	0.00E-01	3.75E 08	0.00E-01	0.00E-01	0.00E-01	:
AG1101	:	5.23E 06	4.28E 07	1.13E 07	1.05E 07	2.06E 07	0.00E-01	0.00E-01	0.00E-01	:
TE127	:	5.12E 07	1.68E 09	5.02E 08	1.30E 08	2.04E 09	1.26E 08	0.00E-01	0.00E-01	:
TE129	:	4.71E 07	1.50E 09	2.93E 08	1.11E 08	1.24E 09	1.02E 08	0.00E-01	0.00E-01	:
I 131	:	5.61E 07	3.04E 07	8.07E 07	1.15E 08	1.93E 08	3.73E 10	0.00E-01	0.00E-01	:
I 132	:	5.21E 01	2.80E 01	5.57E 01	1.49E 02	2.37E 02	5.21E 03	0.00E-01	0.00E-01	:
I 133	:	1.12E 05	3.30E 05	2.11E 05	3.67E 06	6.40E 06	5.39E 08	0.00E-01	0.00E-01	:
I 135	:	3.91E 04	1.20E 05	4.05E 04	1.06E 05	1.70E 05	7.00E 06	0.00E-01	0.00E-01	:
CS134	:	8.33E 09	1.39E 08	4.54E 09	1.03E 10	3.49E 09	0.00E-01	1.16E 09	0.00E-01	:
CS136	:	1.19E 03	1.88E 07	1.12E 07	1.66E 08	9.21E 07	0.00E-01	1.26E 07	0.00E-01	:
CS137	:	5.94E 09	1.76E 08	5.63E 09	9.07E 09	3.03E 09	0.00E-01	1.02E 09	0.00E-01	:
SA140	:	8.40E 06	2.64E 06	1.23E 08	1.61E 05	5.47E 04	0.00E-01	9.22E 04	0.00E-01	:
DE141	:	1.76E 04	4.99E 05	1.93E 05	1.31E 05	5.07E 04	0.00E-01	0.00E-01	0.00E-01	:
DE144	:	1.69E 05	1.06E 10	3.15E 07	1.32E 07	7.80E 05	0.00E-01	0.00E-01	0.00E-01	:

*R VALUES IN UNITS OF MREM/YR PER MICRO-CI/HR**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF
 **2-MREM/YR PER MICRO-CI/SEC FOR ALL OTHERS

POOR ORIGINAL

TABLE 3.3-3 R VALUES FOR THE BRUNSVICK STEAM ELECTRIC PLANT*

PATHWAY = VEGET AGE GROUP EQUALS NUCLIDE T.BODY		TEEN GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H	3	2.61E 03	2.61E 03	0.00E-01	2.61E 03	2.61E 03	2.61E 03	2.61E 03
P	32	6.30E 07	1.47E 03	1.75E 09	1.09E 08	0.00E-01	0.00E-01	0.00E-01
CR	51	6.11E 04	1.03E 07	0.00E-01	0.00E-01	1.34E 04	3.39E 04	3.72E 04
MI	54	8.79E 07	9.09E 03	0.00E-01	1.43E 08	1.32E 08	0.00E-01	0.00E-01
FE	59	1.60E 08	9.78E 08	1.77E 08	4.14E 08	0.00E-01	0.00E-01	1.30E 03
CO	53	9.79E 07	5.35E 03	0.00E-01	4.25E 07	0.00E-01	0.00E-01	0.00E-01
CO	60	5.57E 03	3.22E 02	0.00E-01	2.47E 08	0.00E-01	0.00E-01	0.00E-01
ZN	66	3.68E 03	7.88E 03	5.35E 03	1.36E 09	1.19E 09	0.00E-01	0.00E-01
RB	66	1.30E 03	4.09E 07	0.00E-01	2.76E 03	0.00E-01	0.00E-01	0.00E-01
SR	89	4.36E 03	1.31E 09	1.52E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR	90	2.05E 11	2.33E 10	3.32E 11	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y	91	2.06E 05	3.15E 02	7.63E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN	95	3.68E 05	1.23E 02	1.69E 06	5.35E 05	7.86E 05	0.00E-01	0.00E-01
U3	95	5.77E 04	4.48E 06	1.39E 05	1.05E 05	1.02E 05	0.00E-01	0.00E-01
RU103		2.90E 06	5.66E 03	5.73E 05	0.00E-01	2.39E 07	0.00E-01	0.00E-01
RU106		3.93E 07	1.50E 10	3.12E 03	0.00E-01	6.02E 08	0.00E-01	0.00E-01
AG1103		9.39E 05	4.34E 09	1.63E 07	1.54E 07	2.95E 07	0.00E-01	0.00E-01
TE127M		9.44E 07	1.98E 02	7.93E 08	2.81E 08	3.22E 09	1.89E 08	0.00E-01
TE129M		5.79E 07	1.61E 09	4.29E 08	1.59E 08	1.79E 09	1.34E 08	0.00E-01
I 131		5.77E 07	2.13E 07	7.68E 07	1.07E 08	1.35E 08	3.14E 10	0.00E-01
I 132		4.72E 01	5.72E 01	5.02E 01	1.31E 02	2.07E 02	4.43E 03	0.00E-01
I 133		1.01E 06	2.51E 04	1.95E 05	3.32E 06	5.83E 06	4.54E 08	0.00E-01
I 135		3.49E 04	1.04E 05	3.55E 04	9.42E 04	1.49E 05	6.06E 05	0.00E-01
CS134		7.54E 02	2.02E 03	6.90E 02	1.62E 10	5.16E 09	0.00E-01	1.97E 09
CS135		1.13E 03	1.35E 07	4.23E 07	1.68E 03	9.16E 07	0.00E-01	1.44E 07
CS137		4.90E 02	2.00E 04	1.05E 10	1.41E 10	4.73E 09	0.00E-01	1.86E 09
SA140		3.88E 06	2.12E 04	1.33E 04	1.69E 05	5.72E 04	0.00E-01	1.14E 05
CE141		2.12E 04	5.29E 08	2.77E 05	1.85E 05	8.70E 04	0.00E-01	0.00E-01
CE141		2.71E 06	1.27E 10	5.04E 07	2.02E 07	1.23E 07	0.00E-01	0.00E-01

* R VALUES IN UNITS OF REM/YR PER MICRO-CI/HR³ FOR INHALATION AND TRITIUM, AND IN UNITS OF
 1**2-REM/YR PER MICRO-CI/SEC FOR ALL OTHERS

TABLE 3.3-4 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = VEGET

AGE GROUP EQUALS CHILD

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
I 3	4.04E 03	4.04E 03	0.00E-01	4.04E 03	4.04E 03	4.04E 03	4.04E 03	4.04E 03
P 32	1.42E 03	1.01E 03	3.67E 09	1.72E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CR 51	1.16E 05	6.15E 06	0.00E-01	0.00E-01	1.76E 04	6.44E 04	1.18E 05	0.00E-01
IN 54	1.73E 03	5.44E 03	0.00E-01	5.49E 08	1.82E 08	0.00E-01	0.00E-01	0.00E-01
FE 59	3.17E 03	5.62E 03	3.93E 03	5.36E 08	0.00E-01	0.00E-01	1.34E 03	0.00E-01
ZN 66	1.92E 03	3.66E 03	0.00E-01	5.27E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	1.11E 09	2.04E 09	0.00E-01	3.76E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	1.70E 09	4.81E 03	1.03E 09	2.74E 09	1.73E 09	0.00E-01	0.00E-01	0.00E-01
SR 85	2.81E 04	2.94E 07	0.00E-01	4.56E 03	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	1.03E 09	1.40E 09	3.62E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	3.49E 11	1.86E 10	1.36E 12	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	4.49E 05	2.44E 09	1.83E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CR 95	7.44E 05	8.71E 04	3.80E 05	3.35E 05	1.20E 06	0.00E-01	0.00E-01	0.00E-01
CS 95	1.12E 05	2.91E 03	4.04E 05	1.57E 05	1.48E 05	0.00E-01	0.00E-01	0.00E-01
RU103	5.36E 06	3.94E 08	1.52E 07	0.00E-01	3.84E 07	0.00E-01	0.00E-01	0.00E-01
RU106	2.36E 07	1.17E 10	7.52E 03	0.00E-01	1.02E 09	0.00E-01	0.00E-01	0.00E-01
AG110M	1.37E 07	2.73E 09	3.45E 07	2.34E 07	4.35E 07	0.00E-01	0.00E-01	0.00E-01
TE127I	2.26E 03	1.54E 09	1.90E 09	5.12E 08	5.42E 09	4.56E 08	0.00E-01	0.00E-01
TE129I	1.55E 03	1.22E 09	9.93E 04	2.79E 08	2.93E 09	3.22E 03	0.00E-01	0.00E-01
I 131	5.16E 07	1.23E 07	1.43E 03	1.44E 03	2.36E 08	4.75E 10	0.00E-01	0.00E-01
I 132	7.53E 01	1.93E 02	8.91E 01	1.64E 02	2.51E 02	7.50E 03	0.00E-01	0.00E-01
I 133	1.57E 05	1.79E 05	3.57E 05	4.42E 06	7.35E 06	8.21E 03	0.00E-01	0.00E-01
I 135	5.54E 04	8.92E 04	6.50E 04	1.17E 05	1.79E 05	1.04E 07	0.00E-01	0.00E-01
CS134	5.40E 09	1.33E 03	1.56E 10	2.56E 10	7.93E 09	0.00E-01	2.94E 09	0.00E-01
CS136	1.43E 08	7.77E 06	3.04E 07	2.21E 03	1.13E 08	0.00E-01	1.76E 07	0.00E-01
CS137	3.52E 09	1.50E 08	2.49E 10	2.39E 10	7.73E 09	0.00E-01	2.80E 09	0.00E-01
BA140	1.61E 07	1.40E 03	2.76E 03	2.42E 05	7.37E 04	0.00E-01	1.44E 05	0.00E-01
CE141	4.75E 04	3.79E 03	5.42E 05	3.20E 05	1.40E 05	0.00E-01	0.00E-01	0.00E-01
CE144	5.49E 05	9.94E 09	1.22E 03	3.31E 07	2.11E 07	0.00E-01	0.00E-01	0.00E-01

*R VALUES IN UNITS OF BRE/HR PER MICRO-CI/HR**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF
 **2-BRE/HR PER MICRO-CI/SEC FOR ALL OTHERS

POOR ORIGINAL

TABLE 3.3-5 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = MEAT		AGE GROUP = ADULT		ADULT															
NUCLIDE		T. BODY		GI-TRACT		BONE		LIVER		KIDNEY		THYROID		LUNG		SKIN			
H	3	:	3.27E 02	:	3.27E 02	:	0.00E-01	:	3.27E 02	:	3.27E 02	:	3.27E 02	:	3.27E 02	:	3.27E 02	:	3.27E 02
P	32	:	1.18E 03	:	3.43E 03	:	3.05E 02	:	1.39E 03	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
CR	51	:	4.27E 03	:	1.03E 06	:	0.00E-01	:	0.00E-01	:	9.42E 02	:	2.56E 03	:	5.57E 03	:	0.00E-01	:	0.00E-01
AN	54	:	1.06E 06	:	1.71E 07	:	0.00E-01	:	5.57E 06	:	1.56E 06	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
FE	59	:	1.42E 03	:	1.25E 02	:	1.59E 03	:	3.74E 03	:	0.00E-01	:	0.00E-01	:	1.04E 03	:	0.00E-01	:	0.00E-01
CO	58	:	2.43E 07	:	2.20E 03	:	0.00E-01	:	1.03E 07	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
CO	60	:	1.03E 03	:	8.75E 03	:	0.00E-01	:	4.66E 07	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
ZN	65	:	3.58E 03	:	4.93E 03	:	2.40E 03	:	7.91E 03	:	5.29E 03	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
RB	85	:	1.42E 03	:	6.00E 07	:	0.00E-01	:	3.04E 03	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
SR	89	:	5.23E 06	:	2.92E 07	:	1.32E 03	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
SR	90	:	2.02E 02	:	2.33E 03	:	3.22E 02	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
Y	91	:	1.30E 04	:	3.71E 03	:	5.75E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
ZR	95	:	2.43E 05	:	1.14E 09	:	1.12E 06	:	3.59E 05	:	5.64E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
JB	96	:	4.12E 05	:	4.66E 09	:	1.33E 06	:	7.56E 05	:	7.58E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
RU103		:	2.72E 07	:	7.33E 02	:	5.32E 07	:	0.00E-01	:	2.41E 03	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
RU106		:	2.19E 03	:	1.12E 11	:	1.73E 02	:	0.00E-01	:	3.36E 09	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
AG1101		:	2.34E 06	:	1.61E 09	:	4.27E 05	:	3.95E 05	:	7.75E 06	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
FE1270		:	1.00E 03	:	2.76E 02	:	8.22E 03	:	2.94E 03	:	3.34E 09	:	2.10E 03	:	0.00E-01	:	0.00E-01	:	0.00E-01
FE1290		:	1.17E 03	:	3.73E 02	:	7.40E 03	:	2.76E 03	:	3.09E 09	:	2.54E 03	:	0.00E-01	:	0.00E-01	:	0.00E-01
I 131		:	5.77E 06	:	2.66E 05	:	7.04E 05	:	1.01E 07	:	1.73E 07	:	3.30E 09	:	0.00E-01	:	0.00E-01	:	0.00E-01
I 133		:	1.51E-01	:	4.45E-01	:	2.65E-01	:	4.96E-01	:	3.65E-01	:	7.29E 01	:	0.00E-01	:	0.00E-01	:	0.00E-01
I 135		:	5.07E-17	:	1.85E-15	:	5.23E-17	:	1.64E-16	:	2.64E-16	:	1.03E-14	:	0.00E-01	:	0.00E-01	:	0.00E-01
CS134		:	7.31E 03	:	1.67E 07	:	4.01E 03	:	9.55E 03	:	3.02E 03	:	0.00E-01	:	1.03E 03	:	0.00E-01	:	0.00E-01
CS136		:	2.14E 07	:	3.33E 06	:	7.53E 06	:	2.77E 07	:	1.65E 07	:	0.00E-01	:	2.27E 06	:	0.00E-01	:	0.00E-01
CS137		:	4.99E 03	:	1.47E 07	:	5.57E 03	:	7.61E 03	:	2.53E 03	:	0.00E-01	:	3.59E 07	:	0.00E-01	:	0.00E-01
HA140		:	1.20E 06	:	3.77E 07	:	1.83E 07	:	2.30E 04	:	7.82E 03	:	0.00E-01	:	1.32E 04	:	0.00E-01	:	0.00E-01
CE141		:	5.46E 02	:	2.13E 07	:	3.42E 03	:	5.59E 03	:	2.65E 03	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
CE144		:	4.70E 04	:	2.96E 04	:	3.75E 05	:	3.66E 05	:	2.17E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01

*R VALUES IN UNITS OF REM/YR PER MICRO-CI/4**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF 4**2-REM/YR PER MICRO-CI/SEC FOR ALL OTHERS

TABLE 3.3-5 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = HEAT		AGE GROUP = ADULTS		TEEN															
NUCLIDE		T. BODY		GI-TRACT		BONE		LIVER		KIDNEY		THYROID		LUNG		SKIN			
H 3	:	1.95E 02	:	1.95E 02	:	0.00E-01	:	1.95E 02	:	1.95E 02	:	1.95E 02	:	1.95E 02	:	1.95E 02	:		
P 32	:	9.98E 07	:	2.16E 04	:	2.53E 09	:	1.60E 08	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
CR 51	:	3.42E 03	:	5.75E 05	:	0.00E-01	:	0.00E-01	:	7.49E 02	:	1.90E 03	:	4.89E 03	:	0.00E-01	:		
IN 54	:	8.43E 05	:	8.72E 05	:	0.00E-01	:	4.25E 06	:	1.27E 06	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
FE 59	:	1.15E 03	:	7.02E 03	:	1.27E 03	:	2.97E 03	:	0.00E-01	:	0.00E-01	:	9.36E 07	:	0.00E-01	:		
CO 58	:	1.93E 07	:	1.15E 03	:	0.00E-01	:	8.35E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
CO 50	:	8.15E 07	:	4.71E 03	:	0.00E-01	:	3.62E 07	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
ZN 65	:	2.83E 08	:	2.57E 05	:	1.75E 03	:	6.07E 03	:	3.39E 03	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
RS 86	:	1.19E 08	:	3.76E 07	:	0.00E-01	:	2.54E 03	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
SR 89	:	4.40E 05	:	1.83E 07	:	1.54E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
SR 90	:	1.31E 09	:	1.49E 08	:	5.32E 09	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
Y 91	:	1.52E 04	:	2.33E 03	:	5.63E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
ZR 95	:	1.95E 05	:	5.53E 03	:	3.97E 05	:	2.33E 05	:	4.16E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
NR 96	:	3.29E 05	:	2.55E 09	:	1.03E 05	:	5.97E 05	:	5.79E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
RU103	:	2.20E 07	:	4.30E 09	:	5.15E 07	:	0.00E-01	:	1.82E 03	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
RU106	:	1.84E 03	:	7.00E 10	:	1.45E 09	:	0.00E-01	:	2.81E 09	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
AG1104	:	1.66E 06	:	3.59E 03	:	3.23E 05	:	3.05E 06	:	5.83E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
TE1274	:	8.25E 07	:	1.73E 09	:	5.91E 03	:	2.45E 05	:	2.31E 09	:	1.65E 03	:	0.00E-01	:	0.00E-01	:		
TE1271	:	9.31E 07	:	2.33E 09	:	5.20E 03	:	2.30E 03	:	2.59E 09	:	2.00E 03	:	0.00E-01	:	0.00E-01	:		
I 131	:	4.40E 05	:	1.62E 05	:	5.85E 06	:	3.20E 06	:	1.41E 07	:	2.39E 09	:	0.00E-01	:	0.00E-01	:		
I 133	:	1.23E-01	:	3.05E-01	:	2.39E-01	:	4.05E-01	:	7.10E-01	:	5.65E 01	:	0.00E-01	:	0.00E-01	:		
I 135	:	4.88E-17	:	1.45E-15	:	5.11E-17	:	1.32E-15	:	2.03E-15	:	8.45E-15	:	0.00E-01	:	0.00E-01	:		
CS134	:	3.48E 03	:	9.34E 05	:	3.19E 05	:	7.51E 03	:	2.39E 03	:	0.00E-01	:	7.11E 07	:	0.00E-01	:		
CS135	:	1.55E 07	:	1.85E 05	:	5.37E 06	:	2.31E 07	:	1.26E 07	:	0.00E-01	:	1.78E 06	:	0.00E-01	:		
CS137	:	2.14E 03	:	8.75E 05	:	4.52E 05	:	6.15E 03	:	2.09E 03	:	0.00E-01	:	4.13E 07	:	0.00E-01	:		
BA140	:	9.76E 05	:	2.31E 07	:	1.51E 07	:	1.85E 04	:	6.29E 03	:	0.00E-01	:	1.25E 04	:	0.00E-01	:		
CE141	:	5.42E 02	:	1.35E 07	:	7.07E 03	:	4.72E 03	:	2.22E 03	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
CE144	:	3.76E 04	:	1.35E 03	:	7.37E 05	:	3.05E 05	:	1.32E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		

*R VALUES IN UNITS OF MREM/YR PER MICRO-CI/M**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF
 M**2-MREM/YR PER MICRO-CI/SEC FOR ALL OTHERS

TABLE 3.3-7 H VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = HEAT		AGE GROUP EQUALS		CHILD								
NUCLIDE		T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN			
H 3		2.36E-02	2.36E-02	0.00E-01	2.36E-02	2.36E-02	2.36E-02	2.36E-02	2.36E-02			
P 32		1.87E-03	1.34E-03	4.86E-09	2.27E-03	0.00E-01	0.00E-01	0.00E-01	0.00E-01			
CR 51		5.33E-03	2.83E-05	0.00E-01	0.00E-01	8.09E-02	2.96E-03	5.40E-03	0.00E-01			
AN 54		1.30E-05	4.03E-05	0.00E-01	4.86E-06	1.36E-06	0.00E-01	0.00E-01	0.00E-01			
FE 59		1.82E-03	3.80E-03	2.25E-03	3.55E-03	0.00E-01	0.00E-01	1.06E-03	0.00E-01			
CO 53		2.99E-07	5.70E-07	0.00E-01	9.76E-06	0.00E-01	0.00E-01	0.00E-01	0.00E-01			
CO 60		1.27E-03	2.33E-03	0.00E-01	4.30E-07	0.00E-01	0.00E-01	0.00E-01	0.00E-01			
ZN 66		4.35E-03	1.23E-03	2.62E-03	6.99E-03	4.40E-03	0.00E-01	0.00E-01	0.00E-01			
NR 86		2.21E-03	2.32E-07	0.00E-01	3.60E-03	0.00E-01	0.00E-01	0.00E-01	0.00E-01			
SR 89		3.31E-05	1.13E-07	2.91E-03	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01			
SR 90		1.74E-02	9.25E-07	6.37E-03	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01			
Y 91		2.37E-04	1.43E-03	1.07E-06	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01			
ZR 95		3.12E-05	3.65E-03	1.59E-05	3.50E-05	5.01E-05	0.00E-01	0.00E-01	0.00E-01			
NB 95		5.17E-05	1.34E-02	1.35E-05	7.23E-05	6.87E-05	0.00E-01	0.00E-01	0.00E-01			
RU103		3.56E-07	2.41E-09	9.31E-07	0.00E-01	2.34E-03	0.00E-01	0.00E-01	0.00E-01			
RU106		3.43E-03	4.27E-10	2.75E-09	0.00E-01	3.71E-09	0.00E-01	0.00E-01	0.00E-01			
AG1101		2.89E-06	4.30E-03	5.35E-06	3.62E-06	6.74E-06	0.00E-01	0.00E-01	0.00E-01			
TE127M		1.55E-03	1.05E-09	1.31E-04	3.52E-03	3.73E-09	3.13E-03	0.00E-01	0.00E-01			
TE127M		1.81E-03	1.42E-09	1.17E-04	3.25E-03	3.43E-09	3.77E-03	0.00E-01	0.00E-01			
I 131		5.20E-06	9.72E-05	1.09E-07	1.09E-07	1.79E-07	3.51E-09	0.00E-01	0.00E-01			
I 133		2.07E-01	2.21E-01	4.43E-01	5.43E-01	9.13E-01	1.02E-02	0.00E-01	0.00E-01			
I 135		7.87E-17	1.27E-16	9.25E-17	1.65E-16	2.55E-16	1.47E-14	0.00E-01	0.00E-01			
CS134		1.95E-03	4.93E-05	5.63E-03	9.23E-03	2.85E-03	0.00E-01	1.03E-05	0.00E-01			
CS135		1.80E-07	9.79E-05	1.01E-07	2.73E-07	1.43E-07	0.00E-01	2.21E-06	0.00E-01			
CS137		1.20E-03	5.19E-05	3.51E-03	3.15E-03	2.65E-03	0.00E-01	9.55E-07	0.00E-01			
JA140		1.53E-06	1.42E-07	2.80E-07	2.45E-04	7.97E-03	0.00E-01	1.46E-04	0.00E-01			
CE141		9.66E-02	8.23E-06	1.33E-04	5.64E-03	2.91E-03	0.00E-01	0.00E-01	0.00E-01			
CE144		7.42E-04	1.14E-03	1.29E-05	4.36E-05	2.41E-05	0.00E-01	0.00E-01	0.00E-01			

*2 VALUES IN UNITS OF REM/YR PER MICRO-CI/YR**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF
 **2-REM/YR PER MICRO-CI/SEC FOR ALL OTHERS

TABLE 3.3-3 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = COW MILK
AGE GROUP EQUALS ADULT

ISOLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
I 3	7.69E 02	7.69E 02	0.00E-01	7.69E 02	7.69E 02	7.69E 02	7.69E 02	7.69E 02
P 32	4.32E 08	1.25E 07	1.12E 10	6.95E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CR 51	1.73E 04	4.35E 05	0.00E-01	0.00E-01	3.82E 03	1.04E 04	2.30E 04	0.00E-01
IN 54	2.76E 05	1.57E 07	0.00E-01	5.11E 06	1.52E 05	0.00E-01	0.00E-01	0.00E-01
FE 57	1.60E 07	1.39E 03	1.77E 07	4.17E 07	0.00E-01	0.00E-01	1.17E 07	0.00E-01
CO 58	6.28E 06	5.58E 07	0.00E-01	2.80E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	2.24E 07	1.91E 03	0.00E-01	1.02E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	1.38E 09	1.92E 09	2.59E 08	3.95E 09	2.94E 09	0.00E-01	0.00E-01	0.00E-01
RB 85	7.54E 08	3.19E 08	0.00E-01	1.52E 02	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 87	2.50E 07	1.40E 08	8.70E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	7.59E 09	8.94E 03	3.09E 12	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	1.37E 02	2.81E 05	5.11E 03	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
IR 95	1.22E 02	5.71E 05	5.62E 02	1.30E 02	2.33E 02	0.00E-01	0.00E-01	0.00E-01
RB 95	1.48E 04	1.67E 08	4.95E 04	2.75E 04	2.72E 04	0.00E-01	0.00E-01	0.00E-01
RU103	2.53E 02	7.14E 04	5.11E 02	0.00E-01	2.33E 03	0.00E-01	0.00E-01	0.00E-01
RU105	1.50E 03	6.17E 05	1.25E 04	0.00E-01	2.44E 04	0.00E-01	0.00E-01	0.00E-01
AG1104	2.04E 07	1.40E 10	3.71E 07	3.44E 07	6.76E 07	0.00E-01	0.00E-01	0.00E-01
TE1274	4.11E 06	1.13E 08	3.37E 07	1.21E 07	1.37E 08	8.62E 06	0.00E-01	0.00E-01
TE1274	6.19E 06	1.97E 08	3.91E 07	1.46E 07	1.63E 08	1.34E 07	0.00E-01	0.00E-01
I 131	1.59E 08	7.32E 07	1.94E 08	2.77E 08	4.76E 08	9.09E 10	0.00E-01	0.00E-01
I 132	1.03E-01	5.51E-02	1.10E-01	2.93E-01	4.57E-01	1.03E 01	0.00E-01	0.00E-01
I 133	1.40E 06	4.13E 05	2.54E 05	4.59E 05	8.01E 05	6.75E 03	0.00E-01	0.00E-01
I 135	9.03E 03	2.76E 04	9.34E 03	2.45E 04	3.92E 04	1.51E 06	0.00E-01	0.00E-01
CS134	6.71E 09	1.44E 08	3.45E 09	8.21E 09	2.66E 09	0.00E-01	8.52E 08	0.00E-01
CS135	4.73E 08	7.46E 07	1.55E 08	5.57E 08	3.65E 08	0.00E-01	5.01E 07	0.00E-01
CS137	4.22E 09	1.25E 08	4.71E 09	5.44E 09	2.12E 09	0.00E-01	7.27E 08	0.00E-01
AI140	1.12E 05	3.53E 07	1.71E 07	2.15E 04	7.32E 03	0.00E-01	1.23E 04	0.00E-01
CE141	2.23E 02	7.52E 05	2.91E 03	1.97E 03	9.14E 02	0.00E-01	0.00E-01	0.00E-01
CS144	1.15E 04	7.26E 07	2.15E 05	5.97E 04	5.32E 04	0.00E-01	0.00E-01	0.00E-01

*R VALUES IN UNITS OF BREM/YR PER MICRO-CI/M**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF
1**2-BREM/YR PER MICRO-CI/SEC FOR ALL OTHERS

TABLE 3.3-9 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = COW MILK
AGE GROUP EQUALS TEEN

ISOTOPE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.00E 03	1.00E 03	0.00E-01	1.00E 03	1.00E 03	1.00E 03	1.00E 03	1.00E 03
P 32	8.00E 08	1.73E 09	2.05E 10	1.23E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CR 51	3.02E 04	5.03E	0.00E-01	0.00E-01	6.63E 03	1.53E 04	4.32E 04	0.00E-01
IN 54	1.60E 06	1.75E 07	0.00E-01	8.52E 06	2.54E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	2.79E 07	1.71E 08	3.10E 07	1.23E 07	0.00E-01	0.00E-01	2.28E 07	0.00E-01
CO 53	1.00E 07	6.50E 07	0.00E-01	4.72E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	3.88E 07	2.25E 08	0.00E-01	1.72E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 66	2.33E 09	2.15E 09	1.47E 09	5.11E 09	3.27E 09	0.00E-01	0.00E-01	0.00E-01
RB 35	1.39E 09	4.37E 03	0.00E-01	2.95E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	4.52E 07	1.91E 08	1.60E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.08E 10	1.23E 09	4.37E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	2.52E 02	3.35E 06	9.40E 03	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	2.13E 02	7.15E 05	9.83E 02	3.10E 02	4.55E 02	0.00E-01	0.00E-01	0.00E-01
IS 95	2.58E 04	2.00E 08	8.45E 04	4.68E 04	4.54E 04	0.00E-01	0.00E-01	0.00E-01
RU103	4.65E 02	9.03E 04	1.09E 03	0.00E-01	3.33E 03	0.00E-01	0.00E-01	0.00E-01
RU105	2.93E 03	1.11E 05	2.52E 04	0.00E-01	4.48E 04	0.00E-01	0.00E-01	0.00E-01
AG1104	3.53E 07	1.63E 10	6.14E 07	5.81E 07	1.11E 08	0.00E-01	0.00E-01	0.00E-01
TE1274	7.39E 05	1.55E 08	6.22E 07	2.21E 07	2.52E 03	1.43E 07	0.00E-01	0.00E-01
TE1294	1.13E 07	2.69E 03	7.15E 07	2.65E 07	2.99E 08	2.31E 07	0.00E-01	0.00E-01
I 131	2.65E 08	9.75E 07	3.52E 03	4.93E 08	3.43E 08	1.44E 11	0.00E-01	0.00E-01
I 132	1.83E-01	2.22E-01	1.94E-01	5.09E-01	8.02E-01	1.71E 01	0.00E-01	0.00E-01
I 133	2.49E 06	6.19E 06	4.82E 05	8.18E 06	1.43E 07	1.14E 07	0.00E-01	0.00E-01
I 135	1.58E 04	4.74E 04	1.65E 04	4.27E 04	6.75E 04	2.75E 06	0.00E-01	0.00E-01
CS134	6.54E 09	1.75E 08	6.99E 07	1.41E 10	4.43E 09	0.00E-01	1.71E 09	0.00E-01
CS135	7.48E 08	8.97E 07	2.83E 03	1.11E 09	6.07E 08	0.00E-01	9.56E 07	0.00E-01
CS137	3.96E 09	1.62E 08	8.54E 09	1.14E 10	3.87E 09	0.00E-01	1.50E 09	0.00E-01
BA140	1.99E 06	4.77E 07	3.09E 07	3.79E 04	1.23E 04	0.00E-01	2.55E 04	0.00E-01
CE141	4.09E 02	1.02E 07	6.33E 03	3.56E 03	1.50E 03	0.00E-01	0.00E-01	0.00E-01
CE144	2.12E 04	9.93E 07	3.95E 05	1.63E 05	9.75E 04	0.00E-01	0.00E-01	0.00E-01

*R VALUES IN UNITS OF MREM/YR PER MICRO-CI/YR**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF
 **2-MREM/YR PER MICRO-CI/SEC FOR ALL OTHERS

TABLE 3.3-10 H VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

 PATHWAY = COW MILK
 AGE GROUP = ADULTS CHILD

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
I 3	1.58E 03	1.53E 03	0.00E-01	1.58E 03	1.53E 03	1.53E 03	1.53E 03	1.53E 03
P 32	1.96E 09	1.41E 09	5.09E 10	2.38E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CR 51	6.17E 04	3.27E 06	0.00E-01	0.00E-01	9.35E 03	3.42E 04	5.25E 04	0.00E-01
NI 54	3.39E 06	1.07E 07	0.00E-01	1.27E 07	3.57E 06	0.00E-01	0.00E-01	0.00E-01
FE 59	5.79E 07	1.21E 08	7.13E 07	1.26E 08	0.00E-01	0.00E-01	3.37E 07	0.00E-01
CO 58	2.21E 07	4.20E 07	0.00E-01	7.21E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	7.90E 07	1.43E 08	0.00E-01	2.63E 07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 66	4.79E 09	1.35E 09	2.39E 09	7.70E 09	4.35E 09	0.00E-01	0.00E-01	0.00E-01
RB 86	3.36E 09	3.52E 03	0.00E-01	5.47E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 87	1.13E 03	1.54E 03	3.97E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.37E 10	9.95E 08	7.33E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	6.21E 02	3.09E 05	2.32E 04	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	4.47E 02	5.23E 05	2.23E 03	5.02E 02	7.13E 02	0.00E-01	0.00E-01	0.00E-01
VB 93	5.31E 04	1.37E 08	1.91E 05	7.42E 04	6.93E 04	0.00E-01	0.00E-01	0.00E-01
RU103	9.83E 02	6.65E 04	2.57E 03	0.00E-01	6.47E 03	0.00E-01	0.00E-01	0.00E-01
RU105	7.14E 03	8.90E 05	5.72E 04	0.00E-01	7.72E 04	0.00E-01	0.00E-01	0.00E-01
AG110A	7.19E 07	1.07E 10	1.33E 08	9.00E 07	1.53E 08	0.00E-01	0.00E-01	0.00E-01
TE127H	1.32E 07	1.24E 08	1.53E 03	4.13E 07	4.37E 08	3.65E 07	0.00E-01	0.00E-01
TE127M	2.74E 07	2.15E 03	1.76E 08	4.92E 07	5.13E 08	5.53E 07	0.00E-01	0.00E-01
I 131	4.38E 03	7.64E 07	3.54E 08	3.59E 08	1.41E 09	2.34E 11	0.00E-01	0.00E-01
I 132	3.39E-01	9.95E-01	4.60E-01	3.45E-01	1.29E 00	3.92E 01	0.00E-01	0.00E-01
I 133	5.48E 06	5.84E 05	1.17E 07	1.45E 07	2.41E 07	2.59E 09	0.00E-01	0.00E-01
I 135	3.35E 04	5.39E 04	3.93E 04	7.07E 04	1.03E 05	6.26E 06	0.00E-01	0.00E-01
CS134	4.78E 09	1.22E 08	1.33E 10	2.27E 10	7.03E 09	0.00E-01	2.52E 09	0.00E-01
CS135	1.14E 09	6.17E 07	6.37E 08	1.75E 09	9.35E 08	0.00E-01	1.40E 08	0.00E-01
CS137	2.91E 09	1.23E 08	2.05E 10	1.97E 10	6.42E 09	0.00E-01	2.31E 09	0.00E-01
BA140	4.36E 05	3.73E 07	7.47E 07	6.54E 04	2.13E 04	0.00E-01	3.70E 04	0.00E-01
CE141	9.73E 02	5.17E 05	1.31E 04	6.55E 03	2.57E 03	0.00E-01	0.00E-01	0.00E-01
CE144	5.20E 04	7.95E 07	9.74E 05	3.05E 05	1.69E 05	0.00E-01	0.00E-01	0.00E-01

 *H VALUES IN UNITS OF MREM/YR PER MICRO-CI/M**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF
 M**2-MREM/YR PER MICRO-CI/SEC FOR ALL OTHERS

TABLE 3.3-11: P VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = COW MILK

AGE GROUP EQUALS INFANT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	2.40E-03	2.40E-03	0.00E-01	2.40E-03	2.40E-03	2.40E-03	2.40E-03	2.40E-03
P 32	4.06E-09	1.42E-09	1.05E-11	6.17E-09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CR 51	9.77E-04	2.95E-06	0.00E-01	0.00E-01	1.39E-04	6.38E-04	1.24E-05	0.00E-01
KA 54	5.37E-06	9.71E-06	0.00E-01	2.37E-07	5.25E-06	0.00E-01	0.00E-01	0.00E-01
FE 59	9.23E-07	1.12E-07	1.34E-08	2.34E-08	0.00E-01	0.00E-01	6.92E-07	0.00E-01
CO 58	3.60E-07	3.59E-07	0.00E-01	1.44E-07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	1.29E-08	1.30E-08	0.00E-01	5.47E-07	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 66	6.14E-09	1.12E-10	3.88E-09	1.23E-10	6.45E-09	0.00E-01	0.00E-01	0.00E-01
BR 86	6.86E-09	3.55E-09	0.00E-01	1.39E-10	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	2.17E-09	1.55E-09	7.55E-09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 92	2.05E-10	1.01E-09	0.04E-10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	1.16E-03	3.12E-06	4.36E-04	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	7.01E-02	4.92E-05	4.00E-03	9.88E-02	1.05E-03	0.00E-01	0.00E-01	0.00E-01
AD 95	8.49E-04	1.24E-03	3.56E-05	1.47E-05	1.05E-05	0.00E-01	0.00E-01	0.00E-01
RU103	1.74E-03	8.33E-04	5.21E-03	0.00E-01	1.03E-04	0.00E-01	0.00E-01	0.00E-01
RU105	1.47E-04	8.35E-05	1.48E-05	0.00E-01	1.39E-05	0.00E-01	0.00E-01	0.00E-01
AG110M	1.19E-03	9.32E-04	2.46E-03	1.80E-06	2.57E-03	0.00E-01	0.00E-01	0.00E-01
TE127M	3.75E-07	1.25E-09	3.10E-08	1.03E-08	7.64E-08	9.36E-07	0.00E-01	0.00E-01
TE127M	5.57E-07	7.16E-07	3.62E-03	1.24E-08	9.05E-09	1.39E-03	0.00E-01	0.00E-01
I 131	9.23E-09	7.49E-07	1.78E-09	2.10E-09	2.45E-09	6.70E-11	0.00E-01	0.00E-01
I 132	6.90E-01	1.57E-00	5.55E-01	1.94E-00	2.16E-00	9.09E-01	0.00E-01	0.00E-01
I 133	1.05E-07	6.00E-04	2.47E-07	3.60E-07	4.23E-07	6.55E-09	0.00E-01	0.00E-01
I 135	5.93E-04	5.93E-04	8.17E-04	1.63E-05	1.81E-05	1.46E-07	0.00E-01	0.00E-01
CS134	4.19E-09	1.13E-09	2.23E-10	4.15E-10	1.07E-10	0.00E-01	4.38E-09	0.00E-01
CS136	1.37E-09	5.53E-07	1.25E-09	3.67E-09	1.46E-09	0.00E-01	2.39E-09	0.00E-01
CS137	2.72E-09	1.20E-09	3.23E-10	3.84E-10	1.03E-10	0.00E-01	4.19E-09	0.00E-01
BA140	7.91E-06	3.77E-07	1.54E-09	1.54E-05	3.65E-04	0.00E-01	9.43E-04	0.00E-01
CE141	1.87E-03	9.27E-06	2.60E-04	1.59E-04	4.90E-03	0.00E-01	0.00E-01	0.00E-01
CE144	7.82E-04	9.01E-07	1.40E-06	7.71E-05	2.31E-05	0.00E-01	0.00E-01	0.00E-01

* P VALUES IN UNITS OF MBY/HR PER MICRO-CI/M**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF
 **2-MBY/HR PER MICRO-CI/GG FOR ALL OTHERS

POOR ORIGINAL

TABLE 3.3-12 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = GOATMILK

AGE GROUP EQUALS ADULT

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
13	1.57E 03	1.57E 03	0.00E-01	1.57E 03	1.57E 03	1.57E 03	1.57E 03	1.57E 03
32	5.19E 08	1.51E 09	1.34E 10	3.34E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CR 51	2.08E 03	5.23E 05	0.00E-01	0.00E-01	4.53E 02	1.24E 03	2.76E 03	0.00E-01
MI 54	1.17E 05	1.83E 05	0.00E-01	5.14E 05	1.83E 05	0.00E-01	0.00E-01	0.00E-01
FE 59	2.08E 05	1.81E 05	2.31E 05	5.42E 05	0.00E-01	0.00E-01	1.51E 05	0.00E-01
CO 58	7.54E 05	6.82E 05	0.00E-01	3.35E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	2.69E 05	2.29E 07	0.00E-01	1.22E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 66	1.55E 08	2.31E 08	1.15E 08	3.66E 08	2.45E 08	0.00E-01	0.00E-01	0.00E-01
RB 86	9.05E 07	3.83E 07	0.00E-01	1.94E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	5.24E 07	2.93E 03	1.33E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	1.59E 10	1.83E 09	5.49E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	1.64E 01	3.37E 05	5.13E 02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	1.46E 01	6.85E 04	5.74E 01	2.15E 01	3.39E 01	0.00E-01	0.00E-01	0.00E-01
RB 95	1.78E 03	2.01E 07	5.94E 03	3.31E 03	3.27E 03	0.00E-01	0.00E-01	0.00E-01
RU103	3.16E 01	8.56E 03	7.33E 01	0.00E-01	2.80E 02	0.00E-01	0.00E-01	0.00E-01
RU106	1.92E 02	9.81E 04	1.52E 03	0.00E-01	2.93E 03	0.00E-01	0.00E-01	0.00E-01
AG1104	2.45E 06	1.68E 09	4.46E 05	4.12E 05	8.11E 05	0.00E-01	0.00E-01	0.00E-01
TE1274	4.93E 05	1.36E 07	4.05E 05	1.45E 05	1.54E 07	1.03E 05	0.00E-01	0.00E-01
TE1294	7.43E 05	2.36E 07	4.69E 05	1.75E 05	1.96E 07	1.51E 05	0.00E-01	0.00E-01
I 131	1.91E 08	8.73E 07	2.33E 03	3.33E 08	5.71E 03	1.09E 11	0.00E-01	0.00E-01
I 132	1.23E-01	6.61E-02	1.32E-01	3.52E-01	5.61E-01	1.23E 01	0.00E-01	0.00E-01
I 133	1.68E 05	4.95E 05	3.17E 04	5.51E 05	9.51E 05	8.10E 03	0.00E-01	0.00E-01
I 135	1.08E 04	3.32E 04	1.12E 04	2.94E 04	4.71E 04	1.94E 06	0.00E-01	0.00E-01
CS134	2.01E 10	4.31E 03	1.03E 10	2.46E 10	7.97E 09	0.00E-01	2.65E 09	0.00E-01
CS136	1.42E 09	2.24E 03	4.99E 03	1.27E 09	1.10E 09	0.00E-01	1.50E 03	0.00E-01
CS137	1.27E 10	3.74E 03	1.41E 10	1.93E 10	5.56E 09	0.00E-01	2.18E 09	0.00E-01
BA140	1.35E 05	4.23E 05	2.05E 05	2.58E 03	8.73E 02	0.00E-01	1.45E 03	0.00E-01
CE141	2.58E 01	9.03E 02	3.49E 02	2.36E 02	1.10E 02	0.00E-01	0.00E-01	0.00E-01
CE144	1.38E 03	3.71E 05	2.53E 04	1.08E 04	5.39E 03	0.00E-01	0.00E-01	0.00E-01

*R VALUES IN UNITS OF MREM/YR PER MICRO-CI/H**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF
 **2-MREM/YR PER MICRO-CI/SEC FOR ALL OTHERS

POOR ORIGINAL

TABLE 3.3-13 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

 PATHWAY = GOATMILK
 AGE GROUP EQUALS TEEN

ISOTOPE	T-BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	2.04E 03	2.04E 03	0.00E-01	2.04E 03	2.04E 03	2.04E 03	2.04E 03	2.04E 03
P 32	9.60E 03	2.04E 03	2.43E 10	1.53E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CR 51	3.63E 03	6.10E 05	0.00E-01	0.00E-01	7.95E 02	2.02E 03	5.18E 03	0.00E-01
MM 54	2.03E 05	2.10E 05	0.00E-01	1.02E 06	3.05E 05	0.00E-01	0.00E-01	0.00E-01
FE 59	3.63E 05	2.22E 06	4.03E 05	9.40E 05	0.00E-01	0.00E-01	2.96E 05	0.00E-01
CO 58	1.30E 05	7.80E 05	0.00E-01	5.66E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	4.66E 05	2.69E 07	0.00E-01	2.07E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	2.36E 08	2.60E 08	1.77E 08	5.13E 08	3.93E 08	0.00E-01	0.00E-01	0.00E-01
RS 86	1.66E 03	5.24E 07	0.00E-01	3.54E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	9.65E 07	4.01E 08	3.37E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	2.27E 10	2.53E 09	9.13E 10	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	3.02E 01	4.62E 05	1.13E 03	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	2.56E 01	8.59E 04	1.13E 02	3.72E 01	5.47E 01	0.00E-01	0.00E-01	0.00E-01
NR 96	3.09E 03	2.40E 07	1.01E 04	5.62E 03	5.45E 03	0.00E-01	0.00E-01	0.00E-01
RU103	5.58E 01	1.09E 04	1.30E 02	0.00E-01	4.60E 02	0.00E-01	0.00E-01	0.00E-01
RU105	3.51E 02	1.34E 05	2.79E 03	0.00E-01	5.38E 03	0.00E-01	0.00E-01	0.00E-01
AG1101	4.24E 06	1.96E 09	7.37E 05	6.97E 05	1.33E 07	0.00E-01	0.00E-01	0.00E-01
TE127M	8.37E 05	1.86E 07	7.46E 05	2.65E 05	3.02E 07	1.77E 05	0.00E-01	0.00E-01
TE129I	1.36E 05	3.22E 07	8.58E 05	3.19E 05	3.59E 07	2.77E 05	0.00E-01	0.00E-01
I 131	3.18E 03	1.17E 03	4.22E 03	5.91E 03	1.02E 09	1.73E 11	0.00E-01	0.00E-01
I 132	2.19E-01	2.66E-01	2.33E-01	6.11E-01	9.62E-01	2.06E 01	0.00E-01	0.00E-01
I 133	2.99E 05	7.43E 05	5.79E 05	9.81E 06	1.72E 07	1.37E 09	0.00E-01	0.00E-01
I 135	1.90E 04	5.63E 04	1.99E 04	5.13E 04	8.10E 04	3.30E 06	0.00E-01	0.00E-01
CS134	1.96E 10	5.26E 03	1.30E 10	4.23E 10	1.34E 10	0.00E-01	5.13E 09	0.00E-01
CS136	2.25E 09	2.69E 03	3.50E 03	3.34E 09	1.82E 09	0.00E-01	2.87E 08	0.00E-01
CS137	1.19E 10	4.85E 03	2.56E 10	3.41E 10	1.16E 10	0.00E-01	4.51E 09	0.00E-01
HA140	2.39E 05	5.72E 05	3.71E 05	4.55E 03	1.54E 03	0.00E-01	3.06E 03	0.00E-01
CE141	4.91E 01	1.22E 05	5.40E 02	4.27E 02	2.01E 02	0.00E-01	0.00E-01	0.00E-01
CE144	2.55E 03	1.19E 07	4.74E 04	1.96E 04	1.17E 04	0.00E-01	0.00E-01	0.00E-01

 *R VALUES IN UNITS OF MBQ/YR PER MICRO-CI/4**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF
 1**2-MBQ/YR PER MICRO-CI/SEC FOR ALL OTHERS

POOR ORIGINAL

TABLE 3.3-14 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = GOATMILK
AGE GROUP EQUALS CHILD

NUCLIDE	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	3.23E 03	3.23E 03	0.00E-01	3.23E 03	3.23E 03	3.23E 03	3.23E 03	3.23E 03
P 32	2.35E 09	1.69E 09	5.11E 10	2.35E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CR 51	7.40E 03	3.93E 05	0.00E-01	0.00E-01	1.12E 03	4.11E 03	7.50E 03	0.00E-01
IN 54	4.07E 05	1.23E 05	0.00E-01	1.53E 06	4.29E 05	0.00E-01	0.00E-01	0.00E-01
FE 59	7.52E 05	1.57E 05	9.34E 05	1.51E 06	0.00E-01	0.00E-01	4.38E 05	0.00E-01
CO 58	2.65E 06	5.05E 06	0.00E-01	8.65E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01
CO 60	9.48E 06	1.73E 07	0.00E-01	3.21E 06	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZN 65	5.74E 08	1.62E 08	3.47E 08	9.24E 08	5.82E 08	0.00E-01	0.00E-01	0.00E-01
RB 86	4.04E 08	4.22E 07	0.00E-01	6.57E 08	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 89	2.38E 08	3.23E 08	8.34E 09	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
SR 90	3.93E 10	2.09E 09	1.55E 11	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
Y 91	7.45E 01	3.71E 05	2.79E 03	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
ZR 95	5.36E 01	6.28E 04	2.74E 02	6.02E 01	8.62E 01	0.00E-01	0.00E-01	0.00E-01
MB 96	6.37E 03	1.65E 07	2.29E 04	3.91E 03	8.37E 03	0.00E-01	0.00E-01	0.00E-01
RU103	1.19E 02	7.93E 03	3.09E 02	0.00E-01	7.77E 02	0.00E-01	0.00E-01	0.00E-01
RU106	8.56E 02	1.07E 05	6.85E 03	0.00E-01	9.27E 03	0.00E-01	0.00E-01	0.00E-01
AG110M	3.63E 06	1.23E 09	1.60E 07	1.03E 07	2.01E 07	0.00E-01	0.00E-01	0.00E-01
TE127M	2.18E 06	1.49E 07	1.84E 07	4.95E 06	5.24E 07	4.40E 06	0.00E-01	0.00E-01
TE129M	3.28E 06	2.53E 07	2.12E 07	5.91E 06	6.21E 07	6.82E 06	0.00E-01	0.00E-01
I 131	5.05E 08	9.17E 07	1.02E 09	1.03E 09	1.69E 09	3.41E 11	0.00E-01	0.00E-01
I 132	4.67E-01	1.19E 00	5.52E-01	1.01E 00	1.55E 00	4.71E 01	0.00E-01	0.00E-01
I 133	6.58E 06	7.00E 06	1.41E 07	1.74E 07	2.90E 07	3.23E 09	0.00E-01	0.00E-01
I 135	4.01E 04	6.47E 04	4.72E 04	3.49E 04	1.30E 05	7.52E 06	0.00E-01	0.00E-01
CS134	1.43E 10	3.67E 08	4.14E 10	5.80E 10	2.11E 10	0.00E-01	7.56E 09	0.00E-01
CS136	3.41E 09	1.85E 08	1.92E 09	5.27E 09	2.81E 09	0.00E-01	4.19E 08	0.00E-01
CS137	3.72E 09	3.70E 08	5.17E 10	5.91E 10	1.93E 10	0.00E-01	6.93E 09	0.00E-01
HA140	5.23E 05	4.54E 05	4.95E 05	7.35E 03	2.56E 03	0.00E-01	4.68E 03	0.00E-01
CE141	1.17E 02	4.31E 05	1.53E 03	7.35E 02	3.45E 02	0.00E-01	0.00E-01	0.00E-01
CE144	6.24E 03	4.55E 05	1.17E 05	3.66E 04	2.03E 04	0.00E-01	0.00E-01	0.00E-01

* R VALUES IN UNITS OF MREM/YR PER MICRO-CI/H**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF
 (**2-MREM/YR PER MICRO-CI/SEC FOR ALL OTHERS

POOR ORIGINAL

TABLE 3.3-15 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = GOATMILK										
AGE GROUP		EQUALS	INFANT							
ADULTE		T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN	
H	3	: 4.90E 03	: 4.90E 03	: 0.00E-01	: 4.90E 03	: 4.90E 03	: 4.90E 03	: 4.90E 03	: 4.90E 03	: 4.90E 03
P	32	: 4.88E 09	: 1.70E 09	: 1.26E 11	: 7.40E 09	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
CR	51	: 1.17E 04	: 3.42E 05	: 0.00E-01	: 0.00E-01	: 1.57E 03	: 7.65E 03	: 1.49E 04	: 0.00E-01	: 0.00E-01
IN	54	: 5.45E 05	: 1.04E 06	: 0.00E-01	: 2.84E 06	: 6.30E 05	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
FE	59	: 1.20E 06	: 1.45E 05	: 1.74E 06	: 3.04E 05	: 0.00E-01	: 0.00E-01	: 9.00E 05	: 0.00E-01	: 0.00E-01
CO	58	: 4.31E 06	: 4.31E 05	: 0.00E-01	: 1.73E 06	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
CO	60	: 1.55E 07	: 1.55E 07	: 0.00E-01	: 5.55E 06	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
ZN	65	: 7.36E 08	: 1.35E 09	: 4.65E 08	: 1.60E 09	: 7.74E 08	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
RB	66	: 8.23E 08	: 4.25E 07	: 0.00E-01	: 1.67E 09	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
SR	89	: 4.55E 08	: 3.25E 08	: 1.59E 10	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
SR	90	: 4.30E 10	: 2.11E 09	: 1.69E 11	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
Y	91	: 1.39E 02	: 3.75E 05	: 5.23E 03	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
ZR	95	: 3.41E 01	: 5.90E 04	: 4.86E 02	: 1.19E 02	: 1.23E 02	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
VB	95	: 1.02E 04	: 1.43E 07	: 4.27E 04	: 1.75E 04	: 1.25E 04	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
RJ103		: 2.09E 02	: 7.60E 03	: 5.25E 02	: 0.00E-01	: 1.30E 03	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
RJ105		: 1.77E 03	: 1.07E 05	: 1.41E 04	: 0.00E-01	: 1.57E 04	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
AG1104		: 1.43E 07	: 1.12E 09	: 2.25E 07	: 2.16E 07	: 3.08E 07	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
TE1274		: 4.51E 06	: 1.50E 07	: 3.72E 07	: 1.23E 07	: 9.16E 07	: 1.03E 07	: 0.00E-01	: 0.00E-01	: 0.00E-01
TE1291		: 5.69E 06	: 2.59E 07	: 4.34E 07	: 1.49E 07	: 1.09E 08	: 1.57E 07	: 0.00E-01	: 0.00E-01	: 0.00E-01
I 131		: 1.11E 09	: 8.99E 07	: 2.14E 09	: 2.52E 07	: 2.94E 09	: 5.23E 11	: 0.00E-01	: 0.00E-01	: 0.00E-01
I 132		: 5.25E-01	: 1.93E 00	: 1.15E 00	: 2.33E 00	: 2.59E 00	: 1.09E 02	: 0.00E-01	: 0.00E-01	: 0.00E-01
I 133		: 1.27E 07	: 7.31E 06	: 2.97E 07	: 4.32E 07	: 5.09E 07	: 7.36E 09	: 0.00E-01	: 0.00E-01	: 0.00E-01
I 135		: 7.11E 04	: 7.06E 04	: 9.81E 04	: 1.95E 05	: 2.17E 05	: 1.75E 07	: 0.00E-01	: 0.00E-01	: 0.00E-01
CS134		: 1.26E 10	: 3.39E 08	: 5.68E 10	: 1.25E 11	: 3.21E 10	: 0.00E-01	: 1.31E 10	: 0.00E-01	: 0.00E-01
CS135		: 4.11E 09	: 1.67E 08	: 3.75E 09	: 1.10E 10	: 4.39E 09	: 0.00E-01	: 8.98E 08	: 0.00E-01	: 0.00E-01
CS137		: 8.17E 09	: 3.61E 03	: 9.36E 10	: 1.15E 11	: 3.10E 10	: 0.00E-01	: 1.25E 10	: 0.00E-01	: 0.00E-01
BA140		: 9.50E 05	: 4.53E 05	: 1.84E 07	: 1.84E 04	: 4.38E 03	: 0.00E-01	: 1.13E 04	: 0.00E-01	: 0.00E-01
CE141		: 2.24E 02	: 9.85E 05	: 3.13E 03	: 1.91E 03	: 5.43E 02	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01
CE144		: 9.39E 03	: 9.61E 06	: 1.67E 05	: 6.86E 04	: 2.77E 04	: 0.00E-01	: 0.00E-01	: 0.00E-01	: 0.00E-01

*R VALUES IN UNITS OF BREM/YR PER MICRO-CI/1**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF 1**2-BREM/YR PER MICRO-CI/SEC FOR ALL OTHERS

TABLE 3.3-15 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = INHAL		AGE GROUP EQUALS		ADULT															
ISOTOPE		T.BODY		GI-TRACT		BONE		LIVER		KIDNEY		THYROID		LUNG		SKIN			
H	3	:	1.26E 03	:	1.26E 03	:	0.00E-01	:	1.26E 03	:	1.26E 03	:	1.26E 03	:	1.26E 03	:	1.26E 03	:	1.26E 03
P	32	:	5.00E 04	:	8.63E 04	:	1.32E 05	:	7.70E 04	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
CR	51	:	2.99E 01	:	3.32E 03	:	0.00E-01	:	0.00E-01	:	2.23E 01	:	5.24E 01	:	1.44E 04	:	0.00E-01	:	0.00E-01
AN	54	:	6.29E 03	:	7.72E 04	:	0.00E-01	:	3.95E 04	:	9.83E 03	:	0.00E-01	:	1.40E 06	:	0.00E-01	:	0.00E-01
FE	59	:	1.05E 04	:	1.83E 05	:	1.17E 04	:	2.77E 04	:	0.00E-01	:	0.00E-01	:	1.01E 06	:	0.00E-01	:	0.00E-01
CO	58	:	2.07E 03	:	1.06E 05	:	0.00E-01	:	1.53E 03	:	0.00E-01	:	0.00E-01	:	9.27E 05	:	0.00E-01	:	0.00E-01
CO	60	:	1.48E 04	:	2.84E 05	:	0.00E-01	:	1.15E 04	:	0.00E-01	:	0.00E-01	:	5.26E 06	:	0.00E-01	:	0.00E-01
ZN	65	:	4.65E 04	:	5.31E 04	:	3.24E 04	:	1.03E 05	:	6.89E 04	:	0.00E-01	:	3.63E 05	:	0.00E-01	:	0.00E-01
RB	85	:	5.89E 04	:	1.66E 04	:	0.00E-01	:	1.35E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
SR	89	:	3.71E 03	:	3.49E 05	:	3.04E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	1.40E 06	:	0.00E-01	:	0.00E-01
SR	90	:	6.09E 06	:	7.21E 05	:	2.91E 07	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	2.59E 06	:	0.00E-01	:	0.00E-01
Y	91	:	1.24E 04	:	3.84E 05	:	4.62E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	1.70E 06	:	0.00E-01	:	0.00E-01
ZR	95	:	2.32E 04	:	1.50E 05	:	1.07E 05	:	3.44E 04	:	5.41E 04	:	0.00E-01	:	1.77E 06	:	0.00E-01	:	0.00E-01
RB	95	:	4.20E 03	:	1.04E 05	:	1.41E 04	:	7.80E 03	:	7.72E 03	:	0.00E-01	:	5.04E 05	:	0.00E-01	:	0.00E-01
RU103		:	6.57E 02	:	1.10E 05	:	1.53E 03	:	0.00E-01	:	5.32E 03	:	0.00E-01	:	5.04E 05	:	0.00E-01	:	0.00E-01
RU105		:	3.71E 03	:	9.11E 05	:	5.90E 04	:	0.00E-01	:	1.33E 05	:	0.00E-01	:	2.35E 06	:	0.00E-01	:	0.00E-01
AG1104		:	5.94E 03	:	3.02E 05	:	1.03E 04	:	9.99E 03	:	1.97E 04	:	0.00E-01	:	4.53E 06	:	0.00E-01	:	0.00E-01
TE1274		:	1.57E 03	:	1.49E 05	:	1.24E 04	:	5.75E 03	:	4.57E 04	:	3.23E 03	:	2.59E 05	:	0.00E-01	:	0.00E-01
TE1294		:	1.53E 03	:	3.83E 05	:	2.75E 03	:	4.67E 03	:	3.65E 04	:	3.44E 03	:	1.16E 06	:	0.00E-01	:	0.00E-01
I 131		:	2.05E 04	:	6.27E 03	:	2.52E 04	:	3.57E 04	:	6.12E 04	:	1.19E 07	:	0.00E-01	:	0.00E-01	:	0.00E-01
I 132		:	1.16E 03	:	4.06E 02	:	1.16E 03	:	3.25E 03	:	5.13E 03	:	1.14E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01
I 133		:	4.51E 03	:	8.87E 03	:	3.63E 03	:	1.43E 04	:	2.53E 04	:	2.15E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01
I 135		:	2.56E 03	:	5.24E 03	:	2.63E 03	:	6.97E 03	:	1.11E 04	:	4.47E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01
CS134		:	7.27E 05	:	1.04E 04	:	3.72E 05	:	3.47E 05	:	2.87E 05	:	0.00E-01	:	2.75E 04	:	0.00E-01	:	0.00E-01
CS135		:	1.10E 05	:	1.17E 04	:	3.90E 04	:	1.45E 05	:	8.55E 04	:	0.00E-01	:	1.20E 04	:	0.00E-01	:	0.00E-01
CS137		:	4.27E 05	:	8.39E 03	:	4.73E 05	:	6.20E 05	:	2.22E 05	:	0.00E-01	:	7.51E 04	:	0.00E-01	:	0.00E-01
BA140		:	2.56E 03	:	2.13E 05	:	3.90E 04	:	4.90E 04	:	1.67E 04	:	0.00E-01	:	1.27E 06	:	0.00E-01	:	0.00E-01
CE141		:	1.53E 03	:	1.20E 05	:	1.99E 04	:	1.35E 04	:	6.25E 03	:	0.00E-01	:	3.51E 05	:	0.00E-01	:	0.00E-01
CE144		:	1.34E 05	:	8.15E 05	:	3.43E 06	:	1.43E 06	:	8.47E 05	:	0.00E-01	:	7.76E 06	:	0.00E-01	:	0.00E-01

*R VALUES IN UNITS OF MREM/YR PER MICRO-CI/4**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF 4**2-MREM/YR PER MICRO-CI/SEC FOR ALL OTHERS

TABLE 3.3-17 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = IHAL		AGE GROUP EQUALS TEEN								
NUCLIDE		T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN	
H 3	:	1.27E 03	1.27E 03	0.00E-01	1.27E 03	1.27E 03	1.27E 03	1.27E 03	1.27E 03	:
P 32	:	7.15E 04	9.27E 04	1.89E 06	1.09E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	:
CR 51	:	1.35E 02	3.00E 03	0.00E-01	0.00E-01	3.07E 01	7.49E 01	2.09E 04	0.00E-01	:
NI 54	:	3.39E 03	6.67E 04	0.00E-01	5.10E 04	1.27E 04	0.00E-01	1.98E 06	0.00E-01	:
FE 59	:	1.43E 04	1.73E 05	1.59E 04	3.69E 04	0.00E-01	0.00E-01	1.53E 06	0.00E-01	:
CO 58	:	2.77E 03	9.51E 04	0.00E-01	2.07E 03	0.00E-01	0.00E-01	1.34E 06	0.00E-01	:
CO 50	:	1.98E 04	2.59E 05	0.00E-01	1.51E 04	0.00E-01	0.00E-01	8.71E 06	0.00E-01	:
ZN 66	:	5.23E 04	4.65E 04	3.85E 04	1.33E 05	8.63E 04	0.00E-01	1.24E 06	0.00E-01	:
RB 86	:	8.39E 04	1.77E 04	0.00E-01	1.90E 05	0.00E-01	0.00E-01	0.00E-01	0.00E-01	:
SR 87	:	1.25E 04	3.71E 05	4.34E 05	0.00E-01	0.00E-01	0.00E-01	2.41E 06	0.00E-01	:
SR 90	:	5.67E 06	7.64E 05	1.03E 05	0.00E-01	0.00E-01	0.00E-01	1.55E 07	0.00E-01	:
Z 91	:	1.77E 04	4.08E 05	6.50E 05	0.00E-01	0.00E-01	0.00E-01	2.93E 06	0.00E-01	:
ZR 95	:	3.15E 04	1.49E 05	1.45E 05	4.53E 04	6.73E 04	0.00E-01	2.68E 06	0.00E-01	:
IO 96	:	5.66E 03	9.67E 04	1.85E 04	1.03E 04	9.99E 03	0.00E-01	7.50E 05	0.00E-01	:
RU103	:	3.95E 02	1.09E 05	2.10E 03	0.00E-01	7.42E 03	0.00E-01	1.32E 05	0.00E-01	:
RU106	:	1.24E 04	9.59E 05	9.83E 04	0.00E-01	1.90E 05	0.00E-01	1.51E 07	0.00E-01	:
NO1104	:	7.98E 03	2.72E 05	1.38E 04	1.31E 04	2.50E 04	0.00E-01	5.74E 06	0.00E-01	:
TE1274	:	2.18E 03	1.59E 05	1.80E 04	3.15E 03	6.53E 04	4.33E 03	1.65E 06	0.00E-01	:
TE1294	:	2.24E 03	4.04E 05	1.39E 04	6.57E 03	5.18E 04	4.57E 03	1.97E 06	0.00E-01	:
I 131	:	2.64E 04	6.48E 03	3.54E 04	4.90E 04	8.39E 04	1.45E 07	0.00E-01	0.00E-01	:
I 132	:	1.57E 03	1.27E 03	1.52E 03	4.37E 03	6.91E 03	1.51E 05	0.00E-01	0.00E-01	:
I 133	:	6.21E 03	1.03E 04	1.21E 04	2.05E 04	3.59E 04	2.92E 06	0.00E-01	0.00E-01	:
I 135	:	3.48E 03	6.94E 03	3.69E 03	9.43E 03	1.49E 04	6.20E 05	0.00E-01	0.00E-01	:
CS134	:	5.48E 05	9.75E 03	5.02E 05	1.13E 06	3.75E 05	0.00E-01	1.46E 05	0.00E-01	:
CS136	:	1.37E 05	1.09E 04	5.14E 04	1.93E 05	1.10E 05	0.00E-01	1.77E 04	0.00E-01	:
CS137	:	3.11E 05	3.47E 03	6.69E 05	8.47E 05	3.04E 05	0.00E-01	1.21E 05	0.00E-01	:
JA140	:	3.51E 03	2.28E 05	5.46E 04	6.69E 01	2.23E 01	0.00E-01	2.03E 06	0.00E-01	:
CE141	:	2.14E 03	1.25E 05	2.84E 04	1.59E 04	8.37E 03	0.00E-01	5.13E 05	0.00E-01	:
CE144	:	2.62E 05	6.63E 05	4.89E 06	2.02E 06	1.21E 06	0.00E-01	1.33E 07	0.00E-01	:

*R VALUES IN UNITS OF BREM/YR PER MICRO-CI/HR**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF
 **2-BREM/YR PER MICRO-CI/SEC FOR ALL OTHERS

TABLE 3.3-18 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = INHAL		AGE GROUP		EQUALS		CHILD														
NUCLIDE							T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN						
H 3	:	1.12E 03	:	1.12E 03	:	0.00E-01	:	1.12E 03	:	1.12E 03	:	1.12E 03	:	1.12E 03	:	1.12E 03	:	1.12E 03	:	1.12E 03
P 32	:	9.86E 04	:	4.21E 04	:	2.60E 05	:	1.14E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
CR 51	:	1.54E 02	:	1.09E 03	:	0.00E-01	:	0.00E-01	:	2.43E 01	:	8.53E 01	:	1.70E 04	:	0.00E-01	:	0.00E-01	:	0.00E-01
IN 54	:	9.50E 03	:	2.29E 04	:	0.00E-01	:	4.29E 04	:	1.00E 04	:	0.00E-01	:	1.57E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01
FE 59	:	1.37E 04	:	7.05E 04	:	2.07E 04	:	3.34E 04	:	0.00E-01	:	0.00E-01	:	1.27E 06	:	0.00E-01	:	0.00E-01	:	0.00E-01
CO 58	:	3.16E 03	:	3.43E 04	:	0.00E-01	:	1.77E 03	:	0.00E-01	:	0.00E-01	:	1.10E 06	:	0.00E-01	:	0.00E-01	:	0.00E-01
CO 60	:	2.26E 04	:	9.61E 04	:	0.00E-01	:	1.31E 04	:	0.00E-01	:	0.00E-01	:	7.06E 06	:	0.00E-01	:	0.00E-01	:	0.00E-01
ZN 65	:	7.02E 04	:	1.63E 04	:	4.25E 04	:	1.13E 05	:	7.13E 04	:	0.00E-01	:	9.94E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01
RB 86	:	1.14E 05	:	7.99E 03	:	0.00E-01	:	1.98E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
SR 87	:	1.72E 04	:	1.67E 05	:	5.99E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	2.15E 06	:	0.00E-01	:	0.00E-01	:	0.00E-01
SR 90	:	5.43E 05	:	3.43E 05	:	1.01E 04	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	1.47E 07	:	0.00E-01	:	0.00E-01	:	0.00E-01
Y 91	:	2.43E 04	:	1.84E 05	:	9.13E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	2.62E 06	:	0.00E-01	:	0.00E-01	:	0.00E-01
ZR 95	:	3.69E 04	:	6.10E 04	:	1.90E 05	:	4.17E 04	:	5.95E 04	:	0.00E-01	:	2.23E 06	:	0.00E-01	:	0.00E-01	:	0.00E-01
IR 95	:	6.54E 03	:	3.67E 04	:	2.35E 04	:	9.16E 03	:	8.61E 03	:	0.00E-01	:	6.13E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01
RU103	:	1.07E 03	:	4.47E 04	:	2.79E 03	:	0.00E-01	:	7.02E 03	:	0.00E-01	:	5.61E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01
RU105	:	1.69E 04	:	4.29E 05	:	1.36E 05	:	0.00E-01	:	1.34E 05	:	0.00E-01	:	1.43E 07	:	0.00E-01	:	0.00E-01	:	0.00E-01
AG1104	:	9.13E 03	:	1.00E 05	:	1.63E 04	:	1.14E 04	:	2.12E 04	:	0.00E-01	:	5.47E 06	:	0.00E-01	:	0.00E-01	:	0.00E-01
FE1274	:	3.01E 03	:	7.13E 04	:	2.45E 04	:	8.53E 03	:	6.35E 04	:	5.05E 03	:	1.42E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01
FE1294	:	3.04E 03	:	1.81E 05	:	1.92E 04	:	5.84E 03	:	5.02E 04	:	6.32E 03	:	1.75E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01
I 131	:	2.72E 04	:	2.84E 03	:	4.30E 04	:	4.30E 04	:	7.37E 04	:	1.52E 07	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
I 132	:	1.37E 03	:	3.20E 03	:	2.11E 03	:	4.06E 03	:	6.24E 03	:	1.93E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
I 133	:	7.58E 03	:	5.47E 03	:	1.65E 04	:	2.03E 04	:	3.37E 04	:	3.54E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
I 135	:	4.14E 03	:	4.43E 03	:	4.91E 03	:	8.72E 03	:	1.34E 04	:	7.91E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01
CS134	:	2.24E 05	:	3.34E 03	:	5.50E 05	:	1.01E 06	:	3.30E 05	:	0.00E-01	:	1.21E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01
CS136	:	1.16E 05	:	4.17E 03	:	5.50E 04	:	1.71E 05	:	9.53E 04	:	0.00E-01	:	1.45E 04	:	0.00E-01	:	0.00E-01	:	0.00E-01
CS137	:	1.26E 05	:	3.61E 03	:	9.05E 05	:	8.24E 05	:	2.82E 05	:	0.00E-01	:	1.04E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01
BA140	:	4.32E 03	:	1.02E 05	:	7.39E 04	:	5.47E 01	:	2.11E 01	:	0.00E-01	:	1.74E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01
CE141	:	2.89E 03	:	5.55E 04	:	3.92E 04	:	1.95E 04	:	2.53E 03	:	0.00E-01	:	5.43E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01
CE144	:	3.61E 05	:	3.33E 05	:	6.76E 05	:	2.11E 06	:	1.17E 06	:	0.00E-01	:	1.19E 07	:	0.00E-01	:	0.00E-01	:	0.00E-01

*R VALUES IN UNITS OF REM/YR PER MICRO-CI/M³ FOR INHALATION AND TRITIUM, AND IN UNITS OF
 **2-REM/YR PER MICRO-CI/SEC FOR ALL OTHERS

TABLE 3.3-19 R VALUES FOR THE BRUNSWICK STEAM ELECTRIC PLANT*

PATHWAY = INHAL		AGE GROUP EQUALS		INFANT															
NUCLIDE		T.BODY		GI-TRACT		BONE		LIVER		KIDNEY		THYROID		LUNG		SKIN			
H 3	:	6.46E 02	:	6.46E 02	:	0.00E-01	:	6.46E 02	:	6.46E 02	:	6.46E 02	:	6.46E 02	:	6.46E 02	:		
P 32	:	7.73E 04	:	1.61E 04	:	2.03E 05	:	1.12E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
CR 51	:	8.93E 01	:	3.54E 02	:	0.00E-01	:	0.00E-01	:	1.32E 01	:	5.75E 01	:	1.26E 04	:	0.00E-01	:		
IN 54	:	4.98E 03	:	7.05E 03	:	0.00E-01	:	2.53E 04	:	4.98E 03	:	0.00E-01	:	7.78E 05	:	0.00E-01	:		
FE 59	:	9.46E 03	:	2.47E 04	:	1.35E 04	:	2.35E 04	:	0.00E-01	:	0.00E-01	:	1.31E 05	:	0.00E-01	:		
CO 58	:	1.32E 03	:	1.11E 04	:	0.00E-01	:	1.22E 03	:	0.00E-01	:	0.00E-01	:	7.76E 05	:	0.00E-01	:		
CO 60	:	1.18E 04	:	3.19E 04	:	0.00E-01	:	8.01E 03	:	0.00E-01	:	0.00E-01	:	4.50E 06	:	0.00E-01	:		
ZN 66	:	3.10E 04	:	5.13E 04	:	1.93E 04	:	6.25E 04	:	3.24E 04	:	0.00E-01	:	5.46E 05	:	0.00E-01	:		
RS 86	:	5.81E 04	:	3.03E 03	:	0.00E-01	:	1.90E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	0.00E-01	:		
SR 89	:	1.14E 04	:	6.39E 04	:	3.27E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	2.03E 05	:	0.00E-01	:		
SD 90	:	2.59E 05	:	1.31E 05	:	4.03E 07	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	1.12E 07	:	0.00E-01	:		
Y 91	:	1.57E 04	:	7.02E 04	:	5.87E 05	:	0.00E-01	:	0.00E-01	:	0.00E-01	:	2.45E 06	:	0.00E-01	:		
ZR 95	:	2.03E 04	:	2.17E 04	:	1.15E 05	:	2.78E 04	:	3.10E 04	:	0.00E-01	:	1.75E 06	:	0.00E-01	:		
TS 96	:	3.77E 03	:	1.27E 04	:	1.57E 04	:	6.42E 03	:	4.71E 03	:	0.00E-01	:	4.74E 05	:	0.00E-01	:		
RU103	:	5.78E 02	:	1.61E 04	:	2.01E 03	:	0.00E-01	:	4.24E 03	:	0.00E-01	:	5.51E 05	:	0.00E-01	:		
RU105	:	1.09E 04	:	1.54E 05	:	8.57E 04	:	0.00E-01	:	1.06E 05	:	0.00E-01	:	1.15E 07	:	0.00E-01	:		
AG110M	:	4.99E 03	:	3.30E 04	:	9.97E 03	:	7.21E 03	:	1.09E 04	:	0.00E-01	:	3.66E 06	:	0.00E-01	:		
TE127I	:	2.07E 03	:	2.73E 04	:	1.65E 04	:	6.89E 03	:	3.75E 04	:	4.36E 03	:	1.31E 06	:	0.00E-01	:		
TE129I	:	2.22E 03	:	6.89E 04	:	1.41E 04	:	6.08E 03	:	3.17E 04	:	5.47E 03	:	1.65E 06	:	0.00E-01	:		
I 131	:	1.96E 04	:	1.06E 03	:	3.79E 04	:	4.43E 04	:	5.17E 04	:	1.43E 07	:	0.00E-01	:	0.00E-01	:		
I 132	:	1.26E 03	:	1.90E 03	:	1.69E 03	:	3.54E 03	:	3.94E 03	:	1.69E 05	:	0.00E-01	:	0.00E-01	:		
I 133	:	5.59E 03	:	2.15E 03	:	1.32E 04	:	1.92E 04	:	2.24E 04	:	3.55E 06	:	0.00E-01	:	0.00E-01	:		
I 135	:	2.77E 03	:	1.83E 03	:	3.34E 03	:	7.59E 03	:	8.46E 03	:	6.95E 05	:	0.00E-01	:	0.00E-01	:		
CS134	:	7.44E 04	:	1.33E 03	:	3.96E 05	:	7.02E 05	:	1.90E 05	:	0.00E-01	:	7.95E 04	:	0.00E-01	:		
CS136	:	5.25E 04	:	1.43E 03	:	4.82E 04	:	1.34E 05	:	5.53E 04	:	0.00E-01	:	1.17E 04	:	0.00E-01	:		
CS137	:	4.54E 04	:	1.33E 03	:	5.43E 05	:	6.11E 05	:	1.72E 05	:	0.00E-01	:	7.12E 04	:	0.00E-01	:		
BA140	:	2.39E 03	:	3.83E 04	:	5.59E 04	:	5.59E 01	:	1.34E 01	:	0.00E-01	:	1.59E 06	:	0.00E-01	:		
CE141	:	1.99E 03	:	2.15E 04	:	2.77E 04	:	1.66E 04	:	5.21E 03	:	0.00E-01	:	5.16E 05	:	0.00E-01	:		
CE144	:	1.76E 05	:	1.43E 05	:	3.19E 05	:	1.21E 05	:	5.37E 05	:	0.00E-01	:	9.83E 06	:	0.00E-01	:		

*R VALUES IN UNITS OF MBREM/YR PER MICRO-CI/4**3 FOR INHALATION AND TRITIUM, AND IN UNITS OF 4**2-MBREM/YR PER MICRO-CI/SEC FOR ALL OTHERS

POOR ORIGINAL

Table 4.0-1 contains the sample point description, sampling and collection frequency, analysis, and analysis frequency for various exposure pathways in the vicinity of the BSEP for the radiological monitoring program. Figures 4.0-1a and 4.0-1b show the location of the various sampling points.

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TABLE 4.0-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Point	Sample Point Description, Distance, and Direction	Sampling and Collection Frequency	Analysis Frequency	Analysis ^(a)
1. Airborne Particulate and Radioiodine	1	Information Center 1.0 mi. WSW			
	2	Projected Maximum Annual Con- centration Point 0.6 mi. NE			
	3	CP & L Substation on Con- struction Access Road 1.0 mi. S	Continuous Operating Sampler with Sample Collection at least weekly	Weekly, Quarterly Composite	Gross Beta, ^(b) I-131 Gamma Scan
	4	Southport Substation 2.3 mi. SSW			
	5	Wilmington, N.C. 16 mi. N (Control Station) ^(c)			
2. Direct Radiation	1	Information Center 1.0 mi. WSW			
	2	Projected Maximum Annual Con- centration Point 0.6 mi. NE			
	3	CP & L Substation on Con- struction Access Road 1.0 mi. S	Continuous mea- surement with read out at least once per month. (TLD's)	Monthly	Gamma Dose
	4	Southport Substation 2.3 mi. SSW			
	5	Wilmington, N.C. 16 mi. N (Control Station) ^(c)			

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TABLE 3-1 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Point	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Analysis Frequency	Analysis (a)
3. Waterborne a. Surface Water	6	Intake Canal (Control Station) ^(c)	Composite sample with sample collection at least monthly ^(c)	Monthly	Gamma Scan, H-3
	7	Discharge Canal at Stilling Pond 4.9 mi. SSW			
b. Ground Water	8	Highway-87 west side of Discharge Canal 1.0 mi. WSW	Grab Sample	Monthly	Gamma Scan, H-3
	9	Highway 211 west side of Dis- charge Canal 1.5 mi. WSW			
c. Drinking Water		not required ^(e)			
d. Shoreline Sediment	10	Caswell Beach at Discharge Pipe 5.1 mi. SSW	Semi-Annually	Semi-Annually	Gamma Scan
4. Ingestion a. Milk	11	Stevens Farm 0.79 mi. SSE	At least once per 15 days when animals are on pasture; at least once per 31 days at other times	Each Sample	Gamma Scan, I-131
	12	Johnson Farm (Control Station) ^(c) 14.5 mi. NNW			

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TABLE 4.11 (Continued)

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sample Point	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Analysis Frequency	Analysis (a)
b. Fish	7	Discharge Canal (Location varies within Canal)	Semi-Annual	Each Sample 1) Fish 2) Shellfish (Shrimp, crabs, oysters, etc.)	Gamma Scan on Edible Portions
	14	Atlantic Ocean; Between Little River and Mansonboro Inlet (No further out than 5 miles) (Control Station)			
c. Food products leafy vegetables	15	One location within 3 miles of site in the sector with the highest deposition rate based on the latest information or his- torical data. (Location may vary)	Annual at Harvest Time	Each Sample	I-131, Gamma Scan
	16	One location greater than 5 miles from Plant site with the least deposition rate. (Control Station) (c)			

(a) The LLD for each analysis is specified in Table 2.6-1 of Appendix A.1 of the Radiological Effluent Technical Specification for the Brunswick Steam Electric Plant.

(b) Particulate samples will be analyzed for gross beta radiation 24 hours following filter change. Perform gamma scan on each sample when gross beta activity is 10 times the mean of control station.

(c) Control Station - These stations are presumed to be outside the influence of plant effluents.

(d) Composite samples shall be collected by collecting an aliquot at intervals not exceeding 2 hours.

(e) Collection of drinking water samples are not required since brackish water is not used in reservoirs.

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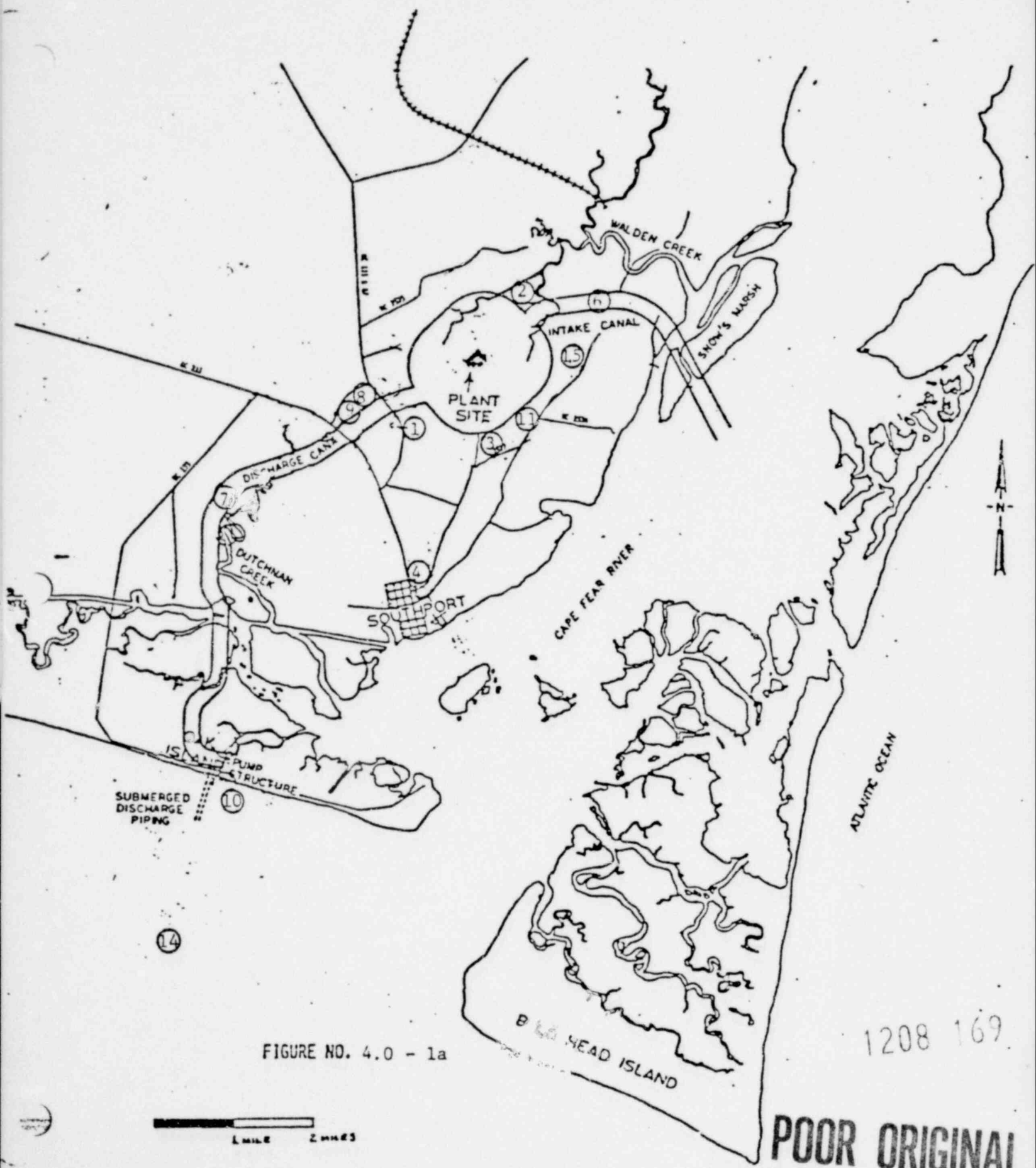
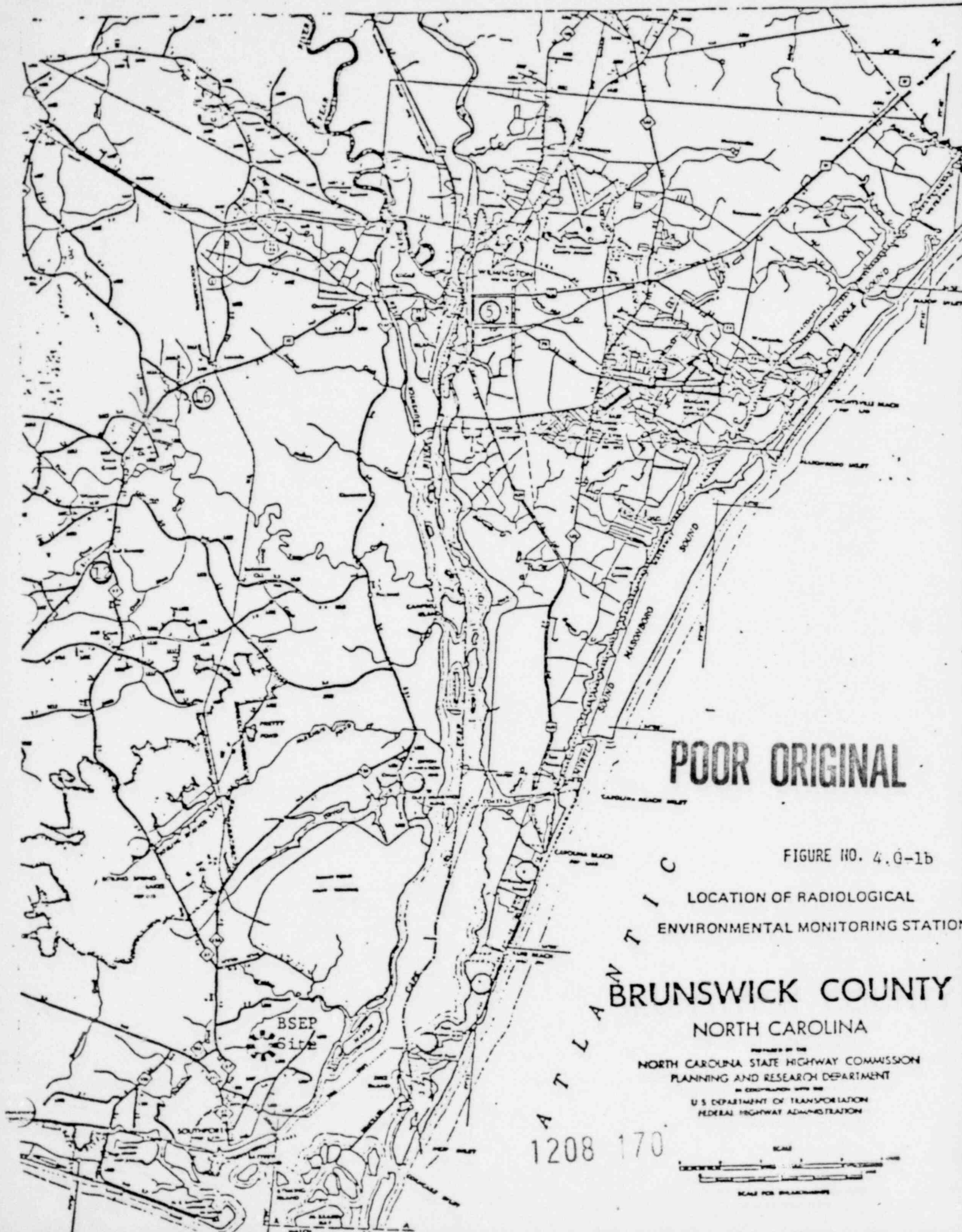


FIGURE NO. 4.0 - 1a

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POOR ORIGINAL



POOR ORIGINAL

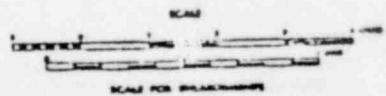
FIGURE NO. 4.Q-1b

LOCATION OF RADIOLOGICAL
ENVIRONMENTAL MONITORING STATION

AT L A N T I C
BRUNSWICK COUNTY
NORTH CAROLINA

PREPARED BY THE
NORTH CAROLINA STATE HIGHWAY COMMISSION
PLANNING AND RESEARCH DEPARTMENT
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

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APPENDIX A

METEOROLOGICAL DISPERSION FACTOR COMPUTATIONS

Carolina Power & Light Company (CP&L) engaged the services of Dames and Moore to assess the transport and dispersion of the effluent in the atmosphere as outlined in Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants, NUREG-0133 (USNRC, 1978). The methodology for this assessment was based on guidelines presented in Regulatory Guide (RG) 1.111, Revision 1 (USNRC, 1977). The results of the assessment were to provide the relative depositions flux and relative concentrations (undepleted and depleted) based on numerical models acceptable for use in Appendix I evaluations.

Regulatory Guide 1.111 presented three acceptable diffusion models for use in estimating deposition flux and concentrations. These are: (1) particle-in-cell model (a variable trajectory model based on the gradient-transport theory), (2) puff-advection model (a variable trajectory model based on the statistical approach to diffusion), and (3) the constant mean wind direction model referred to here as the straight-line trajectory Gaussian diffusion model (the most widely used model based on a statistical approach). It was resolved that for operational efficiency, the straight-line described in XOQDOQ Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations (Draft), NUREG-0324 (USNRC, September 1977) would be used for generating the required analyses of Appendix I. To provide a more realistic accounting of the variability of wind around the plant site, terrain/ recirculation correction factors (TCF) were to be determined from a combined puff-advection/straight-line scheme for a one-year meteorological data base.

Dames and Moore was provided a one-year record of meteorological data from the on-site meteorological program at the Brunswick Steam Electric Plant. This data consisted of all collected parameters at both the 11.46 meter and 104.55 meter tower levels for the year 1977. The description of the model used and the results of the computations are presented in Reference 1. The following tables

from Reference 1 provide the basis for the meteorological dilution factor development of the Technical Specifications for Appendix I and were the source of the X/Q and D/Q values utilized to show compliance with 10 CFR 20 and 10 CFR 50 for noble gases and radioiodines and particulates.

Tables A-1 through A-6

Relative undepleted concentration, relative depleted concentration and relative deposition flux estimates for ground level release for both standard distances and special locations.

Tables A-7 through A-12

Relative undepleted concentration, relative depleted concentration and relative deposition flux estimates for mixed mode release for both standard distances and special locations.

Tables A-13 through A-18

Relative undepleted concentration, relative depleted concentration and relative deposition flux estimates for elevated release for both standard distances and special locations.

It should be noted that the values of X/Q , depleted X/Q , and D/Q for the stack releases to the special locations take into consideration the offset of the stack from the plant center. This is not true for the X/Q , depleted X/Q and D/Q values at the standard distances. These values are based upon the distance from the stack to the point of interest. These values should be good except for the close-in distances.

Future Operational Computations

The NRC "XOQDOQ" Program (Revision 1) was obtained and installed on the CP&L computer system. For routine meteorological dispersion evaluations, the "XOQDOQ" Program will be run with the appropriate physical plant data, appropriate meteorological information for the standard distances and special locations of interest without a terrain/recirculation factor. The input to "XOQDOQ" for ground level releases are presented in Table A-19 and for elevated releases in Table A-20. The resulting computations will have applied the TCF's to produce a final atmospheric diffusion estimate for the site.

In general, it is concluded that the straight-line model is as reasonable a projection of concentrations as the puff-advection model. By inclusion of the terrain correction factors developed by a combination of the puff-advection/straight-line scheme with the results of the XOQDOQ Program, ready evaluation of on-site meteorological data may be made.

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Reference

Chandler, Martin W. and George Hoopes, Revised Radiological Effluent*Technical Specifications: Gaseous Effluent Dilution Factors, Prepared for Carolina Power & Light Company, Brunswick Facility, Dames and Moore, January 18, 1979.

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Table A-1
X/Q Values At The Special Locations For Releases From The Turbine Buildings

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK
RELEASE TYPE: ANNUAL
RELEASE MODEL: GROUND LEVEL
VARIABLE: RELATIVE CONCENTRATION (SEC./CUBIC METER)
CALCULATION POINTS: SPECIAL
MODEL: STRAIGHT LINE (AIRX009)
APPLICATION OF TERRAIN CORRECTION FACTORS: YES
NUMBER OF OBSERVATIONS: 8678

AFFECTED SECTOR	SITE BOUNDARY	DAIRY	MEAT	RESIDENT	GARDEN
ENE	3.01E-06	0.	1.15E-06	1.66E-06	7.88E-07
NE	1.93E-06	0.	0.	4.63E-07	0.
ENE	4.15E-06	0.	0.	0.	0.
E	4.40E-06	0.	0.	2.51E-06	0.
ESE	5.91E-06	0.	0.	0.	0.
SE	4.70E-06	0.	3.15E-06	2.86E-06	2.32E-06
SSE	7.60E-06	6.96E-06	6.76E-06	6.96E-06	0.
S	2.34E-06	0.	0.	1.28E-06	1.12E-06
SSW	1.78E-06	0.	0.	1.00E-06	1.00E-06
SW	1.82E-06	0.	6.78E-07	1.82E-06	1.45E-06
WSW	1.81E-06	0.	0.	1.20E-06	1.20E-06
W	1.78E-06	0.	7.48E-07	1.10E-06	1.10E-06
WNW	1.74E-06	0.	0.	1.06E-06	1.01E-06
NW	1.06E-06	0.	0.	8.23E-07	3.61E-08
WNW	1.96E-06	0.	0.	1.06E-06	8.89E-07
N	1.67E-06	0.	0.	9.63E-07	1.04E-06

* A ZERO INDICATES THAT THIS POINT WAS NOT CALCULATED

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Table A-2
Depleted X/Q Values At The Special Locations For Releases From The Turbine Buildings

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK
RELEASE TYPE: ANNUAL
RELEASE MODE: GROUND LEVEL
VARIABLE: RELATIVE DEPLETED CONCENTRATION (SEC./CUBIC METER)
CALCULATION POINTS: SPECIAL
MODEL: STRAIGHT LINE (ANNX009)
APPLICATION OF TERRAIN CORRECTION FACTORS: YES
NUMBER OF OBSERVATIONS: 8678

AFFECTED SECTOR	SITE BOUNDARY	DAIRY	MEAT	RESIDENT	GARDEN
NNE	2.71E-06	0.	1.00E-06	1.52E-06	6.77E-07
NE	1.69E-06	0.	0.	3.68E-07	0.
ENE	3.71E-06	0.	0.	0.	0.
E	3.94E-06	0.	0.	2.23E-06	0.
ESE	5.28E-06	0.	0.	0.	0.
SE	4.18E-06	0.	2.70E-06	2.43E-06	2.03E-06
SSE	6.68E-06	6.03E-06	6.06E-06	6.03E-06	0.
S	2.05E-06	0.	0.	1.09E-06	9.44E-07
SSW	1.64E-06	0.	0.	8.49E-07	8.49E-07
SW	1.62E-06	0.	5.70E-07	1.62E-06	1.27E-06
WSW	1.67E-06	0.	0.	1.05E-06	1.05E-06
W	1.63E-06	0.	6.53E-07	9.72E-07	9.72E-07
WNW	1.58E-06	0.	0.	9.42E-07	8.96E-07
NW	9.58E-07	0.	0.	7.27E-07	2.66E-08
NNW	1.77E-06	0.	0.	9.36E-07	7.82E-07
N	1.39E-06	0.	0.	8.56E-07	9.17E-07

* A ZERO INDICATES THAT THIS POINT WAS NOT CALCULATED

Table A-3
D/Q Values At The Special Locations For Releases From The Turbine Buildings

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK
RELEASE TYPE: ANNUAL
RELEASE MODE: GROUND LEVEL
VARIABLE: RELATIVE DEPOSITION RATE (METER**-2)
CALCULATION POINTS: SPECIAL
MODEL: STRAIGHT LINE (ANX009)
APPLICATION OF TERRAIN CORRECTION FACTORS: YES
NUMBER OF OBSERVATIONS: 8678

AFFECTED SECTOR	SITE BOUNDARY	DAIRY	MEAT	RESIDENT	GARDEN
NNE	1.66E-08	0.	5.95E-09	8.85E-09	3.94E-09
NE	1.19E-08	0.	0.	2.32E-09	0.
ENE	1.19E-08	0.	0.	0.	0.
E	9.86E-09	0.	0.	5.30E-09	0.
ESE	1.46E-08	0.	0.	0.	0.
SE	1.11E-08	0.	7.35E-09	6.58E-09	5.36E-09
SSE	1.52E-08	1.39E-08	1.35E-08	1.39E-08	0.
S	4.68E-09	0.	0.	2.43E-09	2.04E-09
SSW	4.79E-09	0.	0.	2.47E-09	2.47E-09
SW	7.45E-09	0.	2.31E-09	7.45E-09	5.70E-09
WSW	7.24E-09	0.	0.	4.59E-09	4.59E-09
W	6.08E-09	0.	2.37E-09	3.58E-09	3.58E-09
WNW	5.54E-09	0.	0.	3.27E-09	3.07E-09
NW	3.92E-09	0.	0.	3.02E-09	8.42E-11
NNW	7.67E-09	0.	0.	3.99E-09	3.20E-09
N	7.6E-09	0.	0.	4.41E-09	4.79E-09

* A ZERO INDICATES THAT THIS POINT WAS NOT CALCULATED

Table A-4
X/Q Values At The Standard Distances For Releases From The Turbine Buildings

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK
RELEASE TYPE: ANNUAL
RELEASE MODE: GROUND LEVEL
VARIABLE: RELATIVE CONCENTRATION (SEC./CUBIC METER)
CALCULATION POINTS: STANDARD
MODEL: STRAIGHT LINE (ANNX009)
APPLICATION OF TERRAIN CORRECTION FACTORS: YES
NUMBER OF OBSERVATIONS: 8678

BASE DISTANCE IN MILES / KILOMETERS

AFTO	DESIGN		.25	.75	1.25	1.75	2.25	2.75	3.25	3.75	4.25	4.75
SECT	DIST	MI	.40	1.21	2.01	2.82	3.62	4.42	5.23	6.03	6.84	7.64
NNE	0.		1.5E-05	2.3E-06	9.4E-07	5.9E-07	3.5E-07	2.4E-07	1.9E-07	1.5E-07	1.2E-07	9.0E-08
NE	0.		2.0E-05	2.9E-06	1.3E-06	7.3E-07	4.5E-07	3.4E-07	2.7E-07	2.0E-07	1.7E-07	1.4E-07
ENE	0.		2.1E-05	3.2E-06	1.2E-06	6.5E-07	4.8E-07	3.6E-07	2.9E-07	2.1E-07	1.8E-07	1.4E-07
E	0.		2.9E-05	3.9E-06	1.5E-06	9.1E-07	6.6E-07	4.4E-07	3.5E-07	2.8E-07	2.2E-07	1.9E-07
ESE	0.		3.2E-05	5.2E-06	2.2E-06	1.0E-06	6.5E-07	4.4E-07	3.6E-07	2.9E-07	2.4E-07	1.9E-07
SE	0.		2.3E-05	3.4E-06	1.6E-06	7.9E-07	4.8E-07	3.3E-07	2.4E-07	2.2E-07	1.8E-07	1.6E-07
SSE	0.		4.4E-05	7.5E-06	3.1E-06	1.8E-06	1.2E-06	7.7E-07	5.1E-07	3.9E-07	3.2E-07	2.5E-07
S	0.		2.7E-05	3.8E-06	1.6E-06	9.8E-07	7.2E-07	4.9E-07	3.7E-07	2.9E-07	2.2E-07	1.8E-07
SSW	0.		1.9E-05	2.8E-06	1.2E-06	8.0E-07	4.9E-07	2.9E-07	2.3E-07	2.2E-07	1.3E-07	1.1E-07
SW	0.		1.8E-05	2.5E-06	1.1E-06	6.6E-07	4.9E-07	2.8E-07	2.2E-07	1.7E-07	1.4E-07	1.1E-07
WSW	0.		1.5E-05	1.8E-06	7.5E-07	3.8E-07	2.8E-07	1.8E-07	1.5E-07	1.2E-07	9.5E-08	7.9E-08
W	0.		1.3E-05	1.5E-06	6.9E-07	3.3E-07	2.2E-07	1.5E-07	1.1E-07	9.4E-08	8.1E-08	5.2E-08
WNW	0.		1.0E-05	1.2E-06	6.0E-07	2.8E-07	1.6E-07	1.3E-07	8.6E-08	7.2E-08	5.4E-08	4.4E-08
NW	0.		7.1E-06	9.7E-07	3.5E-07	2.1E-07	1.6E-07	1.2E-07	7.8E-08	6.6E-08	4.6E-08	3.9E-08
NNW	0.		8.9E-06	1.3E-06	5.4E-07	2.7E-07	1.7E-07	1.3E-07	1.1E-07	9.3E-08	6.6E-08	5.3E-08
N	0.		9.2E-06	1.4E-06	5.1E-07	3.3E-07	2.1E-07	1.6E-07	1.3E-07	1.1E-07	8.1E-08	7.0E-08

NUMBER OF VALID OBSERVATIONS = 8678
NUMBER OF INVALID OBSERVATIONS = 82
NUMBER OF CALMS LOWER LEVEL = 125
NUMBER OF CALMS UPPER LEVEL = 0

Table A-5
Depleted X/Q Values At The Standard Distances For Releases From The Turbine Buildings

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK
RELEASE TYPE: ANNUAL
RELEASE MODE: GROUND LEVEL
VARIABLE: RELATIVE DEPLETED CONCENTRATION (SEC./CUBIC METER)
CALCULATION POINTS: STANDARD
MODEL: STRAIGHT LINE (ANNX009)
APPLICATION OF TERRAIN CORRECTION FACTORS: YES
NUMBER OF OBSERVATIONS: 8678

BASE DISTANCE IN MILES / KILOMETERS

AFD SECT	DESIGN DIST MI	.25	.75	1.25	1.75	2.25	2.75	3.25	3.75	4.25	4.75
		.40	1.21	2.01	2.82	3.62	4.42	5.23	6.03	6.84	7.64
NNE	0.	1.5E-05	2.0E-06	8.1E-07	4.8E-07	2.8E-07	1.9E-07	1.5E-07	1.1E-07	8.9E-08	6.8E-08
NE	0.	1.8E-05	2.6E-06	1.1E-06	6.1E-07	3.7E-07	2.6E-07	2.1E-07	1.5E-07	1.2E-07	1.0E-07
ENE	0.	2.0E-05	2.9E-06	1.0E-06	5.5E-07	3.9E-07	2.8E-07	2.2E-07	1.6E-07	1.3E-07	1.0E-07
E	0.	2.7E-05	3.4E-06	1.3E-06	7.6E-07	5.3E-07	3.5E-07	2.6E-07	2.2E-07	1.6E-07	1.4E-07
ESE	0.	3.0E-05	4.6E-06	1.9E-06	8.7E-07	5.3E-07	3.5E-07	2.8E-07	2.3E-07	1.7E-07	1.4E-07
SE	0.	2.2E-05	3.1E-06	1.3E-06	6.6E-07	3.9E-07	2.6E-07	1.9E-07	1.6E-07	1.3E-07	1.2E-07
SSE	0.	4.2E-05	6.8E-06	2.7E-06	1.5E-06	9.9E-07	6.1E-07	4.0E-07	3.0E-07	2.4E-07	1.9E-07
S	0.	2.5E-05	3.5E-06	1.3E-06	8.1E-07	5.9E-07	3.9E-07	2.9E-07	2.2E-07	1.6E-07	1.4E-07
SSW	0.	1.9E-05	2.5E-06	1.0E-06	6.6E-07	4.0E-07	2.3E-07	1.8E-07	1.6E-07	1.0E-07	8.3E-08
SW	0.	1.7E-05	2.4E-06	9.8E-07	5.5E-07	3.9E-07	2.3E-07	1.7E-07	1.3E-07	1.1E-07	9.0E-08
WSW	0.	1.4E-05	1.5E-06	6.4E-07	3.2E-07	2.2E-07	1.4E-07	1.1E-07	9.2E-08	7.0E-08	5.9E-08
W	0.	1.2E-05	1.3E-06	5.9E-07	2.7E-07	1.8E-07	1.1E-07	8.3E-08	7.2E-08	6.1E-08	3.8E-08
WNW	0.	9.9E-06	1.1E-06	5.4E-07	2.4E-07	1.3E-07	1.0E-07	6.6E-08	5.5E-08	4.1E-08	3.3E-08
NW	0.	6.7E-06	8.7E-07	3.0E-07	1.8E-07	1.3E-07	9.4E-08	6.1E-08	5.1E-08	3.5E-08	3.0E-08
NNW	0.	8.5E-06	1.1E-06	4.7E-07	2.2E-07	1.3E-07	1.1E-07	8.3E-08	7.2E-08	5.0E-08	3.9E-08
N	0.	8.6E-06	1.2E-06	4.4E-07	2.8E-07	1.7E-07	1.3E-07	1.0E-07	8.2E-08	6.1E-08	5.1E-08

NUMBER OF VALID OBSERVATIONS = 8678
NUMBER OF INVALID OBSERVATIONS = 82
NUMBER OF CALMS LOWER LEVEL = 125
NUMBER OF CALMS UPPER LEVEL = 0

Table A-6
D/Q Values At The Standard Distances For Releases From The Turbine Buildings

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK
RELEASE TYPE: ANNUAL
RELEASE MODE: GROUND LEVEL
VARIABLE: RELATIVE DEPOSITION RATE (METER**2)
CALCULATION POINTS: STANDARD
MODEL: STRAIGHT LINE (AMX009)
APPLICATION OF TERRAIN CORRECTION FACTORS: YES
NUMBER OF OBSERVATIONS: 8678

		BASE DISTANCE IN MILES / KILOMETERS											
AFTD SECT	DESIGN DIST MI	.25	.75	1.25	1.75	2.25	2.75	3.25	3.75	4.25	4.75		
		.40	1.21	2.01	2.82	3.62	4.42	5.23	6.03	6.84	7.64		
NNE 0.		8.6E-08	1.3E-08	4.8E-09	2.8E-09	1.5E-09	9.9E-10	7.7E-10	5.7E-10	4.3E-10	3.3E-10		
NE 0.		1.3E-07	1.9E-08	7.6E-09	4.0E-09	2.3E-09	1.6E-09	1.3E-09	8.8E-10	6.8E-10	5.7E-10		
ENE 0.		5.8E-08	9.4E-09	3.2E-09	1.6E-09	1.1E-09	7.5E-10	5.5E-10	3.9E-10	3.0E-10	2.3E-10		
E 0.		6.2E-08	8.6E-09	3.1E-09	1.7E-09	1.1E-09	6.9E-10	5.1E-10	3.9E-10	2.9E-10	2.3E-10		
ESE 0.		7.2E-08	1.3E-08	5.0E-09	2.2E-09	1.2E-09	7.6E-10	6.0E-10	4.7E-10	3.5E-10	2.6E-10		
SE 0.		5.1E-08	8.4E-09	3.3E-09	1.6E-09	8.6E-10	5.6E-10	3.8E-10	3.3E-10	2.6E-10	2.2E-10		
SSE 0.		8.2E-08	1.5E-08	5.8E-09	3.0E-09	1.8E-09	1.1E-09	6.8E-10	4.9E-10	3.8E-10	2.9E-10		
S 0.		5.6E-08	8.3E-09	3.2E-09	1.8E-09	1.2E-09	7.5E-10	5.4E-10	3.9E-10	2.9E-10	2.3E-10		
SSW 0.		5.2E-08	7.7E-09	3.0E-09	1.9E-09	1.1E-09	5.8E-10	4.3E-10	3.8E-10	2.2E-10	1.8E-10		
SW 0.		7.5E-08	1.1E-08	4.3E-09	2.4E-09	1.6E-09	8.8E-10	6.4E-10	4.6E-10	3.7E-10	3.1E-10		
WSW 0.		6.0E-08	7.0E-09	2.7E-09	1.3E-09	8.8E-10	5.2E-10	4.0E-10	3.3E-10	2.4E-10	2.0E-10		
W 0.		4.1E-08	5.1E-09	2.0E-09	9.2E-10	5.7E-10	3.6E-10	2.6E-10	2.1E-10	1.7E-10	1.0E-10		
WNW 0.		3.4E-08	3.8E-09	1.7E-09	7.3E-10	3.9E-10	3.0E-10	1.9E-10	1.5E-10	1.1E-10	8.4E-11		
NW 0.		2.7E-08	3.5E-09	1.1E-09	6.6E-10	4.7E-10	3.3E-10	2.1E-10	1.7E-10	1.1E-10	9.6E-11		
NNW 0.		3.6E-08	5.0E-09	1.9E-09	9.5E-10	5.0E-10	3.8E-10	2.8E-10	2.4E-10	1.6E-10	1.3E-10		
N 0.		4.4E-08	6.3E-09	2.1E-09	1.3E-09	8.0E-10	5.6E-10	4.5E-10	3.5E-10	2.5E-10	2.1E-10		

NUMBER OF VALID OBSERVATIONS = 8678
NUMBER OF INVALID OBSERVATIONS = 82
NUMBER OF CALMS LOWER LEVEL = 125
NUMBER OF CALMS UPPER LEVEL = 0

Table A-7
X/Q Values At The Special Locations For Releases From The Reactor Buildings

CAROLINA POWER AND LIGHT COMPANY - HUNTSWICK
RELEASE TYPE: ANNUAL
RELEASE MODE: MIXED MODE
VARIABLE: RELATIVE CONCENTRATION (SEC./CUBIC METER)
CALCULATION POINTS: SPECIAL
MODEL: STRAIGHT LINE (AMX0009)
APPLICATION OF TERRAIN CORRECTION FACTORS: YES
NUMBER OF OBSERVATIONS: 1678

AFFECTED SECTOR	SITE BOUNDARY	DAIRY	MEAT	RESIDENT	GARDEN
NNE	1.19E-07	0.	8.06E-08	8.79E-08	7.31E-08
NE	1.72E-07	0.	0.	9.39E-08	0.
ENE	7.18E-08	0.	0.	0.	0.
E	5.37E-08	0.	0.	3.88E-08	0.
ESE	7.65E-08	0.	0.	0.	0.
SE	4.24E-08	0.	2.44E-08	3.71E-08	3.55E-08
SSE	6.70E-08	6.75E-08	6.50E-08	6.75E-08	0.
S	3.81E-08	0.	0.	3.16E-08	2.90E-08
SSW	4.65E-08	0.	0.	4.17E-08	4.17E-08
SW	5.02E-08	0.	3.98E-08	5.02E-08	5.02E-08
WSW	4.32E-08	0.	0.	4.53E-08	4.53E-08
W	2.71E-08	0.	3.32E-08	3.14E-08	3.14E-08
WNW	1.70E-08	0.	0.	1.81E-08	1.84E-08
NW	1.76E-08	0.	0.	2.02E-08	1.15E-08
NNW	2.94E-08	0.	0.	2.49E-08	2.37E-08
N	4.84E-08	0.	0.	3.46E-08	3.53E-08

• A ZERO INDICATES THAT THIS POINT WAS NOT CALCULATED

Table A 8
Depleted χ_1 Values At The Special Locations For Releases From The Reactor Buildings

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK
RELEASE TYPE: ANNUAL
RELEASE MODE: MIXED MODE
VARIABLE: RELATIVE DEPLETED CONCENTRATION (SEC./CUBIC METER)
CALCULATION POINTS: SPECIAL
MODEL: STRAIGHT LINE (ANX009)
APPLICATION OF TERRAIN CORRECTION FACTORS: YES
NUMBER OF OBSERVATIONS: 8678

AFFECTED SECTOR	SITE BOUNDARY	DAIRY	MEAT	RESIDENT	GARDEN
NNE	1.09E-07	0.	7.63E-08	8.44E-08	6.89E-08
NE	1.62E-07	0.	0.	8.70E-08	0.
ENE	6.68E-08	0.	0.	0.	0.
E	4.93E-08	0.	0.	3.57E-08	0.
ESE	7.04E-08	0.	0.	0.	0.
SE	3.98E-08	0.	3.50E-08	3.45E-08	3.34E-08
SSE	6.25E-08	6.28E-08	6.05E-08	6.28E-08	0.
S	3.56E-08	0.	0.	2.99E-08	2.75E-08
SSW	4.38E-08	0.	0.	3.99E-08	3.99E-08
SW	4.76E-08	0.	3.72E-08	4.76E-08	4.66E-08
WSW	4.09E-08	0.	0.	4.36E-08	4.36E-08
W	2.64E-08	0.	3.24E-08	3.06E-08	3.06E-08
WNW	1.58E-08	0.	0.	1.75E-08	1.77E-08
NW	1.69E-08	0.	0.	1.87E-08	1.15E-08
NNW	2.68E-08	0.	0.	2.33E-08	2.21E-08
N	4.40E-08	0.	0.	3.29E-08	3.35E-08

* A ZERO INDICATES THAT THIS POINT WAS NOT CALCULATED

Table A-9
D/Q Values At The Special Locations For Releases From The Reactor Buildings

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK
RELEASE TYPE: ANNUAL
RELEASE MODE: MIXED MODE
VARIABLE: RELATIVE DEPOSITION RATE (METER**2)
CALCULATION POINTS: SPECIAL
MODEL: STRAIGHT LINE (ATINX009)
APPLICATION OF TERRAIN CORRECTION FACTORS: YES
NUMBER OF OBSERVATIONS: 8678

AFFECTED SECTOR	SITE BOUNDARY	DAIRY	MEAT	RESIDENT	GARDEN
NHE	2.49E-09	0.	1.27E-09	1.58E-09	9.35E-10
NE	3.33E-09	0.	0.	9.78E-10	0.
ENE	1.30E-09	0.	0.	0.	0.
E	5.29E-10	0.	0	3.42E-10	0.
ESE	1.22E-09	0.	0.	0.	0.
SE	8.49E-10	0.	7.26E-10	6.63E-10	5.99E-10
SSE	1.07E-09	1.03E-09	9.93E-10	1.03E-09	0.
S	4.15E-10	0.	0.	2.83E-10	2.52E-10
SSW	6.38E-10	0.	0.	4.17E-10	4.17E-10
SW	8.66E-10	0.	4.16E-10	8.66E-10	7.62E-10
WSW	9.26E-10	0.	0.	7.47E-10	7.47E-10
W	5.72E-10	0.	4.37E-10	5.23E-10	5.23E-10
WNW	2.75E-10	0.	0.	2.59E-10	2.56E-10
NW	3.04E-10	0.	0.	3.07E-10	3.53E-11
NNW	3.86E-10	0.	0.	2.89E-10	2.53E-10
N	7.48E-10	0.	0.	4.38E-10	4.56E-10

* A ZERO INDICATES THAT THIS POINT WAS NOT CALCULATED

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Table A-10
X/Q Values At The Standard Distances For Releases From The Reactor Buildings

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK
RELEASE TYPE: ANNUAL
RELEASE MODEL: MIXED MODE
VARIABLE: RELATIVE CONCENTRATION (SEC./CUBIC METER)
CALCULATION POINTS: STANDARD
MODEL: STRAIGHT LINE (ANXX0009)
APPLICATION OF TERQAIN CORRECTION FACTORS: YES
NUMBER OF OBSERVATIONS: 8678

		BASE DISTANCE IN MILES / KILOMETERS									
AFTO SECT	DESIGN DIST MI	.25	.75	1.25	1.75	2.25	2.75	3.25	3.75	4.25	4.75
		.40	1.21	2.01	2.82	3.62	4.42	5.23	6.03	6.84	7.64
NNE	0.	5.6E-07	1.0E-07	7.8E-08	6.3E-08	5.2E-08	4.1E-08	3.6E-08	3.1E-08	2.7E-08	2.4E-08
NE	0.	5.5E-07	2.0E-07	1.5E-07	1.2E-07	9.4E-08	7.4E-08	6.3E-08	5.3E-08	4.6E-08	4.1E-08
ENE	0.	1.6E-06	6.5E-08	5.8E-08	5.4E-08	4.9E-08	4.3E-08	3.9E-08	3.5E-08	3.1E-08	2.9E-08
E	0.	2.9E-07	4.8E-08	3.5E-08	2.9E-08	2.7E-08	2.3E-08	2.2E-08	1.8E-08	1.7E-08	1.5E-08
ESE	0.	1.2E-07	6.9E-08	5.0E-08	3.9E-08	3.5E-08	3.1E-08	2.6E-08	2.3E-08	2.0E-08	1.7E-08
SE	0.	7.8E-08	4.1E-08	3.6E-08	2.7E-08	2.0E-08	1.8E-08	1.7E-08	1.5E-08	1.3E-08	1.2E-08
SSE	0.	2.2E-07	7.6E-08	5.6E-08	4.2E-08	3.5E-08	2.9E-08	2.5E-08	2.2E-08	1.9E-08	1.6E-08
S	0.	4.2E-07	4.5E-08	3.5E-08	2.8E-08	2.5E-08	2.4E-08	2.1E-08	1.8E-08	1.6E-08	1.4E-08
SSW	0.	5.9E-07	4.7E-08	4.7E-08	4.1E-08	3.7E-08	2.9E-08	2.7E-08	2.3E-08	2.0E-08	1.8E-08
SW	0.	1.8E-07	6.4E-08	5.5E-08	4.4E-08	3.8E-08	3.1E-08	2.7E-08	2.4E-08	2.1E-08	1.9E-08
WSW	0.	8.9E-08	4.1E-08	4.3E-08	3.9E-08	3.4E-08	2.8E-08	2.5E-08	2.5E-08	2.2E-08	1.9E-08
W	0.	3.6E-08	3.4E-08	3.8E-08	3.7E-08	3.1E-08	2.8E-08	2.6E-08	2.2E-08	2.1E-08	1.8E-08
WNW	0.	4.1E-08	1.9E-08	2.2E-08	2.4E-08	2.3E-08	2.0E-08	1.8E-08	1.6E-08	1.4E-08	1.2E-08
NW	0.	3.0E-08	1.9E-08	2.3E-08	2.0E-08	1.9E-08	1.9E-08	1.6E-08	1.4E-08	1.3E-08	1.2E-08
NNW	0.	4.9E-07	3.2E-08	2.7E-08	2.4E-08	2.0E-08	1.8E-08	1.6E-08	1.5E-08	1.4E-08	1.3E-08
N	0.	6.3E-07	4.0E-08	3.0E-08	2.9E-08	2.7E-08	2.7E-08	2.6E-08	2.1E-08	1.8E-08	1.7E-08

NUMBER OF VALID OBSERVATIONS = 8678
NUMBER OF TOTAL OBSERVATIONS = 8678
NUMBER OF CALCS LOWER LEVEL = 12
NUMBER OF CALCS UPPER LEVEL = 0

Table A-11
Depleted X/Q Values At The Standard Distances For Releases From The Reactor Buildings

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK
RELEASE TYPE: ANNUAL
RELEASE MODE: MIXED MODE
VARIABLE: RELATIVE DEPLETED CONCENTRATION (SEC./CUBIC METER)
CALCULATION POINTS: STANDARD
MODEL: STRAIGHT LINE (ANNUAL)
APPLICATION OF TERRAIN CORRECTION FACTORS: YES
NUMBER OF OBSERVATIONS: 8678

BASE DISTANCE IN MILES / KILOMETERS												
AFD SECT	DESIGN DIST MI	.25	.75	1.25	1.75	2.25	2.75	3.25	3.75	4.25	4.75	
		.40	1.21	2.01	2.82	3.62	4.42	5.23	6.03	6.84	7.64	
NNW	0.	5.4E-07	9.1E-08	7.3E-08	5.9E-08	4.9E-08	3.8E-08	3.3E-08	2.8E-08	2.5E-08	2.2E-08	
NNE	0.	5.3E-07	1.9E-07	1.4E-07	1.1E-07	8.7E-08	7.1E-08	5.9E-08	5.0E-08	4.3E-08	3.7E-08	
ENE	0.	1.5E-06	6.1E-08	5.6E-08	5.2E-08	4.7E-08	4.1E-08	3.7E-08	3.3E-08	3.0E-08	2.8E-08	
E	0.	2.8E-07	4.4E-08	3.2E-08	2.7E-08	2.5E-08	2.2E-08	2.1E-08	1.8E-08	1.6E-08	1.4E-08	
ESE	0.	1.1E-07	6.4E-08	4.6E-08	3.7E-08	3.3E-08	2.9E-08	2.4E-08	2.2E-08	1.8E-08	1.6E-08	
SE	0.	7.4E-08	3.8E-08	3.3E-08	2.5E-08	1.9E-08	1.7E-08	1.5E-08	1.4E-08	1.2E-08	1.2E-08	
SSE	0.	2.1E-07	7.1E-08	5.2E-08	3.9E-08	3.7E-08	2.6E-08	2.3E-08	2.0E-08	1.7E-08	1.5E-08	
S	0.	4.0E-07	4.2E-08	3.3E-08	2.7E-08	2.3E-08	2.3E-08	1.9E-08	1.7E-08	1.5E-08	1.3E-08	
SSW	0.	5.9E-07	4.3E-08	4.4E-08	3.9E-08	3.5E-08	2.7E-08	2.6E-08	2.2E-08	1.9E-08	1.7E-08	
SW	0.	1.7E-07	6.0E-08	5.2E-08	4.2E-08	3.6E-08	2.9E-08	2.5E-08	2.2E-08	2.0E-08	1.7E-08	
WSW	0.	8.2E-08	3.9E-08	4.2E-08	3.8E-08	3.7E-08	2.7E-08	2.4E-08	2.4E-08	2.1E-08	1.8E-08	
W	0.	3.4E-08	3.3E-08	3.6E-08	3.6E-08	3.0E-08	2.7E-08	2.5E-08	2.1E-08	2.0E-08	1.7E-08	
WNW	0.	3.9E-08	1.7E-08	2.1E-08	2.3E-08	2.2E-08	1.4E-08	1.7E-08	1.6E-08	1.3E-08	1.1E-08	
NW	0.	2.9E-08	1.8E-08	2.3E-08	2.0E-08	1.8E-08	1.8E-08	1.6E-08	1.4E-08	1.3E-08	1.2E-08	
NNW	0.	4.5E-07	3.0E-08	2.5E-08	2.3E-08	1.9E-08	1.7E-08	1.5E-08	1.4E-08	1.3E-08	1.2E-08	
N	0.	5.8E-07	3.7E-08	2.4E-08	2.8E-08	2.6E-08	2.5E-08	2.4E-08	2.0E-08	1.7E-08	1.6E-08	

NUMBER OF VALID OBSERVATIONS = 8678
NUMBER OF INVALID OBSERVATIONS = 82
NUMBER OF CALMS LOWER LEVEL = 12
NUMBER OF CALMS UPPER LEVEL = 0

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Table A-12
D/Q Values At The Standard Distances For Releases From The Reactor Buildings

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK
RELEASE TYPE: ANNUAL
RELEASE MODE: MIXED MODE
VARIABLE: RELATIVE DEPOSITION RATE (METER**2)
CALCULATION POINTS: STANDARD
MODEL: STRAIGHT LINE (ARHX009)
APPLICATION OF TERRAIN CORRECTION FACTORS: YES
NUMBER OF OBSERVATIONS: 8678

BASE DISTANCE IN MILES / KILOMETERS											
AFTD SECT	DESIGN DIST MI	.25	.75	1.25	1.75	2.25	2.75	3.25	3.75	4.25	4.75
		.40	1.21	2.01	2.82	3.62	4.42	5.23	6.03	6.84	7.64
NNE	0.	1.1E-08	2.0E-09	1.1E-09	7.2E-10	5.0E-10	3.5E-10	2.4E-10	2.2E-10	1.7E-10	1.5E-10
NE	0.	1.1E-08	4.3E-09	2.3E-09	1.5E-09	9.8E-10	7.2E-10	5.3E-10	4.2E-10	3.3E-10	2.7E-10
ENE	0.	1.9E-08	1.1E-09	5.8E-10	3.9E-10	2.8E-10	2.2E-10	1.7E-10	1.4E-10	1.1E-10	9.7E-11
E	0.	2.1E-09	4.6E-10	2.5E-10	1.6E-10	1.2E-10	9.0E-11	7.5E-11	5.7E-11	4.8E-11	3.8E-11
ESE	0.	1.3E-09	1.1E-09	5.4E-10	3.3E-10	2.4E-10	1.9E-10	1.3E-10	1.1E-10	8.3E-11	6.9E-11
SE	0.	1.3E-09	7.6E-10	4.9E-10	2.8E-10	1.8E-10	1.3E-10	1.1E-10	8.9E-11	6.7E-11	6.1E-11
SSE	0.	2.4E-09	1.2E-09	6.7E-10	4.1E-10	2.8E-10	2.1E-10	1.6E-10	1.3E-10	1.0E-10	8.2E-11
S	0.	3.6E-09	5.7E-10	3.4E-10	2.3E-10	1.7E-10	1.4E-10	1.0E-10	8.2E-11	6.5E-11	5.5E-11
SSW	0.	8.0E-09	7.7E-10	5.2E-10	3.5E-10	2.6E-10	1.8E-10	1.5E-10	1.1E-10	9.3E-11	7.4E-11
SW	0.	3.4E-09	1.2E-09	7.3E-10	4.5E-10	3.3E-10	2.3E-10	1.7E-10	1.4E-10	1.2E-10	9.4E-11
WSW	0.	1.8E-09	8.9E-10	5.9E-10	4.1E-10	2.9E-10	2.1E-10	1.7E-10	1.5E-10	1.2E-10	1.0E-10
W	0.	7.9E-10	6.6E-10	4.3E-10	2.9E-10	1.9E-10	1.5E-10	1.2E-10	8.6E-11	7.7E-11	6.4E-11
WNW	0.	5.8E-10	2.7E-10	2.0E-10	1.7E-10	1.3E-10	8.8E-11	6.8E-11	5.5E-11	4.2E-11	3.3E-11
NW	0.	5.4E-10	3.1E-10	2.3E-10	1.5E-10	1.1E-10	8.9E-11	6.9E-11	5.4E-11	4.4E-11	3.9E-11
NNW	0.	5.3E-09	4.0E-10	2.2E-10	1.6E-10	1.0E-10	7.6E-11	6.1E-11	5.0E-11	4.2E-11	3.4E-11
N	0.	8.7E-09	5.6E-10	2.8E-10	2.1E-10	1.6E-10	1.4E-10	1.1E-10	8.1E-11	6.4E-11	5.7E-11

NUMBER OF VALID OBSERVATIONS = 8678
NUMBER OF INVALID OBSERVATIONS = 82
NUMBER OF CALMS LOWER LEVEL = 12
NUMBER OF CALMS UPPER LEVEL = 0

Table A-13

X/Q Values At The Special Locations For Releases From The Stack

Carolina Power and Light Company - Brunswick

Release Type: Annual

Release Mode: Elevated

Variable: Rel. Concentration

Calculational Points: Special

Model: Straight Line

Application of Terrain Factor: Yes

Number of Observations: 8678

Accounting For Stack Center Offset

<u>Affected Sector</u>	<u>Site Boundary</u>	<u>Dairy</u>	<u>Meat</u>	<u>Resident</u>	<u>Garden</u>
NNE	1.3×10^{-8}	-	2.2×10^{-8}	1.9×10^{-8}	2.4×10^{-8}
NE	3.3×10^{-8}	-	-	4.1×10^{-8}	-
ENE	6.3×10^{-9}	-	-	-	-
E	3.0×10^{-9}	-	-	4.9×10^{-9}	-
ESE	5.9×10^{-9}	-	-	-	-
SE	5.7×10^{-9}	-	7.5×10^{-9}	8.0×10^{-9}	9.3×10^{-9}
SSE	5.9×10^{-9}	1.0×10^{-8}	1.0×10^{-8}	1.0×10^{-8}	-
S	6.3×10^{-9}	-	-	9.1×10^{-9}	9.4×10^{-9}
SSW	8.7×10^{-9}	-	-	1.4×10^{-8}	1.4×10^{-8}
SW	1.6×10^{-8}	-	1.8×10^{-8}	1.6×10^{-8}	1.7×10^{-8}
WSW	9.0×10^{-9}	-	-	1.4×10^{-8}	1.4×10^{-8}
W	9.7×10^{-9}	-	1.4×10^{-8}	1.2×10^{-8}	1.2×10^{-8}
WNW	4.8×10^{-9}	-	-	6.2×10^{-9}	6.4×10^{-9}
NW	7.0×10^{-9}	-	-	7.8×10^{-9}	7.0×10^{-9}
NNW	4.2×10^{-9}	-	-	6.0×10^{-9}	6.8×10^{-9}
N	4.8×10^{-9}	-	-	6.8×10^{-9}	6.6×10^{-9}

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Table A-14
Depleted X/Q Values At The Special Locations For Releases From The Stack

Carolina Power and Light Company - Brunswick
Release Type: Annual
Release Mode: Elevated
Variable: Rel. Depleted Concentrations
Calculational Points: Special
Model: Straight Line
Application of Terrain Factor: Yes
Number of Observations: 8678

Accounting For Stack Center Offset

<u>Affected Sector</u>	<u>Site Boundary</u>	<u>Dairy</u>	<u>Meat</u>	<u>Resident</u>	<u>Garden</u>
NNE	1.2×10^{-8}	-	2.1×10^{-8}	1.7×10^{-8}	2.3×10^{-8}
NE	3.2×10^{-8}	-	-	4.0×10^{-8}	-
ENE	6.2×10^{-9}	-	-	-	-
E	3.0×10^{-9}	-	-	4.9×10^{-9}	-
ESE	5.8×10^{-9}	-	-	-	-
SE	5.7×10^{-7}	-	7.4×10^{-9}	7.9×10^{-9}	9.3×10^{-9}
SSE	5.8×10^{-9}	9.9×10^{-9}	9.9×10^{-9}	9.9×10^{-9}	-
S	6.2×10^{-9}	-	-	9.0×10^{-9}	9.3×10^{-9}
SSW	8.5×10^{-9}	-	-	1.3×10^{-8}	1.3×10^{-9}
SW	1.5×10^{-8}	-	1.8×10^{-8}	1.6×10^{-8}	1.7×10^{-8}
WSW	8.9×10^{-9}	-	-	1.2×10^{-8}	1.2×10^{-8}
W	9.6×10^{-9}	-	1.4×10^{-8}	1.2×10^{-8}	1.2×10^{-8}
WNW	4.6×10^{-9}	-	-	5.9×10^{-9}	6.0×10^{-9}
NW	6.9×10^{-9}	-	-	7.7×10^{-9}	6.7×10^{-9}
NNW	4.1×10^{-9}	-	-	5.8×10^{-9}	6.6×10^{-9}
N	4.7×10^{-9}	-	-	6.5×10^{-9}	6.3×10^{-9}

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Table A-15
D/Q Values At The Special Locations For Releases From The Stack

Carolina Power and Light Company - Brunswick

Release Type: Annual

Release Mode: Elevated

Variable: Deposition Rate

Calculational Points: Special

Model: Straight Line

Application of Terrain Factor: Yes

Number of Observations: 8678

Accounting For Stack Center Offset

Affected Sector	Site Boundary	Dairy	Meat	Resident	Garden
NNE	6.0×10^{-10}	-	5.6×10^{-10}	5.9×10^{-10}	5.0×10^{-10}
NE	1.3×10^{-9}	-	-	6.6×10^{-10}	-
ENE	3.3×10^{-10}	-	-	-	-
E	1.8×10^{-10}	-	-	1.6×10^{-10}	-
ESE	4.0×10^{-10}	-	-	-	-
SE	4.4×10^{-10}	-	4.4×10^{-10}	4.4×10^{-10}	4.2×10^{-10}
SSE	6.0×10^{-10}	5.4×10^{-10}	5.4×10^{-10}	5.4×10^{-10}	-
S	2.0×10^{-10}	-	-	1.7×10^{-10}	1.7×10^{-10}
SSW	2.7×10^{-10}	-	-	2.7×10^{-10}	2.7×10^{-10}
SW	5.4×10^{-10}	-	3.2×10^{-10}	5.4×10^{-10}	4.9×10^{-10}
WSW	3.8×10^{-10}	-	-	3.8×10^{-10}	3.8×10^{-10}
W	3.8×10^{-10}	-	3.1×10^{-10}	3.7×10^{-10}	3.7×10^{-10}
WNW	1.7×10^{-10}	-	-	1.6×10^{-10}	1.6×10^{-10}
NW	2.1×10^{-10}	-	-	2.0×10^{-10}	3.2×10^{-11}
NNW	1.5×10^{-10}	-	-	1.4×10^{-10}	1.3×10^{-10}
N	1.9×10^{-10}	-	-	1.6×10^{-10}	1.7×10^{-10}

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Table A-16
X/Q Values At The Standard Distances For Releases From The Stack

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK											
RELEASE TYPE: ANNUAL											
RELEASE MODEL: ELEVATED											
VARIABLE: RELATIVE CONCENTRATION (SEC./CUBIC METER)											
CALCULATION POINTS: STANDARD											
MODEL: STRAIGHT LINE (ANNX009)											
APPLICATION OF TERRAIN CORRECTION FACTOR: YES											
NUMBER OF OBSERVATIONS: 8678											
BASE DISTANCE IN MILES / KILOMETERS											
AFID SECT	DESIGN DIST ML	.25	.75	1.25	1.75	2.25	2.75	3.25	3.75	4.25	4.75
		.40	1.21	2.01	2.82	3.62	4.42	5.23	6.03	6.84	7.64
NNE 0.		1.5E-09	1.3E-08	2.3E-08	2.5E-08	2.4E-08	2.1E-08	1.9E-08	1.7E-08	1.5E-08	1.4E-08
NE 0.		2.5E-09	2.5E-08	4.0E-08	4.4E-08	4.2E-08	3.8E-08	3.3E-08	3.0E-08	2.6E-08	2.4E-08
ENE 0.		8.7E-10	7.2E-09	1.6E-08	2.1E-08	2.2E-08	2.1E-08	2.0E-08	1.9E-08	1.8E-08	1.7E-08
E 0.		7.5E-10	3.6E-09	7.6E-09	8.9E-09	1.0E-08	9.3E-09	9.4E-09	8.1E-09	7.6E-09	7.5E-09
ESE 0.		1.1E-09	7.7E-09	1.1E-08	1.3E-08	1.3E-08	1.3E-08	1.1E-08	1.0E-08	9.3E-09	8.5E-09
SE 0.		1.6E-09	8.7E-09	1.1E-08	1.0E-08	9.1E-09	8.9E-09	8.0E-09	7.3E-09	6.5E-09	6.5E-09
SSE 0.		1.5E-09	1.2E-08	1.6E-08	1.6E-08	1.5E-08	1.3E-08	1.3E-08	1.1E-08	1.0E-08	8.9E-09
S 0.		7.7E-10	4.7E-09	8.5E-09	9.6E-09	9.7E-09	1.1E-08	9.4E-09	8.3E-09	7.7E-09	7.2E-09
SSW 0.		4.9E-10	6.0E-09	1.4E-08	1.6E-08	1.7E-08	1.4E-08	1.4E-08	1.2E-08	1.1E-08	1.0E-08
SW 0.		1.5E-09	1.3E-08	1.8E-08	1.8E-08	1.8E-08	1.6E-08	1.4E-08	1.3E-08	1.1E-08	1.0E-08
WSW 0.		1.5E-09	9.0E-09	1.6E-08	1.8E-08	1.8E-08	1.6E-08	1.4E-08	1.4E-08	1.3E-08	1.2E-08
W 0.		1.4E-09	1.0E-08	1.5E-08	1.7E-08	1.6E-08	1.5E-08	1.4E-08	1.2E-08	1.2E-08	1.1E-08
WNW 0.		8.4E-10	5.3E-09	8.4E-09	1.1E-08	1.2E-08	1.0E-08	9.3E-09	8.6E-09	7.3E-09	6.7E-09
NW 0.		1.0E-09	6.5E-09	1.0E-08	1.0E-08	1.0E-08	1.0E-08	9.5E-09	8.6E-09	7.5E-09	7.5E-09
NNW 0.		1.1E-09	4.2E-09	7.6E-09	9.2E-09	8.5E-09	8.0E-09	7.4E-09	7.0E-09	6.9E-09	6.1E-09
N 0.		8.1E-10	4.5E-09	8.4E-09	1.1E-08	1.2E-08	1.3E-08	1.3E-08	1.1E-08	9.3E-09	9.2E-09

NUMBER OF VALID OBSERVATIONS = 8678
NUMBER OF INVALID OBSERVATIONS = 82
NUMBER OF CALMS LOWER LEVEL = 0
NUMBER OF CALMS UPPER LEVEL = 0

Table A-17
Depleted x/Q Values At The Standard Distances For Releases From The Stack

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK
RELEASE TYPE: ANNUAL
RELEASE MODEL: ELEVATED
VARIABLE: RELATIVE DEPLETED CONCENTRATION (SEC./CUBIC METER)
CALCULATION POINT: STANDARD
MODEL: STRAIGHT LINE (ANNX009)
APPLICATION OF TERRAIN CORRECTION FACTOR: YES
NUMBER OF OBSERVATIONS: 8678

		BASE DISTANCE IN MILES / KILOMETERS									
AFTO SECT	DESIGN DIST MI	.25	.75	1.25	1.75	2.25	2.75	3.25	3.75	4.25	4.75
		.40	1.21	2.01	2.82	3.62	4.42	5.23	6.03	6.84	7.64
NNE	0.	1.5E-09	1.2E-08	2.2E-08	2.4E-08	2.4E-08	2.1E-08	1.9E-08	1.7E-08	1.5E-08	1.4E-08
NE	0.	2.5E-09	2.5E-08	4.0E-08	4.3E-08	4.1E-08	3.7E-08	3.2E-08	2.9E-08	2.5E-08	2.3E-08
ENE	0.	8.7E-10	7.1E-09	1.6E-08	2.1E-08	2.2E-08	2.0E-08	1.9E-08	1.8E-08	1.7E-08	1.7E-08
E	0.	7.5E-10	3.6E-09	7.6E-09	8.9E-09	9.3E-09	9.3E-09	9.4E-09	8.1E-09	7.6E-09	6.8E-09
ESE	0.	1.1E-09	7.5E-09	1.1E-08	1.2E-08	1.3E-08	1.3E-08	1.1E-08	1.0E-08	9.3E-09	8.2E-09
SE	0.	1.6E-09	8.7E-09	1.1E-08	1.0E-08	8.5E-09	8.2E-09	8.0E-09	7.2E-09	6.3E-09	6.3E-09
SSE	0.	1.5E-09	1.2E-08	1.6E-08	1.5E-08	1.4E-08	1.3E-08	1.2E-08	1.0E-08	9.3E-09	8.1E-09
S	0.	7.7E-10	4.6E-09	8.5E-09	9.6E-09	9.7E-09	1.1E-08	9.4E-09	8.2E-09	7.4E-09	6.9E-09
SSW	0.	4.9E-10	6.0E-09	1.4E-08	1.6E-08	1.6E-08	1.4E-08	1.4E-08	1.1E-08	1.0E-08	9.3E-09
SW	0.	1.5E-09	1.3E-08	1.8E-08	1.8E-08	1.8E-08	1.5E-08	1.4E-08	1.2E-08	1.1E-08	1.0E-08
WSW	0.	1.5E-09	9.0E-09	1.5E-08	1.8E-08	1.7E-08	1.5E-09	1.3E-08	1.4E-08	1.2E-08	1.1E-08
W	0.	1.4E-09	1.0E-08	1.5E-08	1.7E-08	1.5E-08	1.5E-08	1.4E-08	1.2E-08	1.2E-08	1.1E-08
WNW	0.	8.4E-10	5.1E-09	8.4E-09	1.1E-08	1.2E-08	1.0E-08	9.3E-09	8.6E-09	7.3E-09	6.5E-09
NW	0.	1.0E-09	6.5E-09	1.0E-08	1.0E-08	9.6E-09	1.0E-08	8.7E-09	7.8E-09	7.3E-09	7.1E-09
NNW	0.	1.1E-09	4.1E-09	7.5E-09	9.2E-09	8.5E-09	8.0E-09	7.3E-09	6.8E-09	6.6E-09	6.0E-09
N	0.	8.1E-10	4.5E-09	8.4E-09	1.1E-08	1.1E-08	1.3E-08	1.3E-08	1.0E-08	9.3E-09	9.2E-09

NUMBER OF VALID OBSERVATIONS = 8678
NUMBER OF INVALID OBSERVATIONS = 82
NUMBER OF CALMS LOWER LEVEL = 0
NUMBER OF CALMS UPPER LEVEL = 0

Table A-18
D/Q Values At The Standard Distances For Releases From The Stack

CAROLINA POWER AND LIGHT COMPANY - BRUNSWICK
RELEASE TYPE: ANNUAL
RELEASE MODE: ELEVATED
VARIABLE: RELATIVE DEPOSITION RATE (METER**-2)
CALCULATION POINTS: STANDARD
MODEL: STRAIGHT LINE (ANNX009)
APPLICATION OF TERRAIN CORRECTION FACTORS: YES
NUMBER OF OBSERVATIONS: 8678

		BASE DISTANCE IN MILES / KILOMETERS										
AFTD SECT	DESIGN DIST MI	.25	.75	1.25	1.75	2.25	2.75	3.25	3.75	4.25	4.75	
		.40	1.21	2.01	2.82	3.62	4.42	5.23	6.03	6.84	7.64	
NNE	0.	1.2E-09	6.0E-10	5.3E-10	4.3E-10	3.4E-10	2.5E-10	2.0E-10	1.6E-10	1.4E-10	1.2E-10	
NE	0.	1.4E-09	1.4E-09	1.1E-09	8.8E-10	6.7E-10	5.2E-10	3.9E-10	3.1E-10	2.6E-10	2.2E-10	
ENE	0.	1.8E-09	3.2E-10	3.0E-10	2.5E-10	2.0E-10	1.6E-10	1.3E-10	1.1E-10	9.3E-11	8.1E-11	
E	0.	2.2E-10	1.6E-10	1.3E-10	1.0E-10	8.7E-11	6.6E-11	5.7E-11	4.4E-11	3.7E-11	3.1E-11	
ESE	0.	1.9E-10	4.1E-10	2.7E-10	2.0E-10	1.7E-10	1.4E-10	1.1E-10	8.2E-11	6.6E-11	5.6E-11	
SE	0.	3.2E-10	4.2E-10	3.1E-10	2.1E-10	1.4E-10	1.1E-10	8.7E-11	7.3E-11	5.8E-11	5.3E-11	
SSE	0.	5.8E-10	5.4E-10	3.9E-10	2.8E-10	2.1E-10	1.7E-10	1.4E-10	1.1E-10	8.5E-11	7.1E-11	
S	0.	5.4E-10	2.0E-10	1.9E-10	1.4E-10	1.1E-10	1.1E-10	8.3E-11	6.6E-11	5.5E-11	4.6E-11	
SSW	0.	1.1E-09	2.7E-10	2.9E-10	2.4E-10	1.9E-10	1.4E-10	1.3E-10	9.5E-11	7.9E-11	6.5E-11	
SW	0.	7.6E-10	5.6E-10	4.3E-10	3.1E-10	2.4E-10	1.9E-10	1.4E-10	1.1E-10	9.5E-11	8.0E-11	
WSW	0.	4.1E-10	3.8E-10	3.6E-10	3.0E-10	2.3E-10	1.7E-10	1.4E-10	1.3E-10	1.0E-10	8.6E-11	
W	0.	2.8E-10	3.9E-10	3.0E-10	2.1E-10	1.5E-10	1.3E-10	1.0E-10	7.8E-11	6.9E-11	5.9E-11	
WNW	0.	2.4E-10	1.7E-10	1.5E-10	1.4E-10	1.0E-10	7.4E-11	5.8E-11	4.8E-11	3.7E-11	2.9E-11	
NW	0.	2.6E-10	2.0E-10	1.7E-10	1.2E-10	8.8E-11	7.5E-11	6.0E-11	4.8E-11	4.0E-11	3.6E-11	
NNW	0.	7.2E-10	1.5E-10	1.3E-10	1.0E-10	7.3E-11	5.4E-11	4.3E-11	3.6E-11	3.2E-11	2.6E-11	
N	0.	8.1E-10	1.9E-10	1.5E-10	1.3E-10	1.1E-10	9.9E-11	7.9E-11	6.0E-11	4.9E-11	4.4E-11	

NUMBER OF VALID OBSERVATIONS = 8678
NUMBER OF INVALID OBSERVATIONS = 82
NUMBER OF CALMS LOWER LEVEL = 0
NUMBER OF CALMS UPPER LEVEL = 0

TABLE A-19

BRUNSWICK PLANT SITE INFORMATION TO BE USED
FOR GROUND LEVEL CALCULATIONS WITH NRC "XOQDOQ" PROGRAM

<u>Card Type</u>	<u>Columns</u>	<u>Description</u>	<u>Value to be Used in XOQDOQ</u>
1	1	Print Input Data	1
	38	Calculate Annual X/Qs for Points of Interest	1
	39	Calculate Annual X/Q Averages for Site Radial Segments	1
	41	Print Out Set Distance X/Qs and D/Qs	1
	55	Calculate Annual D/Q Averages for the Set Radial Segments	1
	56	Allow Depleted X/Qs (If Decays (1), (2), or (3) is Negative)	1
	58	Calculate Annual D/Qs for Points of Interest	1
2	1-80	Title Card	N/A
3	1-5	Number of Wind Velocity Categories	7
	6-10	Number of Stability Categories	7
	11-15	Number of Distances within Terrain Data for Each Sector	1
	16-20	Total Number of Hours in Joint Wind Frequency Distribution	(1)
	21-25	Increment in % for which Plotted Results are to be Printed	5
	25-30	Number of Titles of Receptor Types	
	31-35	Number of Release Exit Locations	1
4	1-5	Height of the Measured Wind	11
	6-20	Half-Life (days) Used in the X/Q Calculations	101.00 2.26 -8.00
5	N/A	N/A	---
6	1-80	Joint Wind Frequency Distribution	(1)

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TABLE A-19 (continued)

<u>Card Type</u>	<u>Columns</u>	<u>Description</u>	<u>Value to be Used in XOQDOQ</u>
7	1-5 6-75	Wind Velocity Units Correction Maximum Wind Speed in Each Wind Class (m/sec)	200.
			0.75
			3.50
			7.50
			12.50
			18.50
			25.00
			26.00
8	1-80	Distance in Meters at Which Terrain Heights are Given	All Are 100
9	1-80	Terrain Heights (In Meters, Above Plant Grade) Correspond to Distances in Card Type 8	All Are 0
10	1-25	Number of Receptor Locations for a Particular Receptor Type	Site Boundary = 16 Dairy = 1 Meat = 5 Residence = 14 Garden = 11
11	1-16	Title of Receptor Type for Receptor Locations	Site Boundary Dairy Meat Residence Garden
12	1-80	Receptor Direction and Distance	(See Table 1)
13	1-80	Title for Release Point Whose Characteristics are Described on Card Type 14	(1)
14	1-5	Vent Average Velocity (m/sec)	1.0
	6-10	Vent Inside Diameter (m)	1.0
	11-15	Height of Vent Release Point (m)	0.000
	16-20	Height of the Vent's Building (m)	56.9
	21-25	Minimum Cross-Sectional Area for the Vent's Building (m ²)	2120.0
	26-30	Wind Height Used for Vent Elevated Release	11.
	31-35	Vent Heat Emission Rate (cal/sec)	0.

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TABLE A-19 (continued)

<u>Card Type</u>	<u>Columns</u>	<u>Description</u>	<u>Value to be Used in XOQDOQ</u>
15	1	Identification for Release Point	A
	2-5	Intermittent Releases	0
	6-10	Number of Intermittent Releases Per Year for this Release Point	0
	11-15	Average Number of Hours Per Intermittent Release	0

(1) Appropriate Data to be Supplied

TABLE A-20

BRUNSWICK PLANT SITE INFORMATION TO BE USED
FOR ELEVATED RELEASE CALCULATIONS WITH NRC "XOQDOQ" PROGRAM

<u>Card Type</u>	<u>Columns</u>	<u>Description</u>	<u>Value to be Used in XOQDOQ</u>
1	1	Print Input Data	1
	4	Release to be Elevated 100% of the Time	1
	38	Calculate Annual X/Qs for Points of Interest	1
	39	Calculate Annual X/Q Averages for Site Radial Segments	1
	41	Print Out Set Distance X/Qs and D/Qs	1
	55	Calculate Annual D/Q Averages for the Set Radial Segments	1
	56	Allow Depleted X/Qs (If Decays (1), (2), or (3) is Negative)	1
	58	Calculate Annual D/Qs for Points of Interest	1
2	1-80	Title Card	N/A
3	1-5	Number of Wind Velocity Categories	7
	6-10	Number of Stability Categories	7
	11-15	Number of Distances Within Terrain Data for Each Sector	1
	16-20	Total Number of Hours in Joint Wind Frequency Distribution	(1)
	21-25	Increment in % for which Plotted Results are to be Printed	5
	26-30	Number of Titles of Receptor Types	5
	31-35	Number of Release Exit Locations	1
4	1-5	Height of the Measured Wind	104
	6-20	Half-Life (days) Used in the X/Q Calculations	101.00
			2.26
			-8.00
5	N/A	N/A	-1-
6	1-80	Joint Wind Frequency Distribution	(1)

TABLE A-20 (continued)

<u>Card Type</u>	<u>Columns</u>	<u>Description</u>	<u>Value to be Used in XOQDOQ</u>
7	1-5	Wind Velocity Units Correction	200.
	6-75	Maximum Wind Speed in Each Wind Class (m/sec)	0.75
			3.50
			7.50
			12.50
			18.50
			25.00
			26.00
8	1-80	Distance in Meters at which Terrain Heights are Given	All Are 100
9	1-80	Terrain Heights (In Meters, Above Plant Grade) Corresponding to Distances in Card Type 8	All Are 0
10	1-25	Number of Receptor Locations for a Particular Receptor Type	Site Boundary = 16 Dairy = 1 Meat = 5 Residence = 14 Garden = 11
11	1-16	Title of Receptor Type for Receptor Locations	Site Boundary Dairy Meat Residence Garden
12	1-80	Receptor Direction and Distance	(See Table 1)
13	1-80	Title for Release Point Whose Characteristics are Described on Card Type 14	(1)
14	1-5	Vent Average Velocity (m/sec)	4.66
	6-10	Vent Inside Diameter (m)	3.58
	11-15	Height of Vent Release Point (m)	100.9
	16-20	Height of Vent's Building (m)	0.0
	21-25	Minimum Cross-Sectional Area for the Vent's Building (m ²)	0.0
	26-30	Wind Height Used for Vent Elevated Release	104.0
	31-35	Vent Heat Emission Rate (cal/sec)	0.

TABLE A-20 (continued)

<u>Card Type</u>	<u>Columns</u>	<u>Description</u>	<u>Value to be Used in XOQDOQ</u>
15	1	Identification for Release Point	A
	2-5	Intermittent Releases	0
	6-10	Number of Intermittent Releases Per Year for this Release Point	0
	11-15	Average Number of Hours Per Intermittent Release	0

(1) Appropriate Data to be Supplied

APPENDIX B

Calculation of V_i and B_i Values for the Elevated Plume

Values of V_i and B_i were calculated for the elevated plume release from the Brunswick stack using the NRC computer program RABFIN. This program was used to determine the controlling location based upon the releases of Table 3.2-1. In addition it was used to develop the V_i and B_i values for the various noble gas radionuclides at the site boundary at each of the 16 sectors. Table B-1 presents the V_i and B_i values for the ENE sector which is the controlling location for noble gases for showing compliance with 10 CFR 20 and 10 CFR 50. Table B-2 presents the joint frequency distribution for the ENE sector. Tables B-3 through B-32 present the V_i and B_i values and the joint frequency distribution for the remaining sectors. The inputs which were utilized in the RABFIN code are presented below.

1. Height of Stack - 100.9(m)
2. Stack Diameter - 3.6(m)
3. Exit Velocity - 5.0 m/sec
4. Wind Height - 104.6 (m)

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TABLE B-1

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
ENE SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}} \right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}} \right)$
Kr-83m	1.66E-09	1.40E-07
Kr-85m	9.18E-05	1.36E-04
Kr-85	1.36E-06	2.06E-06
Kr-87	4.17E-04	6.27E-04
Kr-88	1.08E-03	1.62E-03
Kr-89	6.55E-04	9.84E-04
Xe-131m	2.17E-05	3.41E-05
Xe-133m	1.64E-05	2.66E-05
Xe-133	1.72E-05	2.67E-05
Xe-135m	2.17E-04	3.29E-04
Xe-135	1.47E-04	2.21E-04
Xe-137	5.64E-05	8.52E-05
Xe-138	6.61E-04	9.93E-04
Xe-139	2.03E-05	3.05E-05
Ar-41	7.86E-04	1.18E-03

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-2

Joint Frequency Distribution for ENE Sector (%)
 Period 1-1-77 through 12-31-77
 Brunswick Steam Electric Plant

<u>Stability</u>	<u>MAXIMUM WIND SPEED (m/sec)</u>						
	<u>Total</u>	<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.17	0.00	0.01	0.01	0.07	0.03	0.05
4	3.30	0.02	0.17	0.61	1.21	0.83	0.46
5	4.81	0.02	0.18	0.81	1.63	1.39	0.78
6	1.14	0.05	0.20	0.28	0.27	0.14	0.20
7	0.46	0.01	0.12	0.15	0.09	0.09	0.00
Total	9.88	0.10	0.68	1.86	3.27	2.48	1.49
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

<u>AVERAGE WIND SPEED (m/sec)</u>			
<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	6.75	6.75
Harmonic	0.00	5.27	5.27

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TABLE B-3

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
N SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	8.98E-10	1.11E-07
Kr-85m	4.57E-05	6.79E-05
Kr-85	6.76E-07	1.02E-06
Kr-87	2.06E-04	3.10E-04
Kr-88	5.41E-04	8.11E-04
Kr-89	2.89E-04	4.34E-04
Xe-131m	1.09E-05	1.72E-05
Xe-133m	8.26E-06	1.35E-05
Xe-133	8.69E-06	1.36E-05
Xe-135m	1.04E-04	1.57E-04
Xe-135	7.32E-05	1.10E-04
Xe-137	2.40E-05	3.63E-05
Xe-138	3.26E-04	4.89E-04
Xe-139	6.87E-06	1.03E-05
Ar-41	3.89E-04	5.84E-04

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

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TABLE B-4

Joint Frequency Distribution for N Sector (%)
 Period 1-1-77 through 12-31-77
 Brunswick Steam Electric Plant

<u>Stability</u>	<u>MAXIMUM WIND SPEED (m/sec)</u>						
	<u>Total</u>	<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.01	0.00	0.00	0.00	0.01	0.00	0.00
3	0.11	0.00	0.00	0.01	0.07	0.03	0.00
4	1.79	0.01	0.16	0.70	0.65	0.18	0.09
5	2.00	0.00	0.15	0.46	0.65	0.29	0.45
6	0.68	0.02	0.06	0.29	0.12	0.07	0.12
7	0.15	0.02	0.10	0.01	0.00	0.01	0.01
Total	4.74	0.05	0.47	1.47	1.50	0.58	0.67
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

<u>AVERAGE WIND SPEED (m/sec)</u>			
<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	6.00	6.00
Harmonic	0.00	4.61	4.61

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TABLE B-5
DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
NNE SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.78E-09	3.33E-07
Kr-85m	7.77E-05	1.15E-04
Kr-85	1.13E-06	1.71E-06
Kr-87	3.45E-04	5.19E-04
Kr-88	8.91E-04	1.34E-03
Kr-89	5.42E-04	8.15E-04
Xe-131m	1.89E-05	3.00E-05
Xe-133m	1.42E-05	2.36E-05
Xe-133	1.52E-05	2.40E-05
Xe-135m	1.80E-04	2.73E-04
Xe-135	1.23E-04	1.86E-04
Xe-137	4.70E-05	7.11E-05
Xe-138	5.47E-04	8.22E-04
Xe-139	1.68E-05	2.52E-05
Ar-41	6.49E-04	9.74E-04

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents

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TABLE B-6

Joint Frequency Distribution for the NNE Sector (%)
 Period 1-1-77 through 12-31-77
 Brunswick Steam Electric Plant

<u>Stability</u>	<u>Total</u>	<u>MAXIMUM WIND SPEED (m/sec)</u>					
		<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.07	0.00	0.00	0.01	0.05	0.01	0.00
3	0.45	0.00	0.00	0.03	0.25	0.15	0.02
4	4.51	0.01	0.16	0.56	1.79	1.38	0.61
5	2.90	0.00	0.17	0.21	0.88	0.78	0.86
6	0.65	0.02	0.12	0.22	0.09	0.07	0.13
7	0.45	0.05	0.14	0.08	0.07	0.10	0.01
<hr/>							
Total	9.03	0.08	0.59	1.11	3.13	2.49	1.63
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	7.13	7.13
Harmonic	0.00	5.63	5.63

TABLE B-7
DOSE PARAMETERS FOR FINITE ELEVATED PLUMES
NE SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}} \right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}} \right)$
Kr-83m	2.87E-09	8.70E-07
Kr-85m	9.33E-05	1.39E-04
Kr-85	1.31E-06	1.99E-06
Kr-87	3.99E-04	6.00E-04
Kr-88	1.03E-03	1.54E-03
Kr-89	6.05E-04	9.10E-04
Xe-131m	2.37E-05	3.85E-05
Xe-133m	1.79E-05	3.05E-05
Xe-133	1.96E-05	3.15E-05
Xe-135m	2.09E-04	3.18E-04
Xe-135	1.46E-04	2.20E-04
Xe-137	5.25E-05	7.94E-05
Xe-138	6.34E-04	9.52E-04
Xe-139	1.48E-05	2.23E-05
Ar-41	7.47E-04	1.12E-03

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

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TABLE B-8

Joint Frequency Distribution for NE Sector (%)

Period 1-1-77 through 12-31-77

Brunswick Steam Electric Plant

<u>Stability</u>	<u>Total</u>	<u>MAXIMUM WIND SPEED (m/sec)</u>					
		<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.02	0.00	0.00	0.00	0.01	0.00	0.01
2	0.21	0.00	0.00	0.00	0.05	0.10	0.06
3	1.13	0.00	0.00	0.03	0.28	0.50	0.32
4	7.30	0.01	0.15	0.63	2.50	2.51	1.50
5	5.15	0.03	0.09	0.30	1.21	1.99	1.53
6	1.04	0.01	0.06	0.32	0.33	0.24	0.08
7	0.41	0.01	0.12	0.10	0.13	0.03	0.02
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Total	15.26	0.06	0.42	1.38	4.51	5.37	3.52
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	7.81	7.81
Harmonic	0.00	6.63	6.63

1208 207

TABLE B-9

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES

E SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}} \right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}} \right)$
Kr-83m	9.63E-10	7.31E-08
Kr-85m	5.94E-05	8.82E-05
Kr-85	8.93E-07	1.35E-06
Kr-87	2.73E-04	4.11E-04
Kr-88	7.17E-04	1.08E-03
Kr-89	4.02E-04	6.04E-04
Xe-131m	1.39E-05	2.17E-05
Xe-133m	1.05E-05	1.70E-05
Xe-133	1.09E-05	1.69E-05
Xe-135m	1.38E-04	2.10E-04
Xe-135	9.59E-05	1.44E-04
Xe-137	3.37E-05	5.10E-05
Xe-138	4.32E-04	6.49E-04
Xe-139	1.08E-05	1.62E-05
Ar-41	5.18E-04	7.77E-04

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TAB E B-10

Joint Frequency Distribution for E Sector (%)

Period 1-1-77 through 12-31-77

Brunswick Steam Electric Plant

<u>Stability</u>	<u>Total</u>	MAXIMUM WIND SPEED (m/sec)					
		<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.01	0.00	0.00	0.00	0.00	0.01	0.00
2	0.03	0.00	0.00	0.00	0.01	0.01	0.01
3	0.09	0.00	0.00	0.03	0.02	0.01	0.03
4	1.42	0.01	0.15	0.55	0.32	0.23	0.16
5	2.07	0.03	0.10	0.62	0.74	0.50	0.08
6	1.08	0.02	0.14	0.30	0.38	0.15	0.09
7	0.64	0.03	0.13	0.24	0.10	0.08	0.06
Total	5.34	0.09	0.52	1.74	1.57	0.99	0.43
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	5.80	5.80
Harmonic	0.00	4.41	4.41

TABLE B-11

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES

ESE SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.08E-09	1.89E-07
Kr-85m	5.51E-05	8.18E-05
Kr-85	8.12E-07	1.23E-06
Kr-87	2.51E-04	3.78E-04
Kr-88	6.42E-04	9.63E-04
Kr-89	4.30E-04	6.46E-04
Xe-131m	1.31E-05	2.07E-05
Xe-133m	9.91E-06	1.62E-05
Xe-133	1.04E-05	1.63E-05
Xe-135m	1.34E-04	2.04E-04
Xe-135	8.81E-05	1.32E-04
Xe-137	3.79E-05	5.73E-05
Xe-138	3.99E-04	5.99E-04
Xe-139	1.70E-05	2.55E-05
Ar-41	4.73E-04	7.09E-04

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

1208 210

TABLE B-12

Joint Frequency Distribution for ESE Sector (%)
 Period 1-1-77 through 12-31-77
 Brunswick Steam Electric Plant

<u>Stability</u>	<u>Total</u>	MAXIMUM WIND SPEED (m/sec)					
		<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.06	0.00	0.00	0.01	0.00	0.05	0.00
2	0.15	0.00	0.00	0.01	0.03	0.06	0.05
3	0.31	0.00	0.00	0.02	0.13	0.03	0.13
4	1.71	0.00	0.07	0.31	0.58	0.46	0.29
5	2.02	0.01	0.08	0.31	0.52	0.80	0.30
6	0.85	0.03	0.06	0.17	0.18	0.36	0.05
7	0.46	0.01	0.07	0.12	0.07	0.07	0.12
Total	5.56	0.05	0.28	0.95	1.51	1.83	0.94
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	7.15	7.15
Harmonic	0.00	5.67	5.67

1208 211

TABLE B-13

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES

SE SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}} \right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}} \right)$
Kr-83m	1.36E-09	3.68E-07
Kr-85m	6.01E-05	8.93E-05
Kr-85	8.80E-07	1.33E-06
Kr-87	2.72E-04	4.10E-04
Kr-88	6.95E-04	1.04E-03
Kr-89	4.68E-04	7.04E-04
Xe-131m	1.45E-05	2.31E-05
Xe-133m	1.10E-05	1.82E-05
Xe-133	1.16E-05	1.83E-05
Xe-135m	1.46E-04	2.22E-04
Xe-135	9.58E-05	1.44E-04
Xe-137	4.14E-05	6.26E-05
Xe-138	4.33E-04	6.50E-04
Xe-139	1.87E-05	2.81E-05
Ar-41	5.12E-04	7.68E-04

* The listed dose parameters are for radionuclides
that may be detected in gaseous effluents.

1208 212

TABLE B-14

Joint Frequency Distribution for SE Sector (%)

Period 1-1-77 through 12-31-77

Brunswick Steam Electric Plant

<u>Stability</u>	<u>Total</u>	MAXIMUM WIND SPEED (m/sec)					
		<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.11	0.00	0.00	0.00	0.00	0.06	0.05
2	0.31	0.00	0.00	0.01	0.14	0.15	0.01
3	0.53	0.00	0.00	0.14	0.18	0.18	0.03
4	1.44	0.02	0.08	0.25	0.51	0.41	0.17
5	1.46	0.01	0.09	0.31	0.50	0.46	0.09
6	0.89	0.02	0.05	0.02	0.30	0.44	0.06
7	0.63	0.01	0.13	0.09	0.14	0.21	0.05
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Total	5.37	0.06	0.35	0.82	1.77	1.91	0.46
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	6.78	6.78
Harmonic	0.00	5.37	5.37

1208 213

TABLE B-15

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES

SSE SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.31E-09	2.51E-07
Kr-85m	6.46E-05	9.59E-05
Kr-85	9.55E-07	1.45E-06
Kr-87	2.96E-04	4.45E-04
Kr-88	7.58E-04	1.14E-03
Kr-89	5.11E-04	7.69E-04
Xe-131m	1.54E-05	2.43E-05
Xe-133m	1.17E-05	1.91E-05
Xe-133	1.22E-05	1.91E-05
Xe-135m	1.58E-04	2.39E-04
Xe-135	1.03E-04	1.55E-04
Xe-137	4.52E-05	6.83E-05
Xe-138	4.70E-04	7.06E-04
Xe-139	2.17E-05	3.26E-05
Ar-41	5.58E-04	8.37E-04

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

1208 214

TABLE B-16

Joint Frequency Distribution for SSE Sector (%)

Period 1-1-77 through 12-31-77

Brunswick Steam Electric Plant

<u>Stability</u>	<u>Total</u>	MAXIMUM WIND SPEED (m/sec)					
		<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.02	0.00	0.00	0.00	0.01	0.01	0.00
2	0.13	0.00	0.00	0.02	0.02	0.09	0.00
3	0.49	0.00	0.00	0.14	0.24	0.09	0.02
4	2.35	0.05	0.16	0.32	0.80	0.70	0.32
5	1.40	0.00	0.08	0.23	0.46	0.58	0.05
6	0.84	0.02	0.05	0.13	0.18	0.31	0.15
7	0.32	0.03	0.02	0.05	0.07	0.13	0.02
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Total	5.55	0.10	0.31	0.89	1.78	1.91	0.56
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	6.81	6.81
Harmonic	0.00	5.21	5.21

1208 215

TABLE B-17

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES

S SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}} \right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}} \right)$
Kr-83m	8.30E-10	1.84E-07
Kr-85m	3.54E-05	5.26E-05
Kr-85	5.20E-07	7.88E-07
Kr-87	1.54E-04	2.32E-04
Kr-88	4.18E-04	6.27E-04
Kr-89	2.00E-04	3.00E-04
Xe-131m	8.70E-06	1.39E-05
Xe-133m	6.58E-06	1.09E-05
Xe-133	7.01E-06	1.11E-05
Xe-135m	7.40E-05	1.12E-04
Xe-135	5.66E-05	8.51E-05
Xe-137	1.64E-05	2.48E-05
Xe-138	2.42E-04	3.63E-04
Xe-139	4.28E-06	6.43E-06
Ar-41	2.93E-04	4.40E-04

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

1208 216

TABLE B-18

Joint Frequency Distribution for S Sector (%)

Period 1-1-77 through 12-31-77

Brunswick Steam Electric Plant

<u>Stability</u>	<u>Total</u>	MAXIMUM WIND SPEED (m/sec)					
		<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.03	0.00	0.00	0.00	0.03	0.00	0.00
3	0.16	0.00	0.00	0.02	0.14	0.00	0.00
4	1.74	0.01	0.13	0.28	0.55	0.54	0.23
5	1.32	0.03	0.08	0.25	0.45	0.46	0.05
6	0.93	0.02	0.08	0.17	0.24	0.33	0.09
7	0.37	0.05	0.03	0.05	0.12	0.07	0.05
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Total	4.55	0.11	0.32	0.77	1.53	1.40	0.42
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	6.57	6.57
Harmonic	0.00	4.84	4.84

1208 217

TABLE B-19

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES

SSW SITE BOUNDARY*

	V_i	B_i
	Total Body	Gamma Air
	$\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	$\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
<u>Noble Gas Radionuclides</u>		
Kr-83m	1.09E-09	2.15E-07
Kr-85m	4.68E-05	6.95E-05
Kr-85	6.80E-07	1.03E-06
Kr-87	2.07E-04	3.11E-04
Kr-88	5.39E-04	8.09E-04
Kr-89	2.98E-04	4.48E-04
Xe-131m	1.14E-05	1.82E-05
Xe-133m	8.63E-06	1.43E-05
Xe-133	9.22E-06	1.46E-05
Xe-135m	1.06E-04	1.61E-04
Xe-135	7.44E-05	1.12E-04
Xe-137	2.52E-05	3.81E-05
Xe-138	3.28E-04	4.92E-04
Xe-139	6.80E-06	1.02E-05
Ar-41	3.89E-04	5.84E-04

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

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TABLE B-20

Joint Frequency Distribution for SSW Sector (%)

Period 1-1-77 through 12-31-77

Brunswick Steam Electric Plant

<u>Stability</u>	MAXIMUM WIND SPEED (m/sec)						
	<u>Total</u>	<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.19	0.00	0.00	0.07	0.05	0.06	0.01
4	2.47	0.01	0.03	0.53	0.99	0.62	0.29
5	1.88	0.01	0.15	0.37	0.56	0.74	0.05
6	1.12	0.01	0.12	0.14	0.28	0.55	0.02
7	0.51	0.01	0.03	0.10	0.22	0.13	0.02
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Total	6.17	0.04	0.33	1.21	2.10	2.10	0.39
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	6.61	6.61
Harmonic	0.00	5.44	5.44

1208 217

TABLE B-21

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES

SW SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}} \right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}} \right)$
Kr-83m	1.35E-09	3.69E-07
Kr-85m	5.24E-05	7.79E-05
Kr-85	7.60E-07	1.15E-06
Kr-87	2.29E-04	3.45E-04
Kr-88	6.04E-04	9.06E-04
Kr-89	3.21E-04	4.82E-04
Xe-131m	1.30E-05	2.08E-05
Xe-133m	9.83E-06	1.64E-05
Xe-133	1.05E-05	1.67E-05
Xe-135m	1.15E-04	1.75E-04
Xe-135	8.33E-05	1.25E-04
Xe-137	2.69E-05	4.07E-05
Xe-138	3.63E-04	5.45E-04
Xe-139	7.09E-06	1.07E-05
Ar-41	4.33E-04	6.50E-04

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

1208 220

TABLE B-22

Joint Frequency Distribution for SW Sector (%)

Period 1-1-77 through 12-31-77

Brunswick Steam Electric Plant

<u>Stability</u>	<u>Total</u>	MAXIMUM WIND SPEED (m/sec)					
		<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.01	0.00	0.00	0.00	0.00	0.01	0.00
2	0.10	0.00	0.00	0.02	0.07	0.01	0.00
3	0.53	0.00	0.02	0.10	0.30	0.09	0.02
4	2.32	0.01	0.14	0.50	0.98	0.52	0.17
5	1.71	0.02	0.09	0.39	0.40	0.68	0.13
6	0.88	0.05	0.05	0.20	0.46	0.12	0.00
7	0.56	0.00	0.07	0.15	0.22	0.12	0.00
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Total	6.11	0.08	0.37	1.36	2.43	1.55	0.32
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	6.22	6.22
Harmonic	0.00	4.98	4.98

1208 221

TABLE B-23

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES

WSW SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	1.41E-09	3.28E-07
Kr-85m	5.94E-05	8.83E-05
Kr-85	8.66E-07	1.31E-06
Kr-87	2.63E-04	3.97E-04
Kr-88	6.87E-04	1.03E-03
Kr-89	3.90E-04	5.87E-04
Xe-131m	1.45E-05	2.32E-05
Xe-133m	1.10E-05	1.83E-05
Xe-133	1.17E-05	1.85E-05
Xe-135m	1.35E-04	2.05E-04
Xe-135	9.46E-05	1.42E-04
Xe-137	3.32E-05	5.03E-05
Xe-138	4.18E-04	6.27E-04
Xe-139	9.43E-06	1.42E-05
Ar-41	4.97E-04	7.45E-04

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

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TABLE B-24

Joint Frequency Distribution for WSW Sector (%)

Period 1-1-77 through 12-31-77

Brunswick Steam Electric Plant

<u>Stability</u>	<u>Total</u>	MAXIMUM WIND SPEED (m/sec)					
		<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.02	0.00	0.00	0.00	0.02	0.00	0.00
2	0.18	0.00	0.01	0.00	0.14	0.00	0.03
3	0.36	0.00	0.01	0.15	0.15	0.05	0.00
4	2.64	0.00	0.15	0.54	1.12	0.75	0.08
5	1.73	0.02	0.09	0.37	0.84	0.39	0.02
6	0.87	0.02	0.08	0.25	0.37	0.14	0.01
7	0.36	0.03	0.03	0.13	0.17	0.00	0.00
<hr/>							
Total	6.16	0.07	0.37	1.44	2.81	1.33	0.14
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	5.97	5.97
Harmonic	0.00	4.91	4.91

TABLE B-25

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES

W SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}} \right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}} \right)$
Kr-83m	1.36E-09	2.97E-07
Kr-85m	6.29E-05	9.34E-05
Kr-85	9.33E-07	1.41E-06
Kr-87	2.81E-04	4.23E-04
Kr-88	7.49E-04	1.12E-03
Kr-89	3.82E-04	5.73E-04
Xe-131m	1.52E-05	2.42E-05
Xe-133m	1.15E-05	1.90E-05
Xe-133	1.21E-05	1.91E-05
Xe-135m	1.38E-04	2.09E-04
Xe-135	1.01E-04	1.52E-04
Xe-137	3.16E-05	4.77E-05
Xe-138	4.42E-04	6.64E-04
Xe-139	8.1E-06	1.23E-05
Ar-41	5.33E-04	8.00E-04

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

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TABLE B-26

Joint Frequency Distribution for W Sector (%)

Period 1-1-77 through 12-31-77

Brunswick Steam Electric Plant

<u>Stability</u>	<u>Total</u>	MAXIMUM WIND SPEED (m/sec)					
		<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.05	0.00	0.00	0.00	0.05	0.00	0.00
2	0.10	0.00	0.00	0.00	0.10	0.00	0.00
3	0.37	0.00	0.05	0.18	0.12	0.02	0.00
4	1.95	0.02	0.10	0.47	1.07	0.29	0.00
5	2.00	0.01	0.14	0.53	1.07	0.22	0.03
6	0.85	0.07	0.10	0.29	0.36	0.01	0.02
7	0.37	0.06	0.08	0.18	0.05	0.00	0.00
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Total	5.69	0.16	0.47	1.65	2.82	0.54	0.05
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	5.30	5.30
Harmonic	0.00	4.13	4.13

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TABLE B-27

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES

WNW SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}} \right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}} \right)$
Kr-83m	9.35E-10	2.26E-07
Kr-85m	4.30E-05	6.39E-05
Kr-85	6.41E-07	9.71E-07
Kr-87	1.92E-04	2.89E-04
Kr-88	5.18E-04	7.77E-04
Kr-89	2.41E-04	3.62E-04
Xe-131m	1.04E-05	1.66E-05
Xe-133m	7.92E-06	1.31E-05
Xe-133	8.31E-06	1.31E-05
Xe-135m	9.15E-05	1.39E-04
Xe-135	6.91E-05	1.04E-04
Xe-137	1.93E-05	2.92E-05
Xe-138	3.01E-04	4.53E-04
Xe-139	4.51E-06	6.77E-06
Ar-41	3.65E-04	5.48E-04

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

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TABLE B-28

Joint Frequency Distribution for WINW Sector (%)

Period 1-1-77 through 12-31-77

Brunswick Steam Electric Plant

<u>Stability</u>	<u>Total</u>	MAXIMUM WIND SPEED (m/sec)					
		<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.01	0.00	0.00	0.01	0.00	0.00	0.00
2	0.09	0.00	0.00	0.08	0.01	0.00	0.00
3	0.24	0.00	0.05	0.17	0.02	0.00	0.00
4	1.03	0.01	0.10	0.45	0.45	0.02	0.00
5	1.19	0.03	0.14	0.37	0.50	0.13	0.02
6	0.63	0.05	0.12	0.28	0.17	0.01	0.00
7	0.19	0.03	0.03	0.07	0.06	0.00	0.00
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Total	3.38	0.12	0.44	1.43	1.21	0.16	0.02
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	4.65	4.65
Harmonic	0.00	3.58	3.58

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TABLE B-29

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES

NW SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}}\right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}}\right)$
Kr-83m	9.87E-10	2.60E-07
Kr-85m	4.14E-05	6.14E-05
Kr-85	6.09E-07	9.23E-07
Kr-87	1.80E-04	2.72E-04
Kr-88	4.92E-04	7.38E-04
Kr-89	2.11E-04	3.17E-04
Xe-131m	1.02E-05	1.63E-05
Xe-133m	7.73E-06	1.28E-05
Xe-133	8.20E-06	1.30E-05
Xe-135m	8.45E-05	1.28E-04
Xe-135	6.62E-05	9.95E-05
Xe-137	1.65E-05	2.49E-05
Xe-138	2.83E-04	4.25E-04
Xe-139	3.74E-06	5.61E-06
Ar-41	3.43E-04	5.15E-04

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

TABLE B-30

Joint Frequency Distribution for NW Sector (%)

Period 1-1-77 through 12-31-77

Brunswick Steam Electric Plant

<u>Stability</u>	<u>Total</u>	MAXIMUM WIND SPEED (m/sec)					
		<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.01	0.00	0.00	0.01	0.00	0.00	0.00
2	0.12	0.00	0.01	0.08	0.03	0.00	0.00
3	0.24	0.00	0.02	0.17	0.05	0.00	0.00
4	1.14	0.01	0.16	0.54	0.33	0.09	0.01
5	1.08	0.02	0.12	0.40	0.28	0.10	0.16
6	0.57	0.05	0.17	0.17	0.16	0.01	0.01
7	0.35	0.03	0.07	0.12	0.13	0.00	0.00
Total	3.51	0.11	0.55	1.49	0.98	0.20	0.18
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	4.81	4.81
Harmonic	0.00	3.59	3.59

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TABLE B-31

DOSE PARAMETERS FOR FINITE ELEVATED PLUMES

NNW SITE BOUNDARY*

<u>Noble Gas Radionuclides</u>	V_i	B_i
	Total Body $\left(\frac{\text{mrem/yr}}{\mu\text{Ci/sec}} \right)$	Gamma Air $\left(\frac{\text{mrad/yr}}{\mu\text{Ci/sec}} \right)$
Kr-83m	6.84E-10	1.03E-07
Kr-85m	3.67E-05	5.44E-05
Kr-85	5.51E-07	8.35E-07
Kr-87	1.65E-04	2.48E-04
Kr-88	4.46E-04	6.70E-04
Kr-89	2.09E-04	3.14E-04
Xe-131m	8.75E-06	1.38E-05
Xe-133m	6.63E-06	1.08E-05
Xe-133	6.91E-06	1.08E-05
Xe-135m	7.85E-05	1.19E-04
Xe-135	5.91E-05	8.89E-05
Xe-137	1.68E-05	2.54E-05
Xe-138	2.59E-04	3.89E-04
Xe-139	4.89E-06	7.34E-06
Ar-41	3.14E-04	4.72E-04

* The listed dose parameters are for radionuclides that may be detected in gaseous effluents.

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TABLE B-32

Joint Frequency Distribution for NNW Sector (%)

Period 1-1-77 through 12-31-77

Brunswick Steam Electric Plant

<u>Stability</u>	<u>Total</u>	MAXIMUM WIND SPEED (m/sec)					
		<u>1.50</u>	<u>3.00</u>	<u>5.00</u>	<u>7.50</u>	<u>10.00</u>	<u>12.50</u>
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.02	0.00	0.00	0.01	0.01	0.00	0.00
3	0.12	0.00	0.00	0.06	0.06	0.00	0.00
4	1.00	0.01	0.14	0.36	0.37	0.09	0.03
5	1.17	0.02	0.12	0.27	0.15	0.12	0.39
6	0.82	0.02	0.13	0.23	0.17	0.03	0.24
7	0.34	0.05	0.10	0.14	0.00	0.05	0.00
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Total	3.47	0.10	0.49	1.07	0.86	0.29	0.00
Entrapment		0.00	0.00	0.00	0.00	0.00	0.00
Ground Velocity		0.23	0.70	1.24	1.93	2.71	3.48
Elevated Velocity		0.74	2.21	3.93	6.14	8.59	11.05

AVERAGE WIND SPEED (m/sec)

<u>Mean</u>	<u>Ground</u>	<u>Elevated</u>	<u>Combined</u>
Arithmetic	0.00	5.89	5.89
Harmonic	0.00	4.02	4.02

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APPENDIX C

DOSE PARAMETERS FOR RADIOIODINES, PARTICULATES AND TRITIUM

This appendix contains the methodology which was used to calculate the dose parameters for radioiodines, particulates, and tritium to show compliance with 10 CFR 20 and Appendix I of 10 CFR 50 for gaseous effluents. These dose parameters, P_i and R_i , were calculated using the methodology outlined in NUREG-0133 along with Regulatory Guide 1.109 Revision 1. The following sections provide the specific methodology which was utilized in calculating the P_i and R_i values for the various exposure pathways.

C.1 Calculation of P_i

The parameter, P_i , contained in the radioiodine and particulates portion of Section 3.2, includes pathway transport parameters of the i th radionuclide, the receptor's usage of the pathway media and the dosimetry of the exposure. Pathway usage rates and the internal dosimetry are functions of the receptor's age; however, the youngest age group, the infant, will always receive the maximum dose under the exposure conditions for Technical Specification 1.2.2.1(b). For the infant exposure, separate values of P_i may be calculated for the inhalation pathway which is combined with a W parameter based on (X/Q) , and the food (milk) and ground pathway which is combined with a W parameter normally based on (D/Q) , except for tritium. The following sections provide in detail the methodology which was used in calculating the P_i values for inclusion into this ODCM.

C.1.1 Inhalation Pathway

$$P_{iI} = K'(BR) DFA_i \quad (C.1-1)$$

where:

$$P_{iI} = \text{dose parameter for radionuclide } i \text{ for the inhalation pathway, mrem/yr per } \mu\text{Ci/m}^3;$$

K' = a constant of unit conversion:
 $= 10^6 \text{ pCi}/\mu\text{Ci};$

BR = the breathing rate of the infant age group, $\text{m}^3/\text{yr};$

DFA_i = the maximum organ inhalation dose factor for the infant age group for radionuclide i , $\text{mrem/pCi}.$

The age group considered is the infant group. The infant's breathing rate is taken as $1400 \text{ m}^3/\text{yr}$ from Table E-5 of Regulatory Guide 1.109 Revision 1. The inhalation dose factors for the infant, DFA_i , are presented in Table E-10 of Regulatory Guide 1.109 in units of mrem/pCi . The total body is considered as an organ in the selection of DFA_i .

The incorporation of breathing rate of an infant and the unit conversion factor results in the following:

$$P_{iI} = 1.4 \times 10^9 DFA_i \quad (\text{C.1-2})$$

C.1.2 Ground Plane Pathway

$$P_{iG} = K'K''DFG_i (1 - e^{-\lambda_i t})/\lambda_i \quad (\text{C.1-3})$$

where:

P_{iG} = dose parameter for radionuclide i for the ground plane pathway, $\text{mrem/yr per } \mu\text{Ci/sec per m}^{-2};$

K' = a constant of unit conversion:
 $= 10^6 \text{ pCi}/\mu\text{Ci};$

K'' = a constant of unit conversion;
 $= 8760 \text{ hr/yr};$

λ_i = the radiological decay constant for radionuclide i , $\text{sec}^{-1};$

t = the exposure period;
 $= 3.15 \times 10^7$ sec (1 year);

DFG_i = the ground plane dose conversion factor for radionuclide i ,
 mrem/hr per pCi/m².

The deposition rate onto the ground plane results in a ground plane concentration that is assumed to persist over a year with radiological decay the only operating removal mechanism for each radionuclide. The ground plane dose conversion factors for radionuclide i , DFG_i , are presented in Table E-6 of Regulatory Guide 1.109 Revision 1.

Resolution of the units yields:

$$P_{iG} = 8.76 \times 10^9 DFG_i (1 - e^{-\lambda_i t}) / \lambda_i \quad (C.1-4)$$

C.1.3 Milk

$$P_{iM} = \frac{K' Q_F (U_{ap}) F_{in}}{Y_p (\lambda_i + \lambda_w)} - DFL_i e^{-\lambda_i t_f} \quad (C.1-5)$$

where:

P_{iM} = dose parameter for radionuclide i for the cow milk or goat milk pathway, mrem/yr per μ Ci/sec per m⁻²;

K' = a constant of unit conversion;
 $= 10^6$ pCi/ μ Ci

Q_F = the cow's or goat's consumption rate of feed, kg/day (wet weight);

U_{ap} = the infant's milk consumption rate, liters/yr;

Y_p = the agricultural productivity by unit area, kg/m²;

- F_m = the stable element transfer coefficient, pCi/liter per pCi/day;
 r = fraction of deposited activity retained on cow's or goat's feed grass;
 DFL_i = the maximum organ ingestion dose factor for radionuclide i , mrem/pCi;
 λ_i = the radiological decay constant for radionuclide i , sec^{-1} ;
 w = the decay constant for removal of activity on leaf and plant surfaces by weathering, sec^{-1} ;
 = $5.73 \times 10^{-7} \text{ sec}^{-1}$ (corresponding to a 14 day half-time);
 t_f = the transport time from pasture to cow or goat to milk to infant, sec.

A fraction of the airborne deposition is captured by the ground plant vegetation cover. The captured material is removed from the vegetation (grass) by both radiological decay and weathering processes.

Various parameters which were utilized to determine the P_i values for the cow and goat milk pathways are provided in Table C-1. Table E-1 of Regulatory Guide 1.109 Revision 1 provides the stable element transfer coefficients, F_m , and Table E-14 of the same regulatory guide provides the ingestion dose factors, DFL_i , for the infant's organs. The organ with the maximum value of DFL_i was used in the determination of P_i for this pathway. The incorporation of the various constants of Table C-1 into Equation C.1-5 results in the following:

For cow's milk for radioiodines and particulates:

$$P_{iM} = 2.4 \times 10^{10} \frac{r F_m}{\lambda_i + \lambda_w} DFL_i e^{-\lambda_i t_f} \quad (C.1-6)$$

For the goat milk pathway for radioiodines and particulates:

$$P_{iM} = 2.8 \times 10^9 \frac{rF_m}{\lambda_i + \lambda_w} DFL_i e^{-\lambda_i t_f} \quad (C.1-7)$$

For tritium, the concentration of tritium in milk is based on its airborne concentration rather than the deposition rate.

$$P_{TM} = K'K'''F_m Q_F U_{ap} DFL_T 0.75(0.5/H) \quad (C.1-8)$$

where:

P_{TM} = dose parameter for tritium for the cow milk and goat milk pathways, mrem/yr per $\mu\text{Ci}/\text{m}^3$;

K''' = a constant of unit conversion;
 $= 10^3 \text{ gm/kg}$;

H = absolute humidity of the atmosphere, gm/m^3 ;

0.75 = the fraction of total feed that is water;

0.5 = the ratio of the specific activity of the feed grass water to the atmospheric water;

DFL_T = maximum organ ingestion dose factor for tritium, mrem/pCi.

C.2 Calculation of R_i

The radioiodine and particulate Technical Specification 2.3.1.2 is applicable to the location in the unrestricted area where the combination of existing pathways and receptor age groups indicates the maximum potential exposure occurs. The inhalation and ground plane exposure pathways shall be considered to exist at all locations. The grass-goat-milk, the grass-cow-milk, grass-cow-meat, and vegetation pathways are considered based on their existence at the various locations. R_i values have been calculated for the adult, teen, child, and infant age groups for the ground

plane, cow milk, goat milk, vegetable and beef ingestion pathways. The methodology which was utilized to calculate these values is presented below.

C.2.1 Inhalation Pathway

$$R_{i1} = K' (BR)_a (DFA_{i1})_a \quad (C.2-1)$$

where:

R_{i1} = dose factor for each identified radionuclide i of the organ of interest, mrem/yr per $\mu\text{Ci}/\text{m}^3$;

K' = a constant of unit conversion;
 $= 10^6 \text{ pCi}/\mu\text{Ci}$;

$(BR)_a$ = breathing rate of the receptor of age group a , m^3/yr ;

$(DFA_{i1})_a$ = organ inhalation dose factor for radionuclide i for the receptor of age group a , mrem/pCi.

The breathing rates $(BR)_a$ for the various age groups are tabulated below, as given in Table E-5 of the Regulatory Guide 1.109 Revision 1.

<u>Age Group (a)</u>	<u>Breathing Rate (m^3/yr)</u>
Infant	1400
Child	3700
Teen	8000
Adult	8000

Inhalation dose factors $(DFA_{i1})_a$ for the various age groups are given in Tables E-7 through E-10 of Regulatory Guide 1.109 Revision 1.

C.2.2 Ground Plane Pathway

$$R_{iG} = I_i K' K'' (SF) DFG_i (1 - e^{-\lambda_i t}) / \lambda_i \quad (C.2-2)$$

where:

R_{iG} = dose factor for the ground plane pathway for each identified radionuclide i for the organ of interest, mrem/yr per $\mu\text{Ci}/\text{sec}$ per m^{-2} ;

K' = a constant of unit conversion;
 $= 10^6 \text{ pCi}/\mu\text{Ci}$;

K'' = a constant of unit conversion;
 $= 8760 \text{ hr/year}$;

λ_i = the radiological decay constant for radionuclide i , sec^{-1} ;

t = the exposure time, sec;
 $= 4.73 \times 10^8 \text{ sec (15 years)}$;

DFG_i = the ground plane dose conversion factor for radionuclide i ;
 $\text{mrem/hr per pCi}/\text{m}^2$;

SF = the shielding factor (dimensionless);

I_i = factor to account for fractional deposition of radionuclide i .

For radionuclides other than iodine, the factor I_i is equal to one. For radiiodines, the value of I_i may vary. However, a value of 1.0 was used in calculating the R values in Table 3.3-2.

A shielding factor of 0.7 is suggested in Table E-15 of Regulatory Guide 1.109 Revision 1. A tabulation of DFG_i values is presented in Table E-6 of Regulatory Guide 1.109 Revision 1.

C.2.3 Grass-Cow or Goat-Milk Pathway

$$R_{iM} = I_i K' Q_F U_{ap} F_m (DFL_i)_a e^{-\lambda_i t_f} \left[f_p f_s \left[\frac{r(1-e^{-\lambda_{E_i} t_e})}{Y_p \lambda_{E_i}} + \frac{B_{iv} (1-e^{-\lambda_i t_b})}{P \lambda_i} \right] + (1-f_p f_s) \left[\frac{r(1-e^{-\lambda_{E_i} t_e})}{Y_s \lambda_{E_i}} + \frac{B_{iv} (1-e^{-\lambda_i t_b})}{P \lambda_i} \right] e^{-\lambda_i t_h} \right] \quad (C.2-3)$$

where:

- R_{iM} = dose factor for the cow milk or goat milk pathway, for each identified radionuclide i for the organ of interest, mrem/yr per $\mu\text{Ci}/\text{sec}$ per m^{-2} ;
- K' = a constant of unit conversion;
 $= 10^6 \text{ pCi}/\mu\text{Ci}$;
- Q_F = the cow's or goat's feed consumption rate, kg/day (wet weight);
- U_{ap} = the receptor's milk consumption rate for age group a , liters/yr;
- Y_p = the agricultural productivity by unit area of pasture feed grass, kg/m^2 ;
- Y_s = the agricultural productivity by unit area of stored feed, kg/m^2 ;
- F_m = the stable element transfer coefficients, pCi/liter per pCi/day;
- r = fraction of deposited activity retained on cow's feed grass;
- $(DFL_i)_a$ = the organ ingestion dose factor for radionuclide i for the receptor in age group a , mrem/pCi;

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$$\lambda_{E_i} = \lambda_i + \lambda_w;$$

$$\lambda_i = \text{the radiological decay constant for radionuclide } i, \text{ sec}^{-1};$$

$$\begin{aligned} \lambda_w &= \text{the decay constant for removal of activity on leaf and plant surfaces by weathering, sec}^{-1}; \\ &= 5.73 \times 10^{-7} \text{ sec}^{-1} \text{ (corresponding to a 14 day half-life);} \end{aligned}$$

$$t_f = \text{the transport time from feed to cow or goat to milk, to receptor, sec;}$$

$$t_h = \text{the transport time from harvest, to cow or goat, to consumption, sec;}$$

$$t_b = \text{period of time that sediment is exposed to gaseous effluents sec;}$$

$$B_{iv} = \text{concentration factor for uptake of radionuclide } i \text{ from the soil by the edible parts of crops, pCi/Kg (wet weight) per pCi/Kg (dry soil);}$$

$$\rho = \text{effective surface density for soil, Kg (dry soil)/m}^2;$$

$$f_p = \text{fraction of the year that the cow or goat is on pasture;}$$

$$f_s = \text{fraction of the cow feed that is pasture grass while the cow is on pasture;}$$

$$t_e = \text{period of pasture grass and crop exposure during the growing season, sec;}$$

$$I_i = \text{factor to account for fractional deposition of radionuclide } i.$$

For radionuclides other than iodine, the factor I_i is equal to one. For radioiodines, the value of I_i may vary. However, a value of 1.0 was used in calculating the R values Tables 3.3-9 through 3.3-16.

Milk cattle and goats are considered to be fed from two potential sources, pasture grass and stored feeds. Following the development in Regulatory Guide 1.109 Revision 1, the value of f_s was considered unity in lieu of site-specific information. The value of f_p was 0.667 based upon an 8-month grazing period.

Table C-1 contains the appropriate parameter values and their source in Regulatory Guide 1.109 Revision 1.

The concentration of tritium in milk is based on the airborne concentration rather than the deposition. Therefore, the R_i is based on X/Q :

$$R_{T_M} = K'K''F_m Q_F U_{ap} (DFL_i)_a 0.75(0.5/H) \quad (C.2-4)$$

where:

R_{T_M} = dose factor for the cow or goat milk pathway for tritium for the organ of interest, mrem/yr per $\mu\text{Ci}/\text{m}^3$;

K'' = a constant of unit conversion;
 = 10^3 gm/kg ;

H = absolute humidity of the atmosphere, gm/m^3 ;

0.75 = the fraction of total feed that is water;

0.5 = the ratio of the specific activity of the feed grass water to the atmospheric water.

and other parameters and values are given above. A value of H of 8 grams/meter³, was used in lieu of site-specific information.

The integrated concentration in meat follows in a similar manner to the development for the milk pathway, therefore:

$$R_{iM} = I_i K' Q_F U_{ap} F_m (DFL_i)_a e^{-\lambda_i t_s} \left[f_p f_s \left[\frac{r(1-e^{-\lambda_{E_i} t_e})}{Y_p \lambda_{E_i}} + \frac{B_{iv} (1-e^{-\lambda_i t_b})}{P \lambda_i} \right] + (1-f_p f_s) \left[\frac{r(1-e^{-\lambda_{E_i} t_e})}{Y_s \lambda_{E_i}} + \frac{B_{iv} (1-e^{-\lambda_i t_b})}{P \lambda_i} \right] e^{-\lambda_i t_h} \right] \quad (C.2-5)$$

where:

- R_{iB} = dose factor for the meat ingestion pathway for radionuclide i for any organ of interest, mrem/yr per $\mu\text{Ci/sec}$ per m^{-2} ;
- F_f = the stable element transfer coefficients, pCi/Kg per pCi/day;
- U_{ap} = the receptor's meat consumption rate for age group a , kg/yr;
- t_s = the transport time from slaughter to consumption, sec;
- t_h = the transport time from harvest to animal consumption, sec;
- t_e = period of pasture grass and crop exposure during the growing season, sec;
- I_i = factor to account for fractional deposition of radionuclide i .

For radionuclides other than iodine, the factor I_i is equal to one. For radioiodines, the value of I_i may vary. However, a value of 1.0 was used in calculating the R values in Tables 3.3-6 through 3.3-8.

All other terms remain the same as defined in Equation C.2-3. Table C-2 contains the values which were used in calculating R_i for the meat pathway

The concentration of tritium in meat is based on its airborne concentration rather than the deposition. Therefore, the R_i is based on X/Q .

$$R_{TB} = K' K'' F_f Q_F U_{ap} (DFL_i)_a 0.75(0.5/H) \quad (C.2-6)$$

where:

$$R_{TB} = \text{dose factor for the meat ingestion pathway for tritium for any organ of interest, mrem/yr per } \mu\text{Ci/m}^3.$$

All other terms are defined in Equation C.2-4 and C.2-5, above.

C.2.5 Vegetation Pathway

The integrated concentration in vegetation consumed by man follows the expression developed in the derivation of the milk factor. Man is considered to consume two types of vegetation (fresh and stored) that differ only in the time period between harvest and consumption, therefore:

$$R_{iV} = I_i K' (DFL_i)_a \left[U_a^L f_L e^{-\lambda_i t_L} \left[\frac{r(1-e^{-\lambda_{E_i} t_e})}{Y_v \lambda_{E_i}} + \frac{B_{iv} (1-e^{-\lambda_i t_b})}{P \lambda_i} \right] + U_a^S f_g e^{-\lambda_i t_h} \left[\frac{r(1-e^{-\lambda_{E_i} t_e})}{Y_v \lambda_{E_i}} + \frac{B_{iv} (1-e^{-\lambda_i t_b})}{P \lambda_i} \right] \right] \quad (C.2-7)$$

where:

$$R_{iV} = \text{dose factor for vegetable pathway for radionuclide } i \text{ for the organ of interest, mrem/yr per } \mu\text{Ci/sec per m}^{-2};$$

$$K' = \text{a constant of unit conversion;} \\ = 10^6 \text{ pCi}/\mu\text{Ci};$$

U_a^L = the consumption rate of fresh leafy vegetation by the receptor in age group a, kg/yr;

U_a^S = the consumption rate of stored vegetation by the receptor in age group a, kg/yr;

f_L = the fraction of the annual intake of fresh leafy vegetation grown locally;

f_g = the fraction of the annual intake of stored vegetation grown locally;

t_L = the average time between harvest of leafy vegetation and its consumption, sec;

t_h = the average time between harvest of stored vegetation and its consumption, sec;

Y_v = the vegetation areal density, kg/m²;

t_e = period of leafy vegetable exposure during growing season, sec;

I_i = factor to account for fractional deposition of radionuclide i.

For radionuclides other than iodine, the factor I_i is equal to one. For radioiodines, the value of I_i may vary. However, a value of 1.0 was used in Tables 3.3-3 through 3.3-5.

All other factors were defined above.

Table C-3 presents the appropriate parameter values and their source in Regulatory Guide 1.109 Revision 1.

In lieu of site-specific data default values for f_L and f_g , 1.0 and 0.76, respectively, were used in the calculation of R_i . These values were obtained from Table E-15 of Regulatory Guide 1.109 Revision 1.

The concentration of tritium in vegetation is based on the airborne concentration rather than the deposition. Therefore, the R_i is based on X/Q :

$$R_{TV} = K'K''[U_{aL}^L f_L + U_{ag}^S f_g](DFL_i)_a \quad 0.75(0.5/H) \quad (C.2-8)$$

where:

$$R_{TV} = \text{dose factor for the vegetable pathway for tritium for any organ of interest, mrem/yr per } \mu\text{Ci/m}^3.$$

All other terms remain the same as those in Equations C.2-4 and C.2-7.

TABLE C-1
Parameters For Cow and Goat Milk Pathways

<u>Parameter</u>	<u>Value</u>	<u>Reference (Reg. Guide 1.109 Rev. 1)</u>
Q_F (kg/day)	50 (cow) 6 (goat)	Table E-3 Table E-3
Y_p (kg/m ²)	0.7	Table E-15
t_f (seconds)	1.73×10^5 (2 days)	Table E-15
r	1.0 (radioiodines) 0.2 (particulates)	Table E-15 Table E-15
$(DFL_i)_a$ (mrem/pCi)	Each radionuclide	Tables E-11 to E-14
F_m (pCi/day per pCi/liter)	Each stable element	Table E-1 (cow) Table E-2 (goat)
t_b (seconds)	4.73×10^8 (15 yr)	Table E-15
Y_s (kg/m ²)	2.0	Table E-15
Y_p (kg/m ²)	0.7	Table E-15
t_h (seconds)	7.78×10^6 (90 days)	Table E-15
U_{ap} (liters/yr)	330 infant 330 child 400 teen 310 adult	Table E-5 Table E-5 Table E-5 Table E-5
t_e (seconds)	2.59×10^6 (pasture) 5.18×10^6 (stored feed)	Table E-15
B_{iv} (pCi/Kg (wet weight) per pCi/Kg (dry soil))	Each stable element	Table E-1
P (Kg (dry soil/m ²))	240	Table E-15

TABLE C-2
Parameters For The Meat Pathway

<u>Parameter</u>	<u>Value</u>	<u>Reference (Reg. Guide 1.109 Rev. 1)</u>
r	1.0 (radioiodines) 0.2 (particulates)	Table E-15 Table E-15
F_f (pCi/Kg per pCi/day)	Each stable element	Table E-1
U_{ap} (Kg/yr)	0 infant 41 child 65 teen 110 adult	Table E-5 Table E-5 Table E-5 Table E-5
$(DFL_i)_a$ (mrem/pCi)	Each radionuclide	Tables E-11 to E-14
Y_p (kg/m ²)	0.7	Table E-15
Y_s (kg/m ²)	2.0	Table E-15
t_b (seconds)	4.73×10^8 (15 yr)	Table E-15
t_s (seconds)	1.73×10^6 (20 days)	Table E-15
t_h (seconds)	7.78×10^6 (90 days)	Table E-15
t_e (seconds)	2.59×10^6 (pasture) 5.18×10^6 (stored feed)	Table E-15
Q_F (kg/day)	50	Table E-3
B_{iv} (pCi/Kg (wet weight) per pCi/Kg (dry soil))	Each stable element	Table E-1
P (Kg (dry soil)/m ²)	240	Table E-15

TABLE C-3

Parameters for the Vegetable Pathway

<u>Parameter</u>	<u>Value</u>	<u>Reference (Reg. Guide 1.109 Rev.1)</u>
r (dimensionless)	1.0 (radioiodines)	Table E-1
	0.2 (particulates)	Table E-1
$(DFL_i)_a$ (mrem/Ci)	Each radionuclide	Tables E-11 to E-14
U_a^L (kg/yr) - Infant	0	Table E-5
	- Child	Table E-5
	- Teen	Table E-5
	- Adult	Table E-5
U_a^S (kg/yr) - Infant	0	Table E-5
	- Child	Table E-5
	- Teen	Table E-5
	- Adult	Table E-5
t_L (seconds)	8.6×10^4 (1 day)	Table E-15
t_h (seconds)	5.18×10^6 (60 days)	Table E-15
Y_v (kg/m ²)	2.0	Table E-15
t_e (seconds)	5.18×10^6 (60 days)	Table E-15
t_b (seconds)	4.73×10^8 (15 yr)	Table E-15
$P(\text{Kg(dry soil)/m}^2)$	240	Table E-15
B_{iv} (pCi/Kg(wet weight) per pCi/kg (dry soil))	Each stable element	Table E-1

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APPENDIX D

LOWER LIMIT OF DETECTABILITY

The lower limit of detectability (LLD) is the smallest concentration of a radioactive material in an unknown sample that will be detected with a 95% probability with a 5% probability of falsely concluding that a blank observation represents a "real" signal. The minimum detectable activity (MDA) is the smallest indicated activity in an unknown sample that can be said to be greater than background with a 5% probability that a true activity of zero will be falsely recorded as a detectable activity. To ensure that the LLD is detected 95% of the time it is present requires that activities down to the MDA level be recorded as present in the sample. Both LLD and MDA are given by the following equations:

$$LLD = \frac{4.66 \sigma_b}{E V 2.22 Y \exp(-\lambda_i t_e)} \quad (D.1-1)$$

$$MDA = \frac{2.33 \sigma_b}{E V 2.22 Y \exp(-\lambda_i t_e)} \quad (D.1-2)$$

where

$$\sigma_b = (N/t_b)^{1/2}$$

= standard deviation of background (cpm)

N = background count rate (cpm)

t_b = time background counted for (min)

E = counting efficiency

V = volume or mass of sample

2.22 = conversion factor (dpm/pCi)

Y = fractional radiochemical yield

λ_i = radioactive decay constant of ith nuclide (sec^{-1})

t_e = elapsed time between sample collection and counting (sec)

In calculating the LLD and MDA for a radionuclide determined by gamma ray spectroscopy, the background shall include the typical contributions of other radionuclides normally present in the sample (e.g., potassium-40 in milk samples). Analysis shall be performed in such a manner that the LLD's listed in Tables 2.1-2, 2.2-2, and 2.6-1 of Ref. 1, will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLD's unachievable. In such cases, the contributing factors will be identified and described in the Annual Radiological Environmental Operating Report. In addition, Table 6.9-2 in Section 6.9.2.a(6) of Ref. 1 gives the reporting levels for radioactivity concentrations in environmental samples.

The methodology presented in Ref. 2 and Ref. 3 to determine LLD and MDA may be used in lieu of Equations D.1-1 and D.1-2.

References

1. Radiological Effluent Technical Specifications for Brunswick Steam Electric Plant.
2. HASL-300 (Suppl. 4), HASL Procedures Manual, (1972).
3. NBS SP456 "The Minimum - Detectable - Activity Concept," J. D. Lockamy, (1976).