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Georgia Power
the southern electric system

April 30, 1996

Docket Nos. 50-321
50-366

HL-5149

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Edwin I. Hatch Nuclear Plant
Annual Radioactive Effluent Release Report

Gentlemen:

In accordance with the provisions of Plant Hatch Technical Specifications, Georgia Power Company is providing six copies of the Plant Hatch Units 1 and 2 Annual Radioactive Effluent Release Report. This report covers the period January 1, 1995 through December 31, 1995.

Should you have any questions, please advise.

Sincerely,

J. T. Beckham, Jr.

DMC/eb

Enclosure: Plant E. I. Hatch Units 1 & 2
Annual Radioactive Effluent Release Report

cc: (See next page.)

030043

IE48 1/1

Georgia Power

cc: *Georgia Power Company (w/o copies)*
Mr. H. L. Sumner, Jr., Nuclear Plant General Manager
NORMS

U.S. Nuclear Regulatory Commission, Washington, D.C.
Mr. K. Jabbour, Licensing Project Manager - Hatch

U.S. Nuclear Regulatory Commission, Region II
Mr. S. D. Ebneter, Regional Administrator
Mr. B. L. Holbrook, Senior Resident Inspector - Hatch

American Nuclear Insurers
Mr. M. Marugg

State of Georgia
Mr. J. L. Setser, Department of Natural Resources

GEORGIA POWER COMPANY

E. I. HATCH NUCLEAR PLANT

UNITS NO. 1 & 2

ANNUAL REPORT

PLANT RADIOACTIVE EFFLUENT RELEASES

JANUARY 1, 1995 THROUGH DECEMBER 31, 1995

GEORGIA POWER COMPANY

E. I. HATCH NUCLEAR PLANT

UNITS NO. 1 & 2

ANNUAL REPORT

PLANT RADIOACTIVE EFFLUENT RELEASES

TABLE	LIST OF TABLES	PAGE

LIST OF TABLES

TABLE	*LIST OF TABLES*	*PAGE*
2-4BB	Air Doses Due to Gaseous Releases - Unit 2 (Quarters 3 and 4)	66
2-5A	Doses to a Member of the Public Due to Radioiodine, Tritium, and Particulates in Gaseous Releases - Unit 1 (Quarters 1 and 2)	67
2-5B	Doses to a Member of the Public Due to Radioiodine, Tritium, and Particulates in Gaseous Releases - Unit 2 (Quarters 1 and 2)	68
2-5AA	Doses to a Member of the Public Due to Radioiodine, Tritium, and Particulates in Gaseous Releases - Unit 1 (Quarters 3 and 4)	69
2-5BB	Doses to a Member of the Public Due to Radioiodine, Tritium, and Particulates in Gaseous Releases - Unit 2 (Quarters 3 and 4)	70
2-7	Minimum Detectable Concentration - Gaseous Sample Analyses	71
3-1A,B	Solid Waste and Irradiated Fuel Shipments	74,76
4-1	Dose to A Member of the Public Due to Activities Inside The Site Boundary	79

1.0 Liquid Effluents

1.1 Regulatory Limits/Technical Specifications

1.1.1 Concentration Limits

The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 1.0E-4 microcuries/ml total activity.

1.1.2 Dose Limits

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

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

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

1.2 Effluent Concentration Limit (ECL)

ECL values used in determining allowable liquid radwaste release rates and concentrations for principal gamma emitters, I-131, tritium, Sr-89, Sr-90 and Fe-55 are taken from 10 CFR Part 20, Appendix B, Table II, Column 2. A tolerance factor of up to 10 is utilized to allow flexibility in the establishment of practical monitor set points which can accommodate effluent releases at concentrations higher than the ECL values stated in 10 CFR 20, Appendix B, Table II, Column 2.

For dissolved or entrained noble gases in liquid radwaste, the ECL is 1E-04 uCi/ml total activity.

For gross alpha in liquid radwaste, the ECL is 2.0E-09 uCi/ml.

Furthermore, for all the above radionuclides or categories of radioactivity, the overall ECL fraction is determined in accordance with 10 CFR Part 20, Appendix B.

The method utilizing the ECL fraction to determine release rates and liquid radwaste effluent radiation monitor set points is described in Subsection 1.3 of this report.

1.3 Measurements and Approximations of Total Radioactivity

Prior to release of any tank containing liquid radwaste, following the required recirculations, samples are collected and analyzed in accordance with the Offsite Dose Calculation Manual (ODCM) Table 2-3. A sample from each tank planned for release is analyzed for principal gamma emitters, I-131, and dissolved and entrained noble gases by gamma spectroscopy.

Monthly and quarterly composites are prepared for analysis by extracting aliquots from each sample taken from the tanks which are released. Liquid radwaste sample analyses are performed as follows:

	MEASUREMENT	FREQUENCY	METHOD
1.	Gamma Isotopic	Each Batch	Gamma Spectroscopy with computerized data reduction.
2.	Dissolved or entrained noble gases	Each Batch	Gamma Spectroscopy with computerized data reduction
3.	Tritium	Monthly Composite	Distillation and liquid scintillation counting
4.	Gross Alpha	Monthly Composite	Gas flow proportional counting
5.	Sr-89 & Sr-90	Quarterly Composite	Chemical separation and gas flow proportional or scintillation counting
6.	Fe-55	Quarterly Composite	Chemical separation and liquid scintillation counting

Gamma isotopic measurements are performed in-house using germanium detectors with a resolution of 2.0 keV or lower. The detectors are shielded by four inches of lead. A liquid radwaste sample is typically counted for 3000 seconds and a peak search of the resulting gamma ray spectrum is performed. Energy and net count data for all significant peaks are determined, and a quantitative reduction or MDC calculation is performed. This ensures that the MDC's are met for the nuclides specified in the ODCM Ch 10 (i.e., Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144). The quantitative calculations, corrections for counting time, decay time, sample volume, sample geometry, detector efficiency, baseline counts, branching ratio and MDC calculations, are made based on the counts at the location in the spectrum where the peak for that radionuclide would be located, if present.

Tritium, Gross Alpha, Sr-89, Sr-90 and Fe-55 are, in some cases, analyzed offsite.

The radionuclide concentrations determined by gamma spectroscopic analysis of a sample taken from a tank planned for release in addition to the most current sample analysis results available for tritium, gross alpha, Sr-89, Sr-90 and Fe-55 are used along with the corresponding ECL values to determine the ECL fraction for the tank planned for release. This ECL fraction is then used, with the appropriate safety factors, tolerance factors, and the expected dilution stream flow to calculate maximum permissible release rate and a liquid effluent monitor setpoint. The monitor setpoint is calculated to assure that the limits of the Offsite Dose Calculation Manual (ODCM) are not exceeded.

A monitor reading in excess of the calculated setpoint results in an automatic termination of the liquid radwaste discharge. Liquid effluent discharge is also automatically terminated if the dilution stream flow rate falls below the minimum assured dilution flow rate used in the setpoint calculations and established as a setpoint on the dilution stream flow monitor.

Radionuclide concentrations, safety factors, dilution stream flow rate, and the liquid effluent radiation monitor calibration factor are entered into the computer and a pre-release printout is generated. If the release is not permissible, appropriate warnings will be displayed on the computer screen. If the release is permissible, it is approved by the Chemistry Foreman on duty. The pertinent information is transferred manually from the prerelease printout to a one-page release permit which is forwarded to Radwaste Operations. When the release is completed, the release permit is returned from Radwaste Operations to Chemistry with the actual release data included. These data are input into the computer and a post-release printout is generated. The post release printout contains the actual release rates, actual release concentrations and quantities, actual dilution flow, and the calculated doses to an individual.

1.4 Liquid Effluent Release Data

Regulatory Guide 1.21 Tables 2A and 2B are found in this report as Table 1-1A, 1-1AA for Unit 1, Table 1-1B, 1-1BB for Unit 2 and Table I-1C, 1-1CC for the site; and Table 1-2A, 1-2AA for Unit 1, 1-2B, 1-2BB for Unit 2, and Table I-2C, 1-2CC for the site.

The values for the four categories of Tables 1-1A, 1-1AA and 1-1B, 1-1BB and I-1C, 1-1CC are calculated and the Tables completed as follows:

1. Fission and activation products - The total release values (not including tritium, gases, and alpha) are comprised of the sum of the measured individual radionuclide activities. This sum is for each batch released to the river for the respective quarter.

2. Tritium - The measured tritium concentrations in the monthly composite samples are used to calculate the total release and average diluted concentration during each period.

3. Dissolved and entrained gases - Concentrations of dissolved and entrained gases in liquid effluents are measured by germanium spectroscopy using a one liter sample from each liquid radwaste batch. The measured concentrations are used to calculate the total release and the average diluted concentration during the period. Radioisotopes of iodine in any form are also determined during the isotopic analysis for each batch; therefore, a separate analysis for possible gaseous forms is not performed because it would not provide additional information.

4. Gross alpha radioactivity - The measured gross alpha concentrations in the monthly composite samples are used to calculate the total release of alpha radioactivity.

Other data pertinent to batch releases of radioactive liquid effluent from both units are as follows:

Number of batch releases:	635
Total time period for batch releases:	83,182 minutes
Maximum time period for a batch release:	210.0 minutes
Average time period for batch releases:	131.00 minutes
Minimum time period for a batch release:	11 minutes
Average stream flow during periods of release of liquid effluent into a flowing stream:	15,570 CFS

1.5 Radiological Impact on Man Due to Liquid Releases

Doses to an individual due to radioactivity in liquid effluent were calculated in accordance with the Offsite Dose Calculation Manual. Results are presented in Table 1-3A, 1-3AA for Unit 1 and 1-3B, 1-3BB for Unit 2, for all four quarters.

1.6 Abnormal Releases

There were no abnormal releases for this reporting period.

TABLE 1-1A
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents - Summation of All Releases
Unit: 1
Starting : 1-Jan-1995 Ending : 30-Jun-1995

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	4.54E-02	5.61E-02	4.70E+01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	7.39E-08	5.49E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	8.72E+00	7.49E+00	3.70E+01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	1.42E-05	7.33E-06	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	5.07E-05	1.46E-04	1.00E+02
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	8.26E-11	1.42E-10	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.00E+00	0.00E+00	1.20E+02
E. WASTE VOL RELEASED (PRE-DILUTION)	LITERS	2.92E+06	3.76E+06	1.00E+01
F. VOLUME OF DILUTION WATER USED	LITERS	6.14E+08	1.02E+09	1.60E+02

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

TABLE 1-1B
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents - Summation of All Releases
Unit: 2
Starting : 1-Jan-1995 Ending : 30-Jun-1995

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	1.81E-02	4.49E-02	4.70E+01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	2.35E-08	5.40E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	2.86E+00	2.28E+00	3.70E+01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	3.72E-06	2.75E-06	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	1.90E-02	2.41E-02	1.00E+02
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	2.47E-08	2.89E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.00E+00	0.00E+00	1.20E+02
E. WASTE VOL RELEASED (PRE-DILUTION)	LITERS	3.14E+06	3.16E+06	1.00E+01
F. VOLUME OF DILUTION WATER USED	LITERS	7.69E+08	8.31E+08	1.60E+02

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

TABLE 1-1C
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents - Summation of All Releases
Unit: Site
Starting : 1-Jan-1995 Ending : 30-Jun-1995

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	6.35E-02	1.01E-01	4.70E+01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	4.59E-08	5.45E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	1.16E+01	9.78E+00	3.70E+01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	8.37E-06	5.28E-06	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	1.91E-02	2.42E-02	1.00E+02
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	1.38E-08	1.31E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.00E+00	0.00E+00	1.20E+02
E. WASTE VOL RELEASED(PRE-DILUTION)	LITERS	6.06E+06	6.92E+06	1.00E+01
F. VOLUME OF DILUTION WATER USED	LITERS	1.38E+09	1.85E+09	1.60E+02

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

TABLE 1-1AA
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents - Summation of All Releases
Unit: 1
Starting : 1-Jul-1995 Ending : 31-Dec-1995

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	1.71E-02	1.92E-02	4.70E+01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	1.23E-08	1.49E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	8.06E+00	1.06E+01	3.70E+01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	5.82E-06	8.22E-06	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	1.04E-03	6.95E-03	1.00E+02
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	7.54E-10	5.40E-09	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	1.91E-06	5.29E-07	1.20E+02
E. WASTE VOL RELEASED(PRE-DILUTION)	LITERS	5.03E+06	4.89E+06	1.00E+01
F. VOLUME OF DILUTION WATER USED	LITERS	1.38E+09	1.29E+09	1.60E+02

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

TABLE 1-1BB
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents - Summation of All Releases
Unit: 2
Starting : 1-Jul-1995 Ending : 31-Dec-1995

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	4.61E-02	4.47E-02	4.70E+01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	4.06E-08	3.36E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	2.30E+00	3.58E+00	3.70E+01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	2.03E-06	2.69E-06	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	3.70E-02	7.80E-03	1.00E+02
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	3.26E-08	5.87E-09	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	5.80E-07	2.22E-06	1.20E+02
E. WASTE VOL RELEASED(PRE-DILUTION)	LITERS	4.08E+06	4.28E+06	1.00E+01
F. VOLUME OF DILUTION WATER USED	LITERS	1.14E+09	1.33E+09	1.60E+02

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

TABLE 1-1CC
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents - Summation of All Releases
Unit: Site
Starting : 1-Jul-1995 Ending : 31-Dec-1995

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	6.32E-02	6.39E-02	4.70E+01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	2.51E-08	2.44E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	1.04E+01	1.42E+01	3.70E+01
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	4.11E-06	5.41E-06	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	3.80E-02	1.48E-02	1.00E+02
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	1.51E-08	5.64E-09	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	2.49E-06	2.75E-06	1.20E+02
E. WASTE VOL RELEASED (PRE-DILUTION)	LITERS	9.11E+06	9.17E+06	1.00E+01
F. VOLUME OF DILUTION WATER USED	LITERS	2.52E+09	2.62E+09	1.60E+02

* Applicable limits are expressed in terms of dose. See Tables 1-3A and 1-3B of this report.

TABLE 1-2A*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents
Unit: 1
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE**		BATCH MODE	
NUCLIDE	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
H-3	CURIES	0.00E+00	0.00E+00	8.72E+00	7.49E+00

FISSION & ACTIVATION PRODUCTS

NUCLIDE	UNIT	CONTINUOUS QUARTER 1	CONTINUOUS QUARTER 2	BATCH QUARTER 1	BATCH QUARTER 2
AS-76	CURIES	0.00E+00	0.00E+00	1.91E-04	2.19E-04
BA-139	CURIES	0.00E+00	0.00E+00	0.00E+00	7.79E-06
BA-140	CURIES	0.00E+00	0.00E+00	1.65E-04	2.97E-04
CE-144	CURIES	0.00E+00	0.00E+00	0.00E+00	2.74E-04
CO-58	CURIES	0.00E+00	0.00E+00	6.47E-04	4.56E-04
CO-60	CURIES	0.00E+00	0.00E+00	1.04E-02	1.34E-02
CR-51	CURIES	0.00E+00	0.00E+00	1.38E-03	1.66E-03
CS-134	CURIES	0.00E+00	0.00E+00	2.76E-05	3.12E-06
CS-137	CURIES	0.00E+00	0.00E+00	1.40E-03	1.12E-03
CU-64	CURIES	0.00E+00	0.00E+00	0.00E+00	6.49E-04
FE-55	CURIES	0.00E+00	0.00E+00	3.66E-03	8.15E-03
FE-59	CURIES	0.00E+00	0.00E+00	2.82E-04	5.27E-04
I-131	CURIES	0.00E+00	0.00E+00	1.11E-05	0.00E+00
I-133	CURIES	0.00E+00	0.00E+00	2.67E-05	2.97E-06
LA-140	CURIES	0.00E+00	0.00E+00	9.07E-06	1.26E-05
MN-54	CURIES	0.00E+00	0.00E+00	3.42E-03	3.09E-03
MN-56	CURIES	0.00E+00	0.00E+00	2.13E-05	1.91E-05
MO-99	CURIES	0.00E+00	0.00E+00	1.63E-05	0.00E+00
NA-24	CURIES	0.00E+00	0.00E+00	2.50E-04	1.29E-05
NB-95	CURIES	0.00E+00	0.00E+00	3.22E-05	2.80E-05
NB-97	CURIES	0.00E+00	0.00E+00	1.37E-06	6.94E-05
RU-103	CURIES	0.00E+00	0.00E+00	0.00E+00	1.55E-06
SB-124	CURIES	0.00E+00	0.00E+00	0.00E+00	2.41E-05
SB-125	CURIES	0.00E+00	0.00E+00	0.00E+00	2.97E-05
SR-89	CURIES	0.00E+00	0.00E+00	2.95E-05	1.19E-04
SR-90	CURIES	0.00E+00	0.00E+00	6.25E-13	2.70E-13
SR-91	CURIES	0.00E+00	0.00E+00	2.72E-04	6.57E-04
SR-92	CURIES	0.00E+00	0.00E+00	5.55E-05	6.72E-05
TC-99M	CURIES	0.00E+00	0.00E+00	1.29E-04	2.72E-05
Y-91M	CURIES	0.00E+00	0.00E+00	1.23E-04	5.12E-04
ZN-65	CURIES	0.00E+00	0.00E+00	2.28E-02	2.43E-02
ZN-69M	CURIES	0.00E+00	0.00E+00	5.10E-05	2.38E-04
ZR-95	CURIES	0.00E+00	0.00E+00	0.00E+00	3.80E-05

TABLE 1-2A*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents
Unit: 1
Starting : 1-Jan-1995 Ending : 30-Jun-1995

NUCLIDE	UNIT	CONTINUOUS MODE** QUARTER 1	CONTINUOUS MODE** QUARTER 2	BATCH MODE QUARTER 1	BATCH MODE QUARTER 2
FISSION & ACTIVATION PRODUCTS					
TOTALS	CURIES	0.00E+00	0.00E+00	4.54E-02	5.61E-02
DISSOLVED AND ENTRAINED GASES					
AR-41	CURIES	0.00E+00	0.00E+00	9.07E-06	7.68E-06
XE-133	CURIES	0.00E+00	0.00E+00	3.95E-06	1.57E-05
XE-135	CURIES	0.00E+00	0.00E+00	3.77E-05	1.22E-04
TOTALS	CURIES	0.00E+00	0.00E+00	5.07E-05	1.46E-04

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 1-5 for typical minimum detectable concentrations.

** There are no continuous mode radioactive liquid release pathways at Plant Hatch.

TABLE 1-2B*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents
Unit: 2
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE**		BATCH MODE	
NUCLIDE	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
H-3	CURIES	0.00E+00	0.00E+00	2.86E+00	2.28E+00
FISSION & ACTIVATION PRODUCTS					
AS-76	CURIES	0.00E+00	0.00E+00	7.46E-04	3.63E-03
BA-133	CURIES	0.00E+00	0.00E+00	6.56E-06	0.00E+00
BA-140	CURIES	0.00E+00	0.00E+00	1.43E-04	3.70E-04
CE-141	CURIES	0.00E+00	0.00E+00	0.00E+00	2.45E-05
CE-144	CURIES	0.00E+00	0.00E+00	1.48E-05	0.00E+00
CO-57	CURIES	0.00E+00	0.00E+00	1.28E-06	5.22E-06
CO-58	CURIES	0.00E+00	0.00E+00	2.50E-04	1.18E-03
CO-60	CURIES	0.00E+00	0.00E+00	1.62E-03	3.48E-03
CR-51	CURIES	0.00E+00	0.00E+00	6.37E-04	8.53E-03
CS-134	CURIES	0.00E+00	0.00E+00	1.03E-06	2.77E-05
CS-137	CURIES	0.00E+00	0.00E+00	5.35E-04	6.95E-04
CS-138	CURIES	0.00E+00	0.00E+00	0.00E+00	2.60E-05
FE-55	CURIES	0.00E+00	0.00E+00	3.20E-04	3.15E-04
FE-59	CURIES	0.00E+00	0.00E+00	1.68E-04	1.63E-04
I-131	CURIES	0.00E+00	0.00E+00	3.12E-04	1.04E-03
I-132	CURIES	0.00E+00	0.00E+00	1.32E-04	3.38E-04
I-133	CURIES	0.00E+00	0.00E+00	1.87E-03	3.25E-03
I-134	CURIES	0.00E+00	0.00E+00	7.70E-06	0.00E+00
I-135	CURIES	0.00E+00	0.00E+00	1.14E-03	1.84E-03
LA-140	CURIES	0.00E+00	0.00E+00	4.9[illegible]E-05	3.92E-04
MN-54	CURIES	0.00E+00	0.00E+00	7.65E-04	1.23E-03
MN-56	CURIES	0.00E+00	0.00E+00	8.37E-05	2.01E-05
MO-99	CURIES	0.00E+00	0.00E+00	0.00E+00	4.26E-04
NA-24	CURIES	0.00E+00	0.00E+00	5.56E-04	3.18E-03
NB-95	CURIES	0.00E+00	0.00E+00	1.08E-04	3.27E-06
NB-97	CURIES	0.00E+00	0.00E+00	8.76E-05	3.70E-04
NP-239	CURIES	0.00E+00	0.00E+00	1.54E-04	6.97E-04
RB-89	CURIES	0.00E+00	0.00E+00	0.00E+00	2.87E-05
SB-124	CURIES	0.00E+00	0.00E+00	0.00E+00	6.41E-06
SR-89	CURIES	0.00E+00	0.00E+00	1.48E-04	1.96E-04
SR-90	CURIES	0.00E+00	0.00E+00	1.77E-12	9.75E-06
SR-91	CURIES	0.00E+00	0.00E+00	5.52E-04	5.14E-04
SR-92	CURIES	0.00E+00	0.00E+00	9.34E-05	5.40E-05

TABLE 1-2B*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents
Unit: 2
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE**		BATCH MODE	
NUCLIDE	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
FISSION & ACTIVATION PRODUCTS					
TC-99M	CURIES	0.00E+00	0.00E+00	1.17E-04	1.92E-03
Y-91M	CURIES	0.00E+00	0.00E+00	1.08E-03	1.08E-03
Y-92	CURIES	0.00E+00	0.00E+00	0.00E+00	5.64E-05
ZN-65	CURIES	0.00E+00	0.00E+00	6.18E-03	9.68E-03
ZN-69M	CURIES	0.00E+00	0.00E+00	1.20E-04	9.63E-05
ZR-95	CURIES	0.00E+00	0.00E+00	9.39E-05	5.98E-06
TOTALS	CURIES	0.00E+00	0.00E+00	1.81E-02	4.49E-02
DISSOLVED AND ENTRAINED GASES					
KR-85	CURIES	0.00E+00	0.00E+00	0.00E+00	1.01E-03
XE-131M	CURIES	0.00E+00	0.00E+00	0.00E+00	9.93E-05
XE-133	CURIES	0.00E+00	0.00E+00	2.65E-03	3.78E-03
XE-133M	CURIES	0.00E+00	0.00E+00	0.00E+00	1.59E-05
XE-135	CURIES	0.00E+00	0.00E+00	1.45E-02	1.33E-02
XE-135M	CURIES	0.00E+00	0.00E+00	1.87E-03	5.90E-03
TOTALS	CURIES	0.00E+00	0.00E+00	1.90E-02	2.41E-02

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 1-5 for typical minimum detectable concentrations.

** There are no continuous mode radioactive liquid release pathways at Plant Hatch.

TABLE 1-2C*

E. I. HATCH NUCLEAR PLANT

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995

Liquid Effluents

Unit: Site

Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE**		BATCH MODE	
NUCLIDE	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
H-3	CURIES	0.00E+00	0.00E+00	1.16E+01	9.78E+00

FISSION & ACTIVATION PRODUCTS

NUCLIDE	UNIT	CONTINUOUS MODE** QUARTER 1	CONTINUOUS MODE** QUARTER 2	BATCH MODE QUARTER 1	BATCH MODE QUARTER 2
AS-76	CURIES	0.00E+00	0.00E+00	9.37E-04	3.85E-03
BA-133	CURIES	0.00E+00	0.00E+00	6.56E-06	0.00E+00
BA-139	CURIES	0.00E+00	0.00E+00	0.00E+00	7.79E-06
BA-140	CURIES	0.00E+00	0.00E+00	3.08E-04	6.67E-04
CE-141	CURIES	0.00E+00	0.00E+00	0.00E+00	2.45E-05
CE-144	CURIES	0.00E+00	0.00E+00	1.48E-05	2.74E-04
CO-57	CURIES	0.00E+00	0.00E+00	1.28E-06	5.22E-06
CO-58	CURIES	0.00E+00	0.00E+00	8.97E-04	1.63E-03
CO-60	CURIES	0.00E+00	0.00E+00	1.20E-02	1.69E-02
CR-51	CURIES	0.00E+00	0.00E+00	2.02E-03	1.02E-02
CS-134	CURIES	0.00E+00	0.00E+00	2.87E-05	3.08E-05
CS-137	CURIES	0.00E+00	0.00E+00	1.93E-03	1.82E-03
CS-138	CURIES	0.00E+00	0.00E+00	0.00E+00	2.60E-05
CU-64	CURIES	0.00E+00	0.00E+00	0.00E+00	6.49E-04
FE-55	CURIES	0.00E+00	0.00E+00	3.98E-03	8.47E-03
FE-59	CURIES	0.00E+00	0.00E+00	4.50E-04	6.90E-04
I-131	CURIES	0.00E+00	0.00E+00	3.23E-04	1.04E-03
I-132	CURIES	0.00E+00	0.00E+00	1.32E-04	3.38E-04
I-133	CURIES	0.00E+00	0.00E+00	1.90E-03	3.26E-03
I-134	CURIES	0.00E+00	0.00E+00	7.70E-06	0.00E+00
I-135	CURIES	0.00E+00	0.00E+00	1.14E-03	1.84E-03
LA-140	CURIES	0.00E+00	0.00E+00	5.85E-05	4.04E-04
MN-54	CURIES	0.00E+00	0.00E+00	4.18E-03	4.31E-03
MN-56	CURIES	0.00E+00	0.00E+00	1.05E-04	3.92E-05
MO-99	CURIES	0.00E+00	0.00E+00	1.63E-05	4.26E-04
NA-24	CURIES	0.00E+00	0.00E+00	8.05E-04	3.20E-03
NB-95	CURIES	0.00E+00	0.00E+00	1.40E-04	3.13E-05
NB-97	CURIES	0.00E+00	0.00E+00	8.90E-05	4.39E-04
NP-239	CURIES	0.00E+00	0.00E+00	[illegible].54E-04	6.97E-04
RB-89	CURIES	0.00E+00	0.00E+00	0.00E+00	2.87E-05
RU-103	CURIES	0.00E+00	0.00E+00	0.00E+00	1.55E-06
SB-124	CURIES	0.00E+00	0.00E+00	0.00E+00	3.06E-05
SB-125	CURIES	0.00E+00	0.00E+00	0.00E+00	2.97E-05

TABLE 1-2C*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents
Unit: Site
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE**		BATCH MODE	
NUCLIDE	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
FISSION & ACTIVATION PRODUCTS					
SR-89	CURIES	0.00E+00	0.00E+00	1.78E-04	3.15E-04
SR-90	CURIES	0.00E+00	0.00E+00	2.39E-12	9.75E-06
SR-91	CURIES	0.00E+00	0.00E+00	8.24E-04	1.17E-03
SR-92	CURIES	0.00E+00	0.00E+00	1.49E-04	1.21E-04
TC-99M	CURIES	0.00E+00	0.00E+00	2.47E-04	1.94E-03
Y-91M	CURIES	0.00E+00	0.00E+00	1.20E-03	1.60E-03
Y-92	CURIES	0.00E+00	0.00E+00	0.00E+00	5.64E-05
ZN-65	CURIES	0.00E+00	0.00E+00	2.90E-02	3.40E-02
ZN-69M	CURIES	0.00E+00	0.00E+00	1.71E-04	3.34E-04
ZR-95	CURIES	0.00E+00	0.00E+00	9.39E-05	4.40E-05
TOTALS	CURIES	0.00E+00	0.00E+00	6.35E-02	1.01E-01
DISSOLVED AND ENTRAINED GASES					
AR-41	CURIES	0.00E+00	0.00E+00	9.07E-06	7.68E-06
KR-85	CURIES	0.00E+00	0.00E+00	0.00E+00	1.01E-03
XE-131M	CURIES	0.00E+00	0.00E+00	0.00E+00	9.93E-05
XE-133	CURIES	0.00E+00	0.00E+00	2.66E-03	3.80E-03
XE-133M	CURIES	0.00E+00	0.00E+00	0.00E+00	1.59E-05
XE-135	CURIES	0.00E+00	0.00E+00	1.45E-02	1.34E-02
XE-135M	CURIES	0.00E+00	0.00E+00	1.87E-03	5.90E-03
TOTALS	CURIES	0.00E+00	0.00E+00	1.91E-02	2.42E-02

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 1-5 for typical minimum detectable concentrations.

** There are no continuous mode radioactive liquid release pathways at Plant Hatch.

TABLE 1-2AA*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents
Unit: 1
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE**		BATCH MODE	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
H-3	CURIES	0.00E+00	0.00E+00	8.06E+00	1.06E+01
FISSION & ACTIVATION PRODUCTS					
AS-76	CURIES	0.00E+00	0.00E+00	6.25E-05	7.39E-05
CO-58	CURIES	0.00E+00	0.00E+00	1.02E-06	5.51E-05
CO-60	CURIES	0.00E+00	0.00E+00	5.66E-03	3.37E-03
CS-134	CURIES	0.00E+00	0.00E+00	1.24E-04	7.71E-04
CS-136	CURIES	0.00E+00	0.00E+00	0.00E+00	3.56E-06
CS-137	CURIES	0.00E+00	0.00E+00	3.36E-03	8.17E-03
FE-55	CURIES	0.00E+00	0.00E+00	2.47E-03	1.89E-03
I-131	CURIES	0.00E+00	0.00E+00	2.98E-04	5.53E-04
I-132	CURIES	0.00E+00	0.00E+00	1.16E-05	0.00E+00
I-133	CURIES	0.00E+00	0.00E+00	8.51E-05	3.16E-04
MN-54	CURIES	0.00E+00	0.00E+00	8.29E-04	4.45E-04
NA-24	CURIES	0.00E+00	0.00E+00	1.41E-06	4.59E-04
NP-239	CURIES	0.00E+00	0.00E+00	0.00E+00	2.03E-05
SR-89	CURIES	0.00E+00	0.00E+00	8.19E-05	1.53E-04
TC-99M	CURIES	0.00E+00	0.00E+00	7.26E-06	6.21E-06
TE-131	CURIES	0.00E+00	0.00E+00	0.00E+00	1.98E-06
Y-91M	CURIES	0.00E+00	0.00E+00	0.00E+00	6.18E-07
ZN-65	CURIES	0.00E+00	0.00E+00	4.07E-03	2.90E-03
ZN-69M	CURIES	0.00E+00	0.00E+00	0.00E+00	2.70E-06
TOTALS	CURIES	0.00E+00	0.00E+00	1.71E-02	1.92E-02
DISSOLVED AND ENTRAINED GASES					
KR-85	CURIES	0.00E+00	0.00E+00	4.71E-04	5.55E-04
XE-133	CURIES	0.00E+00	0.00E+00	1.08E-04	1.28E-03
XE-135	CURIES	0.00E+00	0.00E+00	3.71E-04	5.06E-03
XE-135M	CURIES	0.00E+00	0.00E+00	9.32E-05	6.52E-05
TOTALS	CURIES	0.00E+00	0.00E+00	1.04E-03	6.95E-03
G-ALPHA	CURIES	0.00E+00	0.00E+00	1.91E-06	5.29E-07

TABLE 1-2AA*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents
Unit: 1
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE**		BATCH MODE	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 1-5 for typical minimum detectable concentrations.

** There are no continuous mode radioactive liquid release pathways at Plant Hatch.

TABLE 1-2BB*

E. I. HATCH NUCLEAR PLANT

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995

Liquid Effluents

Unit: 2

Starting : 1-Jul-1995 Ending : 31-Dec 1995

		CONTINUOUS MODE**		BATCH MODE	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
H-3	CURIES	0.00E+00	0.00E+00	2.30E+00	3.58E+00

FISSION & ACTIVATION PRODUCTS

AG-110M	CURIES	0.00E+00	0.00E+00	6.79E-06	0.00E+00
AS-76	CURIES	0.00E+00	0.00E+00	1.07E-02	8.25E-03
BA-140	CURIES	0.00E+00	0.00E+00	7.62E-04	5.33E-05
CE-141	CURIES	0.00E+00	0.00E+00	3.90E-05	3.38E-06
CE-144	CURIES	0.00E+00	0.00E+00	0.00E+00	1.57E-05
CO-57	CURIES	0.00E+00	0.00E+00	5.53E-06	0.00E+00
CO-58	CURIES	0.00E+00	0.00E+00	1.37E-03	1.71E-03
CO-60	CURIES	0.00E+00	0.00E+00	3.39E-03	1.19E-02
CR-51	CURIES	0.00E+00	0.00E+00	2.83E-04	2.15E-03
CS-134	CURIES	0.00E+00	0.00E+00	2.52E-05	1.76E-04
CS-136	CURIES	0.00E+00	0.00E+00	2.71E-05	0.00E+00
CS-137	CURIES	0.00E+00	0.00E+00	7.02E-04	1.76E-03
FE-55	CURIES	0.00E+00	0.00E+00	1.63E-04	5.09E-04
FE-59	CURIES	0.00E+00	0.00E+00	0.00E+00	7.31E-05
I-131	CURIES	0.00E+00	0.00E+00	1.02E-03	1.64E-04
I-132	CURIES	0.00E+00	0.00E+00	2.90E-04	1.25E-05
I-133	CURIES	0.00E+00	0.00E+00	3.20E-03	2.48E-04
I-135	CURIES	0.00E+00	0.00E+00	1.76E-03	0.00E+00
LA-140	CURIES	0.00E+00	0.00E+00	8.64E-04	6.73E-05
MN-54	CURIES	0.00E+00	0.00E+00	1.50E-03	2.77E-03
MN-56	CURIES	0.00E+00	0.00E+00	5.85E-05	3.11E-05
MO-99	CURIES	0.00E+00	0.00E+00	1.41E-03	1.81E-04
NA-24	CURIES	0.00E+00	0.00E+00	4.15E-03	1.14E-03
NB-97	CURIES	0.00E+00	0.00E+00	1.65E-03	6.86E-04
NP-239	CURIES	0.00E+00	0.00E+00	5.93E-04	1.71E-04
SB-122	CURIES	0.00E+00	0.00E+00	0.00E+00	9.75E-06
SB-124	CURIES	0.00E+00	0.00E+00	0.00E+00	3.21E-06
SR-89	CURIES	0.00E+00	0.00E+00	2.72E-04	1.30E-04
SR-90	CURIES	0.00E+00	0.00E+00	5.72E-06	2.59E-05
SR-91	CURIES	0.00E+00	0.00E+00	1.23E-03	8.14E-05
SR-92	CURIES	0.00E+00	0.00E+00	1.89E-04	9.83E-06
TC-99M	CURIES	0.00E+00	0.00E+00	3.01E-03	3.47E-04
TE-129	CURIES	0.00E+00	0.00E+00	0.00E+00	2.05E-05

TABLE 1-2BB*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents
Unit: 2
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE**		BATCH MODE	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
FISSION & ACTIVATION PRODUCTS					
Y-91M	CURIES	0.00E+00	0.00E+00	1.63E-03	1.46E-04
Y-92	CURIES	0.00E+00	0.00E+00	2.89E-04	3.01E-04
ZN-65	CURIES	0.00E+00	0.00E+00	5.45E-03	1.15E-02
ZN-69M	CURIES	0.00E+00	0.00E+00	5.48E-05	3.46E-05
TOTALS	CURIES	0.00E+00	0.00E+00	4.61E-02	4.47E-02
DISSOLVED AND ENTRAINED GASES					
AR-41	CURIES	0.00E+00	0.00E+00	0.00E+00	5.55E-06
KR-85	CURIES	0.00E+00	0.00E+00	5.50E-04	3.33E-04
XE-131M	CURIES	0.00E+00	0.00E+00	1.19E-04	0.00E+00
XE-133	CURIES	0.00E+00	0.00E+00	7.87E-03	1.11E-03
XE-133M	CURIES	0.00E+00	0.00E+00	9.68E-05	0.00E+00
XE-135	CURIES	0.00E+00	0.00E+00	2.46E-02	6.19E-03
XE-135M	CURIES	0.00E+00	0.00E+00	3.79E-03	1.62E-04
TOTALS	CURIES	0.00E+00	0.00E+00	3.70E-02	7.80E-03
G-ALPHA	CURIES	0.00E+00	0.00E+00	5.80E-07	2.22E-06

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 1-5 for typical minimum detectable concentrations.

** There are no continuous mode radioactive liquid release pathways at Plant Hatch.

TABLE 1-2CC*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents
Unit: Site
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE**		BATCH MODE	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
H-3	CURIES	0.00E+00	0.00E+00	1.04E+01	1.42E+01

FISSION & ACTIVATION PRODUCTS

AG-110M	CURIES	0.00E+00	0.00E+00	6.79E-06	0.00E+00
AS-76	CURIES	0.00E+00	0.00E+00	1.07E-02	8.32E-03
BA-140	CURIES	0.00E+00	0.00E+00	7.82E-04	5.33E-05
CE-141	CURIES	0.00E+00	0.00E+00	3.90E-05	3.38E-06
CE-144	CURIES	0.00E+00	0.00E+00	0.00E+00	1.57E-05
CO-57	CURIES	0.00E+00	0.00E+00	5.53E-06	0.00E+00
CO-58	CURIES	0.00E+00	0.00E+00	1.37E-03	1.76E-03
CO-60	CURIES	0.00E+00	0.00E+00	9.05E-03	1.53E-02
CR-51	CURIES	0.00E+00	0.00E+00	2.83E-04	2.15E-03
CS-134	CURIES	0.00E+00	0.00E+00	1.49E-04	9.47E-04
CS-136	CURIES	0.00E+00	0.00E+00	2.71E-05	3.56E-06
CS-137	CURIES	0.00E+00	0.00E+00	4.06E-03	9.93E-03
FE-55	CURIES	0.00E+00	0.00E+00	2.63E-03	2.40E-03
FE-59	CURIES	0.00E+00	0.00E+00	0.00E+00	7.31E-05
I-131	CURIES	0.00E+00	0.00E+00	1.32E-03	7.17E-04
I-132	CURIES	0.00E+00	0.00E+00	3.02E-04	1.25E-05
I-133	CURIES	0.00E+00	0.00E+00	3.29E-03	5.64E-04
I-135	CURIES	0.00E+00	0.00E+00	1.76E-03	0.00E+00
LA-140	CURIES	0.00E+00	0.00E+00	8.64E-04	6.73E-05
MN-54	CURIES	0.00E+00	0.00E+00	2.33E-03	3.21E-03
MN-56	CURIES	0.00E+00	0.00E+00	5.85E-05	3.11E-05
MO-99	CURIES	0.00E+00	0.00E+00	1.41E-03	1.81E-04
NA-24	CURIES	0.00E+00	0.00E+00	4.15E-03	1.60E-03
NB-97	CURIES	0.00E+00	0.00E+00	1.65E-03	6.86E-04
NP-239	CURIES	0.00E+00	0.00E+00	5.93E-04	1.91E-04
SB-122	CURIES	0.00E+00	0.00E+00	0.00E+00	9.75E-06
SB-124	CURIES	0.00E+00	0.00E+00	0.00E+00	3.21E-06
SR-89	CURIES	0.00E+00	0.00E+00	3.54E-04	2.83E-04
SR-90	CURIES	0.00E+00	0.00E+00	5.72E-06	2.59E-05
SR-91	CURIES	0.00E+00	0.00E+00	1.23E-03	8.14E-05
SR-92	CURIES	0.00E+00	0.00E+00	1.89E-04	9.83E-06
TC-99M	CURIES	0.00E+00	0.00E+00	3.02E-03	3.53E-04
TE-129	CURIES	0.00E+00	0.00E+00	0.00E+00	2.05E-05

TABLE 1-2CC*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Liquid Effluents
Unit: Site
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE**		BATCH MODE	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
FISSION & ACTIVATION PRODUCTS					
TE-131	CURIES	0.00E+00	0.00E+00	0.00E+00	1.98E-06
Y-91M	CURIES	0.00E+00	0.00E+00	1.63E-03	1.47E-04
Y-92	CURIES	0.00E+00	0.00E+00	2.89E-04	3.01E-04
ZN-65	CURIES	0.00E+00	0.00E+00	9.52E-03	1.44E-02
ZN-69M	CURIES	0.00E+00	0.00E+00	5.48E-05	3.73E-05
TOTALS	CURIES	0.00E+00	0.00E+00	6.32E-02	6.39E-02
DISSOLVED AND ENTRAINED GASES					
AR-41	CURIES	0.00E+00	0.00E+00	0.00E+00	5.55E-06
KR-85	CURIES	0.00E+00	0.00E+00	1.02E-03	8.89E-04
XE-131M	CURIES	0.00E+00	0.00E+00	1.19E-04	0.00E+00
XE-133	CURIES	0.00E+00	0.00E+00	7.97E-03	2.39E-03
XE-133M	CURIES	0.00E+00	0.00E+00	9.68E-05	0.00E+00
XE-135	CURIES	0.00E+00	0.00E+00	2.49E-02	1.12E-02
XE-135M	CURIES	0.00E+00	0.00E+00	3.88E-03	2.27E-04
TOTALS	CURIES	0.00E+00	0.00E+00	3.80E-02	1.48E-02
G-ALPHA	CURIES	0.00E+00	0.00E+00	2.49E-06	2.75E-06

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 1-5 for typical minimum detectable concentrations.

** There are no continuous mode radioactive liquid release pathways at Plant Hatch.

TABLE 1-3A
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSES TO A MEMBER OF THE PUBLIC DUE TO LIQUID RELEASES
Unit: 1

Starting: 01-Jan-1995 Ending: 30-Jun-1995

Cumulative Doses per Quarter

Organ	ODCM Limit	Units	Quarter 1	% of ODCM Limit	Quarter 2	% of ODCM Limit
Bone	5.0	mrem	7.36E-03	1.47E-01	5.27E-03	1.05E-01
Liver	5.0	mrem	1.49E-02	2.98E-01	1.15E-02	2.29E-01
TBody	1.5	mrem	8.67E-03	5.78E-01	6.59E-03	4.39E-01
Thyroid	5.0	mrem	1.44E-04	2.88E-03	4.24E-05	8.48E-04
Kidney	5.0	mrem	7.48E-03	1.50E-01	6.03E-03	1.21E-01
Lung	5.0	mrem	8.42E-04	1.68E-02	5.30E-04	1.06E-02
GILLI	5.0	mrem	1.08E-02	2.16E-01	1.05E-02	2.10E-01

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	10.0	mrem	1.26E-02	1.26E-01
Liver	10.0	mrem	2.64E-02	2.64E-01
TBody	3.0	mrem	1.53E-02	5.09E-01
Thyroid	10.0	mrem	1.87E-04	1.87E-03
Kidney	10.0	mrem	1.35E-02	1.35E-01
Lung	10.0	mrem	1.37E-03	1.37E-02
GILLI	10.0	mrem	2.13E-02	2.13E-01

TABLE 1-3B
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSES TO A MEMBER OF THE PUBLIC DUE TO LIQUID RELEASES
Unit: 2
Starting: 01-Jan-1995 Ending: 30-Jun-1995

Cumulative Doses per Quarter

Organ	ODCM Limit	Units	Quarter 1	% of ODCM Limit	Quarter 2	% of ODCM Limit
Bone	5.0	mrem	2.90E-03	5.79E-02	3.80E-03	7.60E-02
Liver	5.0	mrem	5.40E-03	1.08E-01	7.30E-03	1.46E-01
TBody	1.5	mrem	3.13E-03	2.09E-01	4.28E-03	2.85E-01
Thyroid	5.0	mrem	3.23E-03	6.46E-02	8.10E-03	1.62E-01
Kidney	5.0	mrem	2.63E-03	5.26E-02	3.65E-03	7.30E-02
Lung	5.0	mrem	3.54E-04	7.07E-03	4.44E-04	8.87E-03
GILLI	5.0	mrem	2.76E-03	5.53E-02	4.59E-03	9.19E-02

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	10.0	mrem	6.70E-03	6.70E-02
Liver	10.0	mrem	1.27E-02	1.27E-01
TBody	3.0	mrem	7.41E-03	2.47E-01
Thyroid	10.0	mrem	1.13E-02	1.13E-01
Kidney	10.0	mrem	6.28E-03	6.28E-02
Lung	10.0	mrem	7.97E-04	7.97E-03
GILLI	10.0	mrem	7.36E-03	7.36E-02

TABLE 1-3AA
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSES TO A MEMBER OF THE PUBLIC DUE TO LIQUID RELEASES
Unit: 1
Starting: 01-Jul-1995 Ending: 31-Dec-1995

Cumulative Doses per Quarter

Organ	ODCM Limit	Units	Quarter 3	% of ODCM Limit	Quarter 4	% of ODCM Limit
Bone	5.0	mrem	9.93E-03	1.99E-01	2.59E-02	5.18E-01
Liver	5.0	mrem	1.46E-02	2.93E-01	3.78E-02	7.56E-01
TBody	1.5	mrem	9.67E-03	6.45E-01	2.54E-02	1.69E+00
Thyroid	5.0	mrem	1.44E-03	2.88E-02	2.89E-03	5.77E-02
Kidney	5.0	mrem	5.30E-03	1.06E-01	1.31E-02	2.61E-01
Lung	5.0	mrem	1.55E-03	3.10E-02	4.20E-03	8.40E-02
GILLI	5.0	mrem	3.29E-03	6.59E-02	2.78E-03	5.56E-02

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	10.0	mrem	4.85E-02	4.85E-01
Liver	10.0	mrem	7.88E-02	7.88E-01
TBody	3.0	mrem	5.03E-02	1.68E+00
Thyroid	10.0	mrem	4.51E-03	4.51E-02
Kidney	10.0	mrem	3.19E-02	3.19E-01
Lung	10.0	mrem	7.12E-03	7.12E-02
GILLI	10.0	mrem	2.74E-02	2.74E-01

TABLE 1-3BB
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSES TO A MEMBER OF THE PUBLIC DUE TO LIQUID RELEASES
Unit: 2
Starting: 01-Jul-1995 Ending: 31-Dec-1995

Cumulative Doses per Quarter

Organ	ODCM Limit	Units	Quarter 3	% of ODCM Limit	Quarter 4	% of ODCM Limit
Bone	5.0	mrem	3.35E-03	6.71E-02	7.03E-03	1.41E-01
Liver	5.0	mrem	5.85E-03	1.17E-01	1.23E-02	2.45E-01
TBody	1.5	mrem	3.62E-03	2.41E-01	7.97E-03	5.31E-01
Thyroid	5.0	mrem	7.63E-03	1.53E-01	1.13E-03	2.26E-02
Kidney	5.0	mrem	2.75E-03	5.51E-02	5.18E-03	1.04E-01
Lung	5.0	mrem	4.47E-04	8.95E-03	9.83E-04	1.97E-02
GILLI	5.0	mrem	3.75E-03	7.51E-02	8.12E-03	1.62E-01

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	10.0	mrem	1.71E-02	1.71E-01
Liver	10.0	mrem	3.08E-02	3.08E-01
TBody	3.0	mrem	1.90E-02	6.33E-01
Thyroid	10.0	mrem	2.01E-02	2.01E-01
Kidney	10.0	mrem	1.42E-02	1.42E-01
Lung	10.0	mrem	2.23E-03	2.23E-02
GILLI	10.0	mrem	1.92E-02	1.92E-01

TABLE 1-5

MINIMUM DETECTABLE CONCENTRATIONS - LIQUID SAMPLE ANALYSES

E. I. HATCH NUCLEAR PLANT

JANUARY, 1995 - DECEMBER, 1995

The values in this table represent a priori Minimum Detectable Concentration (MDC) which are typically achieved in laboratory analyses of liquid radwaste samples.

RADIONUCLIDE	MDC	UNITS
Mn-54	1.97E-08	uCi/ml
Fe-59	3.94E-08	uCi/ml
Co-58	1.59E-08	uCi/ml
Co-60	1.72E-08	uCi/ml
Zn-65	2.92E-08	uCi/ml
Mo-99	1.20E-07	uCi/ml
Cs-134	1.75E-08	uCi/ml
Cs-137	1.62E-08	uCi/ml
Ce-141	1.92E-08	uCi/ml
Ce-144	8.83E-08	uCi/ml
I-131	1.43E-08	uCi/ml
Xe-135	1.03E-08	uCi/ml
Fe-55	2.34E-08	uCi/ml
Sr-89	1.44E-08	uCi/ml
Sr-90	8.50E-09	uCi/ml
H-3	6.00E-07	uCi/ml

2.0 *Gaseous Effluents*

2.1 *ODCM Specifications*

The ODCM Specifications presented in this section are for Unit 1 and Unit 2.

2.1.1 *Dose Rate Limit*

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

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

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

2.1.2 *Air Dose Due To Noble Gas*

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

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

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

2.1.3 *Dose To Any Organ*

The dose to a MEMBER OF THE PUBLIC from Iodine-131, Iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents released, from each unit, to areas at and beyond the SITE BOUNDARY shall be limited to the following.

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

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

2.1.4 *Total Fuel Cycle Dose Commitment (40CFR190)*

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

2.2 *Release Points of Gaseous Effluents*

Waste gas release at Plant Hatch is confined to four paths: main stack (also called the offgas vent), Unit 1 reactor building vent; Unit 2 reactor building vent, and the recombiner building vent. Each of these four paths is continuously monitored for gaseous radioactivity. Each is equipped with an integrating-type sample collection device for collecting particulates and iodines. Unless required more frequently under certain circumstances samples are collected as follows:

1. Noble gas samples are collected by grab sampling monthly.

2. Tritium samples are collected by grab sampling monthly.

3. Radioiodine samples are collected by pulling the sample stream through a charcoal cartridge over a 7-day period.

4. Particulates are collected by pulling the sample stream through a particulate filter over a 7-day period.

5. The 7-day particulate filters above are analyzed for gross alpha activity.

6. Quarterly composite samples are prepared from the particulate filters collected over the previous quarter and the sample is analyzed for Sr-89 and Sr-90.

Sample analyses results and release flow rates from the four release points form the basis for calculating released quantities of radionuclide-specific radioactivity, dose rates associated with gaseous releases, and cumulative doses for the current quarter and year. This task is normally performed with computer assistance.

The noble gas grab sample analysis results are used along with maximum expected release flow rates from each of the four vents to calculate monitor setpoints for the gaseous effluent monitors serving the four release points. Calculation of monitor setpoints is described in the Plant Hatch ODCM.

With each release period released radioactivity, dose rates, and cumulative doses are calculated. Cumulative dose results are tabulated along with the percent of the ODCM limit for each release, for the current quarter and year.

2.3 Total Quantities of Radioactivity, Dose Rates, and Cumulative Doses

The methods for determining release quantities of radioactivity, dose rates, and cumulative doses follow:

2.3.1 Fission and Activation Gas

The released radioactivity is determined using sample analyses results collected as described above and the average release flow rates over the period represented by the collected sample.

Instantaneous dose rates due to noble gases, radioiodines, tritium, and particulates are calculated (with computer assistance). Calculated dose rates are compared to the dose rate limits specified in ODCM 3.1.2 for noble gases, radioiodine, tritium, and particulates. Dose rate calculation methodology is presented in the ODCM.

Beta and gamma air doses due to noble gases are calculated for the location in the unrestricted area with the potential for the highest exposure due to gaseous releases. Air doses are calculated for each release period and cumulative totals are kept for each unit for the calendar quarter and year. Cumulative air doses are compared to the dose limits specified in ODCM 3.1.3. The current percent of the ODCM limits are shown on the printout for each release period. Air dose calculation methodology is presented in the ODCM.

2.3.2 Radioiodine, Tritium and Particulate Releases

Released quantities of radioiodines are determined using the weekly samples and release flow rates for the four release points. Radioiodine concentrations are determined by gamma spectroscopy.

Release quantities of particulates are determined using the weekly (filter) samples and release flow rates for the four release points. Gamma spectroscopy is used to quantify concentrations of principal gamma emitters.

After each quarter, the particulate filters from each vent are combined, fused, and a strontium separation is performed. Since sample flows and vent flows are almost constant over each quarterly period the filters from each vent can be dissolved together. Decay corrections are made back to the middle of the quarterly collection period. If Sr-89 or Sr-90 is not detected, MDC's are calculated. Strontium concentrations are input into the composite file of the computer and used for release dose rate and individual dose calculations.

Tritium samples are obtained monthly from each vent by passing the sample stream through a cold trap. The grams of water vapor/cubic foot is measured upstream of the cold trap in order to alleviate the difficulties in determining water vapor collection efficiencies. The tritium samples are analyzed by an independent laboratory and results are furnished in uCi/ml of water. The tritium concentration in water is converted to the tritium concentration in air and this value is input into the composite file of the computer and used in release, dose rate, and individual dose calculations.

Dose rates due to radioiodine, tritium, and particulates are calculated for a hypothetical child, exposed to the inhalation pathway, at the location in the unrestricted area where the potential dose rate is expected to be the highest. Dose rates are calculated for each release point, for each release period, and the total dose rates from both release points are compared to the dose rate limits specified in ODCM 3.1.2

Individual doses due to radioiodine, tritium and particulates are calculated for the controlling receptor, which is described in the Plant Hatch ODCM. Individual doses are calculated for each release period, and cumulative totals are kept for each unit for the current calendar quarter and year. Cumulative individual doses are compared to the dose limits specified in ODCM 3.1.4. The current percent of ODCM limits are shown on the printout for each release period.

2.3.3 Gross Alpha Release

The gross alpha release is computed each month by counting the particulate filters for each week for gross alpha activity in a proportional counter. The four or five weeks' numbers are then recorded on a data sheet and the activity is summed at the end of the month. The summed activity is then divided by the total monthly volume to determine the concentration.
This concentration is input into the composite file of the computer and used for release calculations.

2.4 Gaseous Effluent Release Data

2.4.1 Methodology

Regulatory Guide 1.21 Tables 1A, 1B, and 1C are found in this report as Tables 2-1A, 2-1AA,2-1B, 2-1BB, 2-1C, 2-1CC, 2-2A, 2-2AA, 2-2B, 2-2BB, 2-2C, 2-2CC, 2-3A, 2-3AA, 2-3B, 2-3BB, 2-3C, and 2-3CC. Data is presented on a quarterly basis as required by Regulatory Guide 1.21 for all quarters.

To complete table 2-1A, 2-1B, and 2-1C, total release for each of the four categories (fission and activation gases, iodine's, particulates, and tritium) was divided by the number of seconds in the quarter to obtain a release rate in uCi/second for each category for each quarter. However, the percent of the ODCM limits are not applicable because we have no curie limits for gaseous releases.

Applicable limits are expressed in terms of dose. Noble gases are limited as specified in ODCM 3.1.2. The other three categories (tritium, radioiodines, and particulates) are limited as a group as specified in ODCM 3.1.2.

Dose rates due to noble gas releases, and due to radioiodine, tritium, and particulates were calculated as part of the pre-release and post-release permits on individual permits. No limits were exceeded for this reporting period.

Gross alpha radioactivity is reported in Table 2-1A, 2-1B, and 2-1C as curies released in each quarter.

Limits for cumulative beta and gamma air doses due to noble gases are specified in ODCM 3.1.3. Cumulative air doses are presented in Table 2-4A and 2-4B, along with percent of ODCM limits.

Limits for cumulative individual doses due to radioiodine, tritium and particulates, are specified in ODCM 3.1.4. Cumulative individual doses are presented in Table 2-5A, and 2-5B, along with percent of ODCM limits.

The total or maximum error associated with the effluent measurement will include the cumulative errors resulting from the total process of sampling and measurement. Due to the difficulty with assigning error terms for each parameter affecting the final measurement, detailed statistical evaluation of error is not suggested. The objective is to obtain an overall estimate of the error associated with measurements of radioactive materials released in liquid and gaseous effluents and solid waste.

Estimated errors are based on errors in counting equipment calibration, counting statistics, vent-flow rates, vent sample flow rates, non steady release rates, chemical yield factors and sample losses for such items as charcoal cartridges.

Fission and activation total release was calculated from sample analysis results and release point flow rates.

Statistical error	60%
Counting equipment calibration	10%
Vent flow Rates	10%
Non-steady release rates	20%
TOTAL ERROR	100%

I-131 releases were calculated from each weekly sample:

Statistical error	60%
Counting equipment calibration	10%
Vent Flow Rates	10%
Vent Sample Flow Rates	10%
Non-Steady release rates	10%
Losses from charcoal cartridges	10%
TOTAL ERROR	110%

Particulates with half lives greater than 8 days releases were calculated from sample and analysis results and release point flow rates.

Statistical error at MDC concentration	60%
Counting equipment calibration	10%
Vent flow rates	10%
Vent sample flow rates	10%
Non steady release rates	10%
TOTAL ERROR	100%

Total tritium releases were calculated from sample analysis results and release point flow rates.

Water vapor in sample stream determination	20%
Vent flow rates	10%
Counting calibration and statistics	10%
Non-steady release rates	50%
TOTAL ERROR	90%

Gross Alpha radioactivity was calculated from sample analysis results and release point flow rates.

Statistical error at MDC concentration	60%
Counting equipment calibration	10%
Vent flow rates	10%
Vent sample flow rates	10%
Non Steady release rates	10%
TOTAL ERROR	100%

2.5 *Radiological Impact Due to Gaseous Releases*

Dose rates due to noble gas release were calculated for the site in accordance with ODCM 3.1.2. Dose rates due to radioiodine, tritium, and particulates in gaseous releases were calculated in accordance with ODCM 3.1.2.

These dose rates were calculated as part of the pre-release and post release on individual release permits. No limits were exceeded for this reporting period.

Cumulative air doses due to noble gas releases were calculated for each unit in accordance with ODCM 3.1.4. These results are presented in Tables 2-6A ,and 2-6B,.

Dose rates and doses were calculated using the methodology presented in the E. I. Hatch Nuclear Plant Offsite Dose Calculation Manual.

2.6 Abnormal Releases

There were no unplanned releases during this reporting period.

TABLE 2-1A
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents - Summation of All Releases
Unit: 1
Starting : 1-Jan-1995 Ending : 30-Jun-1995

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	2.69E+02	1.78E+02	1.00E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	3.46E+01	2.27E+01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	7.30E-03	7.57E-03	1.10E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	9.39E-04	9.62E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	2.51E-03	2.45E-03	1.00E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	3.23E-04	3.12E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
4. GROSS ALPHA RADIOACTIVITY	CURIES	9.34E-08	1.27E-07	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	4.60E+00	5.11E+00	9.00E+01
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	5.92E-01	6.50E-01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, and 2-5B of this report.

TABLE 2-1B
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents - Summation of All Releases
Unit: 2
Starting : 1-Jan-1995 Ending : 30-Jun-1995

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	3.54E+02	1.34E+02	1.00E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	4.56E+01	1.70E+01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	3.45E-03	4.27E-03	1.10E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	4.44E-04	5.43E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	2.03E-03	8.24E-04	1.00E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	2.61E-04	1.05E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
4. GROSS ALPHA RADIOACTIVITY	CURIES	2.46E-07	3.22E-07	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	7.47E+00	7.78E+00	9.00E+01
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	9.60E-01	9.89E-01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, and 2-5B of this report.

TABLE 2-1C
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents - Summation of All Releases
Unit: Site
Starting : 1-Jan-1995 Ending : 30-Jun-1995

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	6.23E+02	3.12E+02	1.00E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	8.01E+01	3.97E+01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	1.08E-02	1.18E-02	1.10E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.38E-03	1.51E-03	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	4.54E-03	3.28E-03	1.00E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	5.84E-04	4.17E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
4. GROSS ALPHA RADIOACTIVITY	CURIES	3.40E-07	4.49E-07	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	1.21E+01	1.29E+01	9.00E+01
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.55E+00	1.64E+00	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, and 2-5B of this report.

TABLE 2-1AA
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents - Summation of All Releases
Unit: 1
Starting : 1-Jul-1995 Ending : 31-Dec-1995

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	1.41E+02	1.30E+02	1.00E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.78E+01	1.63E+01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	8.91E-03	1.48E-03	1.10E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.12E-03	1.87E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	8.69E-04	4.04E-04	1.00E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.09E-04	5.08E-05	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
4. GROSS ALPHA RADIOACTIVITY	CURIES	4.20E-07	8.19E-07	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	9.22E+00	1.52E+00	9.00E+01
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.16E+00	1.91E-01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, and 2-5B of this report.

TABLE 2-1BB
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents - Summation of All Releases
Unit: 2
Starting : 1-Jul-1995 Ending : 31-Dec-1995

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	1.29E+02	1.17E+02	1.00E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.62E+01	1.47E+01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	6.38E-03	1.58E-03	1.10E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	8.03E-04	1.99E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	2.64E-03	5.30E-04	1.00E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	3.33E-04	6.66E-05	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
4. GROSS ALPHA RADIOACTIVITY	CURIES	6.73E-07	6.15E-07	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	5.09E+00	2.70E+00	9.00E+01
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	6.41E-01	3.40E-01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, and 2-5B of this report.

TABLE 2-1CC
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents - Summation of All Releases
Unit: Site
Starting : 1-Jul-1995 Ending : 31-Dec-1995

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	2.70E+02	2.46E+02	1.00E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	3.40E+01	3.10E+01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	1.53E-02	3.06E-03	1.10E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.92E-03	3.85E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	3.51E-03	9.33E-04	1.00E+02
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	4.42E-04	1.17E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
4. GROSS ALPHA RADIOACTIVITY	CURIES	1.09E-06	1.43E-06	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	1.43E+01	4.22E+00	9.00E+01
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.80E+00	5.31E-01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	

* Applicable limits are expressed in terms of dose. See Tables 2-4A, 2-4B, 2-5A, and 2-5B of this report.

TABLE 2-2A*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Elevated Level Releases
Unit: 1
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
FISSION GASES					
XE-138	CURIES	3.62E+01	3.51E+01	0.00E+00	0.00E+00
XE-135M	CURIES	9.78E+00	9.24E+00	0.00E+00	0.00E+00
KR-87	CURIES	2.24E+00	2.36E+00	0.00E+00	0.00E+00
AR-41	CURIES	3.99E-01	6.56E-01	0.00E+00	0.00E+00
KR-85M	CURIES	1.58E+00	1.75E+00	0.00E+00	0.00E+00
XE-135	CURIES	2.36E+00	2.64E+00	0.00E+00	0.00E+00
XE-133	CURIES	9.48E+00	1.85E+01	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	6.20E+01	7.02E+01	0.00E+00	0.00E+00
IODINES					
I-135	CURIES	8.14E-04	0.00E+00	0.00E+00	0.00E+00
I-133	CURIES	6.13E-03	7.80E-03	0.00E+00	0.00E+00
I-131	CURIES	3.31E-04	1.08E-03	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	7.28E-03	8.88E-03	0.00E+00	0.00E+00
PARTICULATES					
I-131	CURIES	4.60E-07	6.98E-07	0.00E+00	0.00E+00
BA-140	CURIES	1.40E-04	1.27E-04	0.00E+00	0.00E+00
SR-89	CURIES	6.85E-05	6.52E-06	0.00E+00	0.00E+00
ZN-65	CURIES	1.60E-06	1.21E-06	0.00E+00	0.00E+00
CE-144	CURIES	0.00E+00	7.34E-07	0.00E+00	0.00E+00
SR-90	CURIES	1.30E-06	1.53E-07	0.00E+00	0.00E+00
CS-137	CURIES	1.20E-06	1.10E-06	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.13E-04	1.37E-04	0.00E+00	0.00E+00
G-ALPHA	CURIES	1.29E-08	1.75E-08	0.00E+00	0.00E+00
H-3	CURIES	5.84E-01	7.19E-01	0.00E+00	0.00E+00

TABLE 2-2A*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Elevated Level Releases
Unit: 1
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-7 for typical minimum detectable concentrations.

** There are no batch mode radioactive gaseous release pathways at Plant Hatch.

TABLE 2-2B*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Elevated Level Releases
Unit: 2
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
FISSION GASES					
XE-138	CURIES	3.62E+01	3.51E+01	0.00E+00	0.00E+00
XE-135M	CURIES	9.78E+00	9.24E+00	0.00E+00	0.00E+00
KR-87	CURIES	2.24E+00	2.36E+00	0.00E+00	0.00E+00
AR-41	CURIES	3.99E-01	6.56E-01	0.00E+00	0.00E+00
KR-85M	CURIES	1.58E+00	1.75E+00	0.00E+00	0.00E+00
XE-135	CURIES	2.36E+00	2.64E+00	0.00E+00	0.00E+00
XE-133	CURIES	9.48E+00	1.85E+01	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	6.20E+01	7.02E+01	0.00E+00	0.00E+00
IODINES					
I-135	CURIES	8.14E-04	0.00E+00	0.00E+00	0.00E+00
I-133	CURIES	6.13E-03	7.80E-03	0.00E+00	0.00E+00
I-131	CURIES	3.31E-04	1.08E-03	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	7.28E-03	8.88E-03	0.00E+00	0.00E+00
PARTICULATES					
I-131	CURIES	4.60E-07	6.98E-07	0.00E+00	0.00E+00
BA-140	CURIES	1.40E-04	1.27E-04	0.00E+00	0.00E+00
SR-89	CURIES	6.85E-05	6.52E-06	0.00E+00	0.00E+00
ZN-65	CURIES	1.60E-06	1.21E-06	0.00E+00	0.00E+00
CE-144	CURIES	0.00E+00	7.34E-07	0.00E+00	0.00E+00
SR-90	CURIES	1.30E-06	1.53E-07	0.00E+00	0.00E+00
CS-137	CURIES	1.20E-06	1.10E-06	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.13E-04	1.37E-04	0.00E+00	0.00E+00
G-ALPHA	CURIES	1.29E-08	1.75E-08	0.00E+00	0.00E+00
H-3	CURIES	5.84E-01	7.19E-01	0.00E+00	0.00E+00

TABLE 2-2B*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Elevated Level Releases
Unit: 2
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-7 for typical minimum detectable concentrations.

** There are no batch mode radioactive gaseous release pathways at Plant Hatch.

TABLE 2-2C*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Elevated Level Releases
Unit: Site
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
FISSION GASES					
XE-138	CURIES	7.23E+01	7.01E+01	0.00E+00	0.00E+00
XE-135M	CURIES	1.96E+01	1.85E+01	0.00E+00	0.00E+00
KR-87	CURIES	4.48E+00	4.72E+00	0.00E+00	0.00E+00
AR-41	CURIES	7.97E-01	1.31E+00	0.00E+00	0.00E+00
KR-85M	CURIES	3.16E+00	3.49E+00	0.00E+00	0.00E+00
XE-135	CURIES	4.73E+00	5.29E+00	0.00E+00	0.00E+00
XE-133	CURIES	1.90E+01	3.70E+01	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.24E+02	1.40E+02	0.00E+00	0.00E+00
IODINES					
I-135	CURIES	1.63E-03	0.00E+00	0.00E+00	0.00E+00
I-133	CURIES	1.23E-02	1.56E-02	0.00E+00	0.00E+00
I-131	CURIES	6.61E-04	2.16E-03	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.46E-02	1.78E-02	0.00E+00	0.00E+00
PARTICULATES					
I-131	CURIES	9.21E-07	1.40E-06	0.00E+00	0.00E+00
BA-140	CURIES	2.81E-04	2.53E-04	0.00E+00	0.00E+00
SR-89	CURIES	1.37E-04	1.30E-05	0.00E+00	0.00E+00
ZN-65	CURIES	3.19E-06	2.42E-06	0.00E+00	0.00E+00
CE-144	CURIES	0.00E+00	1.47E-06	0.00E+00	0.00E+00
SR-90	CURIES	2.60E-06	3.05E-07	0.00E+00	0.00E+00
CS-137	CURIES	2.40E-06	2.20E-06	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	4.27E-04	2.74E-04	0.00E+00	0.00E+00
G-ALPHA	CURIES	2.58E-08	3.50E-08	0.00E+00	0.00E+00
H-3	CURIES	1.17E+00	1.44E+00	0.00E+00	0.00E+00

TABLE 2-2C*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Elevated Level Releases
Unit: Site
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-7 for typical minimum detectable concentrations.

** There are no batch mode radioactive gaseous release pathways at Plant Hatch.

TABLE 2-2AA*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Elevated Level Releases
Unit: 1
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
FISSION GASES					
XE-137	CURIES	6.36E+01	6.04E+01	0.00E+00	0.00E+00
XE-138	CURIES	2.12E+01	3.25E+01	0.00E+00	0.00E+00
XE-135M	CURIES	9.75E+00	1.24E+01	0.00E+00	0.00E+00
KR-87	CURIES	1.74E+00	3.35E+00	0.00E+00	0.00E+00
AR-41	CURIES	5.90E-01	0.00E+00	0.00E+00	0.00E+00
KR-85M	CURIES	2.19E+00	1.96E+00	0.00E+00	0.00E+00
XE-135	CURIES	2.38E+00	3.78E+00	0.00E+00	0.00E+00
XE-133	CURIES	8.95E+00	1.03E+01	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.10E+02	1.25E+02	0.00E+00	0.00E+00
IODINES					
I-133	CURIES	1.40E-02	1.04E-02	0.00E+00	0.00E+00
I-131	CURIES	2.31E-03	1.37E-03	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.63E-02	1.18E-02	0.00E+00	0.00E+00
PARTICULATES					
I-131	CURIES	6.36E-06	1.06E-05	0.00E+00	0.00E+00
BA-140	CURIES	1.59E-04	2.79E-04	0.00E+00	0.00E+00
CE-141	CURIES	0.00E+00	2.90E-07	0.00E+00	0.00E+00
SR-89	CURIES	2.21E-06	1.06E-04	0.00E+00	0.00E+00
CO-58	CURIES	2.01E-07	0.00E+00	0.00E+00	0.00E+00
ZN-65	CURIES	1.24E-06	0.00E+00	0.00E+00	0.00E+00
CE-144	CURIES	0.00E+00	6.40E-07	0.00E+00	0.00E+00
CO-60	CURIES	2.61E-07	0.00E+00	0.00E+00	0.00E+00
SR-90	CURIES	3.54E-08	4.96E-06	0.[illegible]E+00	0.00E+00
CS-137	CURIES	1.2[illegible]-06	2.08E-06	0[illegible]+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.70E-04	4.03E-04	0.00E+00	0.00E+00
G-ALPHA	CURIES	2.41E-08	2.79E-08	0.00E+00	0.00E+00
H-3	CURIES	7.88E-01	3.78E-01	0.00E+00	0.00E+00

TABLE 2-2AA*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Elevated Level Releases
Unit: 1
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-7 for typical minimum detectable concentrations.

** There are no batch mode radioactive gaseous release pathways at Plant Hatch.

TABLE 2-2BB*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Elevated Level Releases
Unit: 2
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
FISSION GASES					
XE-137	CURIES	6.36E+01	5.36E+01	0.00E+00	0.00E+00
XE-138	CURIES	2.12E+01	2.94E+01	0.00E+00	0.00E+00
XE-135M	CURIES	9.52E+00	8.70E+00	0.00E+00	0.00E+00
KR-87	CURIES	1.74E+00	2.97E+00	0.00E+00	0.00E+00
AR-41	CURIES	5.90E-01	0.00E+00	0.00E+00	0.00E+00
KR-85M	CURIES	2.19E+00	1.33E+00	0.00E+00	0.00E+00
XE-135	CURIES	2.30E+00	2.62E+00	0.00E+00	0.00E+00
XE-133	CURIES	8.45E+00	6.04E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.10E+02	1.05E+02	0.00E+00	0.00E+00
IODINES					
I-133	CURIES	1.38E-02	5.64E-03	0.00E+00	0.00E+00
I-131	CURIES	2.18E-03	6.03E-04	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.60E-02	6.24E-03	0.00E+00	0.00E+00
PARTICULATES					
I-131	CURIES	6.08E-06	6.38E-06	0.00E+00	0.00E+00
BA-140	CURIES	1.56E-04	1.99E-04	0.00E+00	0.00E+00
CE-141	CURIES	0.00E+00	2.14E-07	0.00E+00	0.00E+00
SR-89	CURIES	2.03E-06	1.04E-04	0.00E+00	0.00E+00
CO-58	CURIES	2.01E-07	0.00E+00	0.00E+00	0.00E+00
ZN-65	CURIES	1.24E-06	0.00E+00	0.00E+00	0.00E+00
CE-144	CURIES	0.00E+00	6.40E-07	0.00E+00	0.00E+00
CO-60	CURIES	2.61E-07	0.00E+00	0.00E+00	0.00E+00
SR-90	CURIES	3.04E-08	4.91E-06	0.00E+00	0.00E+00
CS-137	CURIES	1.25E-06	1.75E-06	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.67E-04	3.17E-04	0.00E+00	0.00E+00
G-ALPHA	CURIES	2.24E-08	1.66E-08	0.00E+00	0.00E+00
H-3	CURIES	7.53E-01	1.14E-01	0.00E+00	0.00E+00

TABLE 2-2BB*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Elevated Level Releases
Unit: 2
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-7 for typical minimum detectable concentrations.

** There are no batch mode radioactive gaseous release pathways at Plant Hatch.

TABLE 2-2CC*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Elevated Level Releases
Unit: Site
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
FISSION GASES					
XE-137	CURIES	1.27E+02	1.14E+02	0.00E+00	0.00E+00
XE-138	CURIES	4.25E+01	6.20E+01	0.00E+00	0.00E+00
XE-135M	CURIES	1.93E+01	2.11E+01	0.00E+00	0.00E+00
KR-87	CURIES	3.48E+00	6.31E+00	0.00E+00	0.00E+00
AR-41	CURIES	1.18E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	CURIES	4.37E+00	3.29E+00	0.00E+00	0.00E+00
XE-135	CURIES	4.68E+00	6.40E+00	0.00E+00	0.00E+00
XE-133	CURIES	1.74E+01	1.63E+01	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.20E+02	2.29E+02	0.00E+00	0.00E+00
IODINES					
I-133	CURIES	2.78E-02	1.61E-02	0.00E+00	0.00E+00
I-131	CURIES	4.49E-03	1.97E-03	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	3.23E-02	1.80E-02	0.00E+00	0.00E+00
PARTICULATES					
I-131	CURIES	1.24E-05	1.69E-05	0.00E+00	0.00E+00
BA-140	CURIES	3.14E-04	4.78E-04	0.00E+00	0.00E+00
CE-141	CURIES	0.00E+00	5.04E-07	0.00E+00	0.00E+00
SR-89	CURIES	4.24E-06	2.09E-04	0.00E+00	0.00E+00
CO-58	CURIES	4.03E-07	0.00E+00	0.00E+00	0.00E+00
ZN-65	CURIES	2.49E-06	0.00E+00	0.00E+00	0.00E+00
CE-144	CURIES	0.00E+00	1.28E-06	0.00E+00	0.00E+00
CO-60	CURIES	5.22E-07	0.00E+00	0.00E+00	0.00E+00
SR-90	CURIES	6.58E-08	9.86E-06	0.00E+00	0.00E+00
CS-137	CURIES	2.50E-06	3.83E-06	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	3.37E-04	7.19E-04	0.00E+00	0.00E+00
G-ALPHA	CURIES	4.64E-08	4.45E-08	0.00E+00	0.00E+00
H-3	CURIES	1.54E+00	4.92E-01	0.00E+00	0.00E+00

TABLE 2-2CC*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Elevated Level Releases
Unit: Site
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-7 for typical minimum detectable concentrations.

** There are no batch mode radioactive gaseous release pathways at Plant Hatch.

TABLE 2-3A*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Ground Level Releases
Unit: 1
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
FISSION GASES					
XE-135M	CURIES	0.00E+00	2.40E+01	0.00E+00	0.00E+00
KR-87	CURIES	0.00E+00	2.70E-02	0.00E+00	0.00E+00
KR-85M	CURIES	2.57E-02	1.75E-02	0.00E+00	0.00E+00
XE-135	CURIES	7.00E+00	6.61E+01	0.00E+00	0.00E+00
XE-133	CURIES	2.00E+02	1.80E+01	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.07E+02	1.08E+02	0.00E+00	0.00E+00
IODINES					
I-135	CURIES	5.30E-02	0.00E+00	0.00E+00	0.00E+00
I-133	CURIES	2.14E-01	2.19E-01	0.00E+00	0.00E+00
I-131	CURIES	6.59E-03	6.23E-03	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.73E-01	2.26E-01	0.00E+00	0.00E+00
PARTICULATES					
I-131	CURIES	3.78E-04	2.52E-04	0.00E+00	0.00E+00
BA-140	CURIES	8.69E-04	4.57E-04	0.00E+00	0.00E+00
CR-51	CURIES	2.84E-04	0.00E+00	0.00E+00	0.00E+00
CE-141	CURIES	5.34E-05	4.11E-05	0.00E+00	0.00E+00
NB-95	CURIES	3.62E-06	0.00E+00	0.00E+00	0.00E+00
SR-89	CURIES	3.14E-04	1.42E-03	0.00E+00	0.00E+00
CO-58	CURIES	1.98E-05	6.96E-06	0.00E+00	0.00E+00
ZN-65	CURIES	3.37E-04	1.11E-04	0.00E+00	0.00E+00
MN-54	CURIES	1.97E-05	1.56E-06	0.00E+00	0.00E+00
CO-60	CURIES	1.41E-05	3.47E-06	0.00E+00	0.00E+00
SR-90	CURIES	5.26E-06	2.47E-05	0.00E+00	0.00E+00
CS-137	CURIES	1.99E-06	6.14E-10	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.30E-03	2.32E-03	0.00E+00	0.00E+00
G-ALPHA	CURIES	8.05E-08	1.10E-07	0.00E+00	0.00E+00
H-3	CURIES	4.02E+00	4.39E+00	0.00E+00	0.00E+00

TABLE 2-3A*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Ground Level Releases
Unit: 1
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-7 for typical minimum detectable concentrations.

** There are no batch mode radioactive gaseous release pathways at Plant Hatch.

TABLE 2-3B*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Ground Level Releases
Unit: 2
Starting : 1-Jan-1995 Ending : 30-Jun-1995

NUCLIDES RELEASED	UNIT	CONTINUOUS MODE QUARTER 1	CONTINUOUS MODE QUARTER 2	BATCH MODE** QUARTER 1	BATCH MODE** QUARTER 2
FISSION GASES					
XE-135	CURIES	1.80E+01	5.03E+01	0.00E+00	0.00E+00
XE-133	CURIES	2.74E+02	1.32E+01	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.92E+02	6.36E+01	0.00E+00	0.00E+00
IODINES					
I-132	CURIES	0.00E+00	1.24E-02	0.00E+00	0.00E+00
I-135	CURIES	2.93E-02	2.55E-03	0.00E+00	0.00E+00
I-133	CURIES	8.34E-02	9.66E-02	0.00E+00	0.00E+00
I-131	CURIES	2.88E-03	3.00E-03	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.16E-01	1.15E-01	0.00E+00	0.00E+00
PARTICULATES					
I-131	CURIES	2.41E-04	1.88E-04	0.00E+00	0.00E+00
BA-140	CURIES	9.89E-04	4.31E-04	0.00E+00	0.00E+00
CR-51	CURIES	1.00E-05	0.00E+00	0.00E+00	0.00E+00
CE-141	CURIES	3.78E-05	2.41E-05	0.00E+00	0.00E+00
SR-89	CURIES	5.26E-04	3.78E-05	0.00E+00	0.00E+00
ZN-65	CURIES	0.00E+00	5.12E-06	0.00E+00	0.00E+00
SR-90	CURIES	4.74E-06	2.92E-07	0.00E+00	0.00E+00
CS-137	CURIES	6.96E-06	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.81E-03	6.87E-04	0.00E+00	0.00E+00
G-ALPHA	CURIES	2.33E-07	3.05E-07	0.00E+00	0.00E+00
H-3	CURIES	6.88E+00	7.06E+00	0.00E+00	0.00E+00

TABLE 2-3B*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Ground Level Releases
Unit: 2
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-7 for typical minimum detectable concentrations.

** There are no batch mode radioactive gaseous release pathways at Plant Hatch.

TABLE 2-3C*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Ground Level Releases
Unit: Site
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
FISSION GASES					
XE-135M	CURIES	0.00E+00	2.40E+01	0.00E+00	0.00E+00
KR-87	CURIES	0.00E+00	2.70E-02	0.00E+00	0.00E+00
KR-85M	CURIES	2.57E-02	1.75E-02	0.00E+00	0.00E+00
XE-135	CURIES	2.50E+01	1.16E+02	0.00E+00	0.00E+00
XE-133	CURIES	4.74E+02	3.12E+01	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	4.99E+02	1.72E+02	0.00E+00	0.00E+00
IODINES					
I-132	CURIES	0.00E+00	1.24E-02	0.00E+00	0.00E+00
I-135	CURIES	8.22E-02	2.55E-03	0.00E+00	0.00E+00
I-133	CURIES	2.97E-01	3.16E-01	0.00E+00	0.00E+00
I-131	CURIES	9.47E-03	9.23E-03	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	3.89E-01	3.40E-01	0.00E+00	0.00E+00
PARTICULATES					
I-131	CURIES	6.18E-04	4.40E-04	0.00E+00	0.00E+00
BA-140	CURIES	1.86E-03	8.88E-04	0.00E+00	0.00E+00
CR-51	CURIES	2.94E-04	0.00E+00	0.00E+00	0.00E+00
CE-141	CURIES	9.12E-05	6.51E-05	0.00E+00	0.00E+00
NB-95	CURIES	3.62E-06	0.00E+00	0.00E+00	0.00E+00
SR-89	CURIES	8.40E-04	1.46E-03	0.00E+00	0.00E+00
CO-58	CURIES	1.98E-05	6.96E-06	0.00E+00	0.00E+00
ZN-65	CURIES	3.37E-04	1.16E-04	0.00E+00	0.00E+00
MN-54	CURIES	1.97E-05	1.56E-06	0.00E+00	0.00E+00
CO-60	CURIES	1.41E-05	3.47E-06	0.00E+00	0.00E+00
SR-90	CURIES	1.00E-05	2.50E-05	0.00E+00	0.00E+00
CS-137	CURIES	8.95E-06	6.14E-10	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	4.11E-03	3.00E-03	0.00E+00	0.00E+00
G-ALPHA	CURIES	3.14E-07	4.14E-07	0.00E+00	0.00E+00
H-3	CURIES	1.09E+01	1.15E+01	0.00E+00	0.00E+00

TABLE 2-3C*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Ground Level Releases
Unit: Site
Starting : 1-Jan-1995 Ending : 30-Jun-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-7 for typical minimum detectable concentrations.

** There are no batch mode radioactive gaseous release pathways at Plant Hatch.

TABLE 2-3AA*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Ground Level Releases
Unit: 1
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
FISSION GASES					
XE-135	CURIES	2.43E-02	4.91E-02	0.00E+00	0.00E+00
XE-133	CURIES	3.09E+01	4.92E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	3.09E+01	4.97E+00	0.00E+00	0.00E+00
IODINES					
I-135	CURIES	4.52E-03	0.00E+00	0.00E+00	0.00E+00
I-133	CURIES	1.58E-01	4.19E-04	0.00E+00	0.00E+00
I-131	CURIES	6.36E-03	1.05E-04	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.68E-01	5.24E-04	0.00E+00	0.00E+00
PARTICULATES					
I-131	CURIES	2.28E-04	1.22E-06	0.00E+00	0.00E+00
BA-140	CURIES	2.98E-04	0.00E+00	0.00E+00	0.00E+00
CE-141	CURIES	1.97E-05	0.00E+00	0.00E+00	0.00E+00
SR-89	CURIES	7.43E-05	3.20E-08	0.00E+00	0.00E+00
ZN-65	CURIES	6.92E-05	0.00E+00	0.00E+00	0.00E+00
CS-134	CURIES	2.23E-06	0.00E+00	0.00E+00	0.00E+00
SR-90	CURIES	1.28E-06	5.13E-08	0.00E+00	0.00E+00
CS-137	CURIES	5.36E-06	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	6.99E-04	1.30E-06	0.00E+00	0.00E+00
G-ALPHA	CURIES	3.96E-07	7.91E-07	0.00E+00	0.00E+00
H-3	CURIES	8.43E+00	1.14E+00	0.00E+00	0.00E+00

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-7 for typical minimum detectable concentrations.

** There are no batch mode radioactive gaseous release pathways at Plant Hatch.

TABLE 2-3BB*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Ground Level Releases
Unit: 2
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
FISSION GASES					
XE-135	CURIES	1.94E+01	0.00E+00	0.00E+00	0.00E+00
XE-133	CURIES	0.00E+00	1.19E+01	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.94E+01	1.19E+01	0.00E+00	0.00E+00
IODINES					
I-135	CURIES	8.80E-05	0.00E+00	0.00E+00	0.00E+00
I-133	CURIES	6.63E-02	6.00E-03	0.00E+00	0.00E+00
I-131	CURIES	4.00E-03	9.22E-04	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	7.04E-02	6.92E-03	0.00E+00	0.00E+00
PARTICULATES					
I-131	CURIES	1.93E-04	4.71E-05	0.00E+00	0.00E+00
BA-140	CURIES	2.80E-04	6.64E-05	0.00E+00	0.00E+00
CE-141	CURIES	9.27E-06	0.00E+00	0.00E+00	0.00E+00
SR-89	CURIES	1.96E-03	9.69E-05	0.00E+00	0.00E+00
SR-90	CURIES	3.20E-05	2.41E-06	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.48E-03	2.13E-04	0.00E+00	0.00E+00
G-ALPHA	CURIES	6.51E-07	5.98E-07	0.00E+00	0.00E+00
H-3	CURIES	4.34E+00	2.59E+00	0.00E+00	0.00E+00

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-7 for typical minimum detectable concentrations.

** There are no batch mode radioactive gaseous release pathways at Plant Hatch.

TABLE 2-3CC*
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
Gaseous Effluents-Ground Level Releases
Unit: Site
Starting : 1-Jul-1995 Ending : 31-Dec-1995

		CONTINUOUS MODE		BATCH MODE**	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
FISSION GASES					
XE-135	CURIES	1.94E+01	4.91E-02	0.00E+00	0.00E+00
XE-133	CURIES	3.09E+01	1.68E+01	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	5.04E+01	1.69E+01	0.00E+00	0.00E+00
IODINES					
I-135	CURIES	4.61E-03	0.00E+00	0.00E+00	0.00E+00
I-133	CURIES	2.24E-01	6.42E-03	0.00E+00	0.00E+00
I-131	CURIES	1.04E-02	1.03E-03	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.39E-01	7.45E-03	0.00E+00	0.00E+00
PARTICULATES					
I-131	CURIES	4.21E-04	4.84E-05	0.00E+00	0.00E+00
BA-140	CURIES	5.78E-04	6.64E-05	0.00E+00	0.00E+00
CE-141	CURIES	2.90E-05	0.00E+00	0.00E+00	0.00E+00
SR-89	CURIES	2.04E-03	9.69E-05	0.00E+00	0.00E+00
ZN-65	CURIES	6.92E-05	0.00E+00	0.00E+00	0.00E+00
CS-134	CURIES	2.23E-06	0.00E+00	0.00E+00	0.00E+00
SR-90	CURIES	3.33E-05	2.46E-06	0.00E+00	0.00E+00
CS-137	CURIES	5.36E-06	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	3.18E-03	2.14E-04	0.00E+00	0.00E+00
G-ALPHA	CURIES	1.05E-06	1.39E-06	0.00E+00	0.00E+00
H-3	CURIES	1.28E+01	3.73E+00	0.00E+00	0.00E+00

* Zeroes in this table indicate that no radioactivity was present at detectable levels. See Table 2-7 for typical minimum detectable concentrations.

** There are no batch mode radioactive gaseous release pathways at Plant Hatch.

TABLE 2-4A
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
AIR DOSES DUE TO GASEOUS RELEASES
Unit: 1

Starting: 01-Jan-1995 Ending: 30-Jun-1995

Cumulative Doses per Quarter

Type of Radi-ation	ODCM Limit	Units	Quarter 1	% of ODCM Limit	Quarter 2	% of ODCM Limit
Gamma	5.0	mrad	2.32E-02	4.63E-01	5.77E-02	1.15E+00
Beta	10.0	mrad	6.05E-02	6.05E-01	5.33E-02	5.33E-01

Cumulative Doses per Year

Type of Radi-ation	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Gamma	10.0	mrad	8.09E-02	8.09E-01
Beta	20.0	mrad	1.14E-01	5.69E-01

TABLE 2-4B
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
AIR DOSES DUE TO GASEOUS RELEASES
Unit: 2
Starting: 01-Jan-1995 Ending: 30-Jun-1995

Cumulative Doses per Quarter

Type of Radi-ation	ODCM Limit	Units	Quarter 1	% of ODCM Limit	Quarter 2	% of ODCM Limit
Gamma	5.0	mrad	3.57E-02	7.15E-01	2.78E-02	5.55E-01
Beta	10.0	mrad	8.84E-02	8.84E-01	3.68E-02	3.68E-01

Cumulative Doses per Year

Type of Radi-ation	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Gamma	10.0	mrad	6.35E-02	6.35E-01
Beta	20.0	mrad	1.25E-01	6.26E-01

TABLE 2-4AA
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
AIR DOSES DUE TO GASEOUS RELEASES
Unit: 1
Starting: 01-Jul-1995 Ending: 31-Dec-1995

Cumulative Doses per Quarter

Type of Radiation	ODCM Limit	Units	Quarter 3	% of ODCM Limit	Quarter 4	% of ODCM Limit
Gamma	5.0	mrad	3.69E-03	7.38E-02	1.52E-03	3.05E-02
Beta	10.0	mrad	9.87E-03	9.87E-02	2.69E-03	2.69E-02

Cumulative Doses per Year

Type of Radiation	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Gamma	10.0	mrad	8.61E-02	8.61E-01
Beta	20.0	mrad	1.26E-01	6.32E-01

TABLE 2-4BB
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
AIR DOSES DUE TO GASEOUS RELEASES
Unit: 2
Starting: 01-Jul-1995 Ending: 31-Dec-1995

Cumulative Doses per Quarter

Type of Radi-ation	ODCM Limit	Units	Quarter 3	% of ODCM Limit	Quarter 4	% of ODCM Limit
Gamma	5.0	mrad	1.07E-02	2.13E-01	2.02E-03	4.05E-02
Beta	10.0	mrad	1.39E-02	1.39E-01	4.46E-03	4.46E-02

Cumulative Doses per Year

Type of Radi-ation	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Gamma	10.0	mrad	7.62E-02	7.62E-01
Beta	20.0	mrad	1.44E-01	7.18E-01

TABLE 2-5A
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSES TO A MEMBER OF THE PUBLIC DUE TO RADIOIODINES, TRITIUM, AND PARTICULATES IN GASEOUS RELEASES
Unit: 1

Starting: 01-Jan-1995 Ending: 30-Jun-1995

Cumulative Doses per Quarter

Organ	ODCM Limit	Unit	Quarter 1	% of ODCM Limit	Quarter 2	% of ODCM Limit
Bone	7.5	mrem	6.24E-03	8.33E-02	2.37E-02	3.16E-01
Liver	7.5	mrem	3.75E-03	5.00E-02	3.59E-03	4.78E-02
TBody	7.5	mrem	3.55E-03	4.73E-02	5.43E-03	7.24E-02
Thyroid	7.5	mrem	2.37E-01	3.16E+00	2.33E-01	3.10E+00
Kidney	7.5	mrem	4.34E-03	5.79E-02	4.22E-03	5.63E-02
Lung	7.5	mrem	2.76E-03	3.68E-02	2.95E-03	3.93E-02
GILLI	7.5	mrem	3.01E-03	4.01E-02	3.49E-03	4.66E-02

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	15.0	mrem	2.99E-02	2.00E-01
Liver	15.0	mrem	7.34E-03	4.89E-02
TBody	15.0	mrem	8.98E-03	5.99E-02
Thyroid	15.0	mrem	4.70E-01	3.13E+00
Kidney	15.0	mrem	8.56E-03	5.71E-02
Lung	15.0	mrem	5.71E-03	3.81E-02
GILLI	15.0	mrem	6.50E-03	4.33E-02

TABLE 2-5B
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSES TO A MEMBER OF THE PUBLIC DUE TO RADIOIODINES, TRITIUM, AND PARTICULATES IN GASEOUS RELEASES
Unit: 2
Starting: 01-Jan-1995 Ending: 30-Jun-1995

Cumulative Doses per Quarter

Organ	ODCM Limit	Unit	Quarter 1	% of ODCM Limit	Quarter 2	% of ODCM Limit
Bone	7.5	mrem	7.79E-03	1.04E-01	1.04E-03	1.39E-02
Liver	7.5	mrem	4.16E-03	5.55E-02	4.22E-03	5.63E-02
TBody	7.5	mrem	4.48E-03	5.97E-02	4.00E-03	5.33E-02
Thyroid	7.5	mrem	1.01E-01	1.35E+00	1.11E-01	1.48E+00
Kidney	7.5	mrem	4.41E-03	5.88E-02	4.53E-03	6.03E-02
Lung	7.5	mrem	3.99E-03	5.32E-02	3.84E-03	5.12E-02
GILLI	7.5	mrem	4.09E-03	5.46E-02	3.91E-03	5.22E-02

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	15.0	mrem	8.83E-03	5.89E-02
Liver	15.0	mrem	8.39E-03	5.59E-02
TBody	15.0	mrem	8.48E-03	5.65E-02
Thyroid	15.0	mrem	2.12E-01	1.41E+00
Kidney	15.0	mrem	8.94E-03	5.96E-02
Lung	15.0	mrem	7.83E-03	5.22E-02
GILLI	15.0	mrem	8.01E-03	5.34E-02

TABLE 2-5AA
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSES TO A MEMBER OF THE PUBLIC DUE TO RADIOIODINES, TRITIUM, AND PARTICULATES IN GASEOUS RELEASES
Unit: 1

Starting: 01-Jul-1995 Ending: 31-Dec-1995

Cumulative Doses per Quarter

Organ	ODCM Limit	Unit	Quarter 3	% of ODCM Limit	Quarter 4	% of ODCM Limit
Bone	7.5	mrem	2.21E-03	2.94E-02	6.98E-04	9.31E-03
Liver	7.5	mrem	5.47E-03	7.29E-02	6.16E-04	8.21E-03
TBody	7.5	mrem	5.09E-03	6.79E-02	7.21E-04	9.61E-03
Thyroid	7.5	mrem	2.02E-01	2.69E+00	5.73E-03	7.64E-02
Kidney	7.5	mrem	5.96E-03	7.94E-02	6.26E-04	8.34E-03
Lung	7.5	mrem	4.64E-03	6.18E-02	5.99E-04	7.99E-03
GILLI	7.5	mrem	4.81E-03	6.41E-02	6.17E-04	8.22E-03

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	15.0	mrem	3.28E-02	2.19E-01
Liver	15.0	mrem	1.34E-02	8.95E-02
TBody	15.0	mrem	1.48E-02	9.86E-02
Thyroid	15.0	mrem	6.77E-01	4.52E+00
Kidney	15.0	mrem	1.51E-02	1.01E-01
Lung	15.0	mrem	1.09E-02	7.30E-02
GILLI	15.0	mrem	1.19E-02	7.95E-02

TABLE 2-5BB
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSES TO A MEMBER OF THE PUBLIC DUE TO RADIOIODINES, TRITIUM,
AND PARTICULATES IN GASEOUS RELEASES
Unit: 2
Starting: 01-Jul-1995 Ending: 31-Dec-1995

Cumulative Doses per Quarter

Organ	ODCM Limit	Unit	Quarter 3	% of ODCM Limit	Quarter 4	% of ODCM Limit
Bone	7.5	mrem	3.17E-02	4.23E-01	2.13E-03	2.84E-02
Liver	7.5	mrem	2.74E-03	3.65E-02	1.42E-03	1.89E-02
TBody	7.5	mrem	5.92E-03	7.89E-02	1.66E-03	2.22E-02
Thyroid	7.5	mrem	1.08E-01	1.44E+00	2.03E-02	2.70E-01
Kidney	7.5	mrem	3.01E-03	4.01E-02	1.46E-03	1.95E-02
Lung	7.5	mrem	2.85E-03	3.80E-02	1.39E-03	1.85E-02
GILLI	7.5	mrem	3.37E-03	4.50E-02	1.42E-03	1.90E-02

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	15.0	mrem	4.27E-02	2.84E-01
Liver	15.0	mrem	1.25E-02	8.36E-02
TBody	15.0	mrem	1.61E-02	1.07E-01
Thyroid	15.0	mrem	3.40E-01	2.27E+00
Kidney	15.0	mrem	1.34E-02	8.94E-02
Lung	15.0	mrem	1.21E-02	8.04E-02
GILLI	15.0	mrem	1.28E-02	8.53E-02

TABLE 2-7

MINIMUM DETECTABLE CONCENTRATIONS - GASEOUS SAMPLE ANALYSES

E. I. HATCH NUCLEAR PLANT

JANUARY, 1995 THROUGH DECEMBER, 1995

The values in this table represent a priori Minimum Detectable Concentration (MDC) which are typically achieved in laboratory analyses of gaseous radwaste samples.

RADIONUCLIDE	*MDC*	*UNITS*
Kr-87	2.94E-08	uCi/cc
Kr-88	3.22E-08	uCi/cc
Xe-133	2.30E-08	uCi/cc
Xe-133m	7.30E-08	uCi/cc
Xe-135	8.73E-09	uCi/cc
Xe-138	1.99E-07	
I-131	1.34E-13*	uCi/cc
I-133	1.53E-13*	uCi/cc
Mn-54	1.62E-13*	uCi/cc
Fe-59	3.42E-13*	uCi/cc
Co-58	1.30E-13*	uCi/cc
Co-60	1.54E-13*	uCi/cc
Zn-65	2.54E-13*	uCi/cc
Mo-99	9.61E-13*	uCi/cc
Cs-134	1.42E-13*	uCi/cc
Cs-137	1.28E-13*	uCi/cc
Ce-141	1.26E-13*	uCi/cc
Ce-144	5.64E-13*	uCi/cc
Sr-89	1.10E-16	uCi/cc
Sr-90	6.70E-16	uCi/cc
H-3	4.00E-07	uCi/cc

** Based on an estimated sample quantity of 4.078E+07 cc's.*

3.0 Solid Waste

3.1 Regulatory Limits/ODCM

The ODCM Limits presented in this section are for Unit 1 and Unit 2 and are stated in part.

3.1.1 Solid Radioactive Waste System

A.3.1 Solid Radioactive Waste System control states:

The solid radwaste system shall be used in accordance with the PROCESS CONTROL PROGRAM to provide for the SOLIDIFICATION of wet solid wastes and for the SOLIDIFICATION and packaging of other radioactive wastes, as required, to ensure that they meet requirements of 10 CFR Parts 20 and 71, prior to shipment of radioactive wastes from the site.

3.1.2 Reporting Requirements

Technical Specification 5.6.3

The Radioactive Effluent Release Report covering the operation of the unit shall be submitted in accordance with 10 CFR 50.36a. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The material provided shall be consistent with the objectives outlined in the ODCM and the Process Control Program and in conformance with 10 CFR 50.36a and 10 CFR 50, Appendix I, Section IV.B.1.

3.1.3 Process Control Program (PCP)

A.4.1 states in part:

The Radioactive Effluent Release Report, submitted in accordance with Technical Specification 5.6.3, shall include a summary of the Quantities of solid radwaste released from the units as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1, June 1974, with data summarized on a 6 month basis following the format of Appendix B thereof.

For each type of solid radwaste shipped offsite during the report period, the report shall include the following information:

a. Container volume.

b. Total curie quantity (specify whether determined by measurement of estimate).

c. Principal radionuclides (specify whether determined by measurement or estimate).

d. Type of waste (such as spent resin, compacted dry waste, evaporator bottoms).

e. Type of container (such as LSA, type A, type B, large quantity).

f. Solidification agent (such as cement).

Major changes to the solid radioactive waste treatment system shall be reported to the Nuclear Regulatory Commission in the Radioactive Effluent Release Report for the period in which the evaluation was reviewed and accepted by the PRB.

3.2 Solid Waste Data

Regulatory Guide 1.21, Table 3 is found in this report as Table 3-1A and 3-1B.

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 1995
JANUARY 1, 1995 - DECEMBER 31, 1995
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
FOR UNITS I AND II

TABLE 3-IA

FORM TITLE: REG GUIDE 1.21 EFFLUENT AND WASTE DISPOSAL
ANNUAL REPORT OF SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

PERIOD COVERED: FROM 1 / 1 / 95 TO 6 / 30 / 95 FOR UNIT: 1 & 2

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

1. Type of waste	UNIT	6 month period	Est. Total ERROR %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3	1.219 E2	
	Ci	2.416 E3	1.0 E1
b. Dry compressible waste, contaminated equip. etc.	m^3	3.84 E1	
	Ci	5.79 E0	2.0 E1
c. Irradiated components, control rods,	m^3	. E	
	Ci	. E	. E
d. Control Rod Drive Filters	m^3	. E	
	Ci	. E	. E
e. Other (describe) equip. etc.	m^3	. E	
	Ci	. E	. E

2. Estimate of major nuclide composition (by type of waste)

ISOTOPE	PERCENT	CURIES
a. Zn65	46	1111
Co-60	24	580
Fe55	7	169
Cs-137	14	338
Other	9	217
b. Zn-65	66	3.82
Fe-55	9	.52
Co-60	18	1.04
Cs-137	2	.12
Other	5	.29
d.		
e.		

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
32	Truck	Barnwell, SC

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
N/A	N/A	N/A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 1995
JANUARY 1, 1995 - DECEMBER 31, 1995
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
FOR UNITS I AND II

TABLE 3-IA (CONT'D)

FORM TITLE: REG GUIDE 1.21 EFFLUENT AND WASTE DISPOSAL
ANNUAL REPORT OF SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

PERIOD COVERED: FROM 7 / 1 / 95 TO 12 / 31 / 95 FOR UNIT: 1 & 2

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

1. Type of waste	UNIT	6 month period	Est. Total ERROR %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3	1.03 E2	10
	Ci	2.32 E2	1.0 E1
b. Dry compressible waste, contaminated equip. etc.	m^3	3.98 E1	
	Ci	1.89 E0	2.0 E1
c. Irradiated components, control rods,	m^3	. E	
	Ci	. E	. E
d. Control Rod Drive Filters	m^3	. E	
	Ci	. E	. E
e. Other (describe) equip. etc.	m^3	. E	
	Ci	. E	. E

2. Estimate of major nuclide composition (by type of waste)

ISOTOPE	PERCENT	CURIES
a. Zn-65	33	77
Co-60	36	84
Fe-55	13	30
Mn-54	4	9
Other	14	32
b. Zn-65	66	1.25
Co-60	18	.34
Fe-55	9	.17
Mn-54	2	.04
Other	5	.09
d.		
e.		

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
37	Truck	Barnwell, SC

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
N/A	N/A	N/A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 1995
JANUARY 1, 1995 - DECEMBER 31, 1995
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
FOR UNITS I AND II

TABLE 3-IB

FORM TITLE:
OFFSITE DOSE CALCULATION MANUAL, SECTION 7.2, REPORT

PERIOD COVERED FROM: 1/1/95 TO: 6/30/95 FOR UNIT: 1 & 2

TYPE OF WASTE	CURIE QUANTITY/ DETERMINED	PRINCIPLE NUCLIDES/ DETERMINATION	BURIAL COTAINER DESCRIPTION	NUMBER OF CONTAINERS SHIPPED	VOLUME OF EACH CONTAINER CUBIC FEET (FT 3)	TYPE SHIPMENT/ CONTAINER	SOLIDIFICATION AGENT
Dewatered Resins	Measured	Zn-65, Co-60 Fe-55, Cs137	High Integrity	2	132.4	Type B Cask 10-142	NA
Dewatered Resins	Measured	Zn-65, Co-60 Fe-55, Cs137	High Integrity Container	21	202.1	Type A Cask 14-210	NA
DAW (Dry active waste)	Estimated	Zn65, Co60 Fe55, Cs137	Strong Tight Container	14	95	Strong tight boxes B-25	NA

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 1995
JANUARY 1, 1995 - DECEMBER 31, 1995
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
FOR UNITS I AND II

TABLE 3-IB (CONT'D)

FORM TITLE:
OFFSITE DOSE CALCULATION MANUAL, SECTION 7.2, REPORT

PERIOD COVERED FROM: 7 / 1 / 95 TO: 12 / 31 / 95 FOR UNIT: 1 & 2

TYPE OF WASTE	CURIE QUANTITY/ DETERMINED	PRINCIPLE NUCLIDES/ DETERMINATION	BURIAL COTAINER DESCRIPTION	NUMBER OF CONTAINERS SHIPPED	VOLUME OF EACH CONTAINER CUBIC FEET (FT 3)	TYPE SHIPMENT/ CONTAINER	SOLIDIFICATION AGENT
Dewatered Resins	Measured	Zn-65,Co60 Fe-55,Mn54	High Integrity Container	17	202.1	Typa A Cask 14-210	N/A
DAW (Dry Active Waste)	Fstimated	Zn-65,Co60 Fe55,Mn-58	Strong Tight Container B-25	15	95	Strong tight container B-25	N/A

4.0 Changes to the Plant Hatch ODCM

Pursuant to Technical Specification 5.5.1 and ODCM section 7.2.2.5 Licensee initiated changes shall be submitted to the NRC in the form of a complete, legible copy of the entire ODCM as part of or concurrent with the Radioactive Effluent Release Report for the period of the report in which any change in the ODCM was made. Each change shall be identified by markings in the margin of the affected pages, clearly indicating the area of the page that was changed, and shall indicate the date (i.e., month and year) the change was implemented.

On July 31, 1995, the PRB recommended approval of changes to the Plant Hatch ODCM so that changes to definitions and references within the ODCM comply with changes made by the Technical Specifications Improvement Program (TSIP).

Appendix A of this report contains documentation of PRB review and approval of these changes and the revised Plant Hatch ODCM. The modifications are identified as Revision 10.

5.0 Doses to Members of the Public Inside the Site Boundary

The Radioactive Effluent Release Report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY during the report period; this assessment must be performed in accordance with the Plant Hatch ODCM.

The locations of concern within the site boundary are the Roadside Park, the Camping Area, the Recreation Area, and the Visitors Center. Listed in Table 4-1 are: The distance and direction from a point midway between the center of Unit 1 and the Unit 2 reactors, the dispersion and deposition factors for any releases from the Main Stack (elevated)and from the reactor building (ground level); and the estimated maximum occupancy factor for an individual and the assumed age group of this individual.

The source term is not listed in Table 4-1 . The source term is listed in Tables 2-2A, 2-2AA, 2-2B, and 2-2BB for the elevated releases. Similarly, it is listed in Tables 2-3A, 2-3AA, 2-3B, and 2-3BB for the ground level releases.

The maximum doses in units of mrem accumulated by an individual MEMBER OF THE PUBLIC due to their activities inside the site boundary during the reporting period are presented in Table 4-1.

TABLE 4-1
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSE TO A MEMBER OF THE PUBLIC
DUE TO ACTIVITIES INSIDE THE SITE BOUNDARY
Unit: Site

Starting: 01-Jan-1995 Ending: 30-Jun-1995

Page: 1

Location Name	ROADSIDE PARK	
Distance (kilometers)	1.18E+00	
Sector	WNW	
Occupancy Factor	2.28E-04	(2.00E+00 hr/yr)
Age Group	CHILD	

Ground Level Releases:	
Noble Gas X/Q (sec/m3)	7.83E-06
Particulate X/Q (sec/m3)	7.00E-06
Particulate D/Q (m-2)	2.01E-08
Mixed Mode Releases:	
Noble Gas X/Q (sec/m3)	N/A
Particulate X/Q (sec/m3)	N/A
Particulate D/Q (m-2)	N/A
Elevated Releases:	
Noble Gas X/Q (sec/m3)	2.42E-08
Particulate X/Q (sec/m3)	2.37E-08
Particulate D/Q (m-2)	1.29E-09

	Units	Quarter 1	Quarter 2	Quarters 1 and 2	Year to Ending Date
Bone	mrem	1.17E-05	1.76E-05	2.94E-05	2.94E-05
Liver	mrem	1.24E-05	1.82E-05	3.05E-05	3.05E-05
TBody	mrem	1.21E-05	1.80E-05	3.01E-05	3.01E-05
Thyroid	mrem	8.56E-05	8.55E-05	1.71E-04	1.71E-04
Kidney	mrem	1.26E-05	1.84E-05	3.10E-05	3.10E-05
Lung	mrem	1.23E-05	1.81E-05	3.04E-05	3.04E-05
GI-LLI	mrem	1.21E-05	1.79E-05	3.00E-05	3.00E-05

TABLE 4-1
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSE TO A MEMBER OF THE PUBLIC
DUE TO ACTIVITIES INSIDE THE SITE BOUNDARY
Unit: Site

Starting: 01-Jul-1995 Ending: 31-Dec-1995

Location Name	ROADSIDE PARK
Distance (kilometers)	1.18E+00
Sector	WNW
Occupancy Factor	2.28E-04 (2.00E+00 hr/yr)
Age Group	CHILD

Ground Level Releases:	
Noble Gas X/Q (sec/m3)	7.83E-06
Particulate X/Q (sec/m3)	7.00E-06
Particulate D/Q (m-2)	2.01E-08
Mixed Mode Releases:	
Noble Gas X/Q (sec/m3)	N/A
Particulate X/Q (sec/m3)	N/A
Particulate D/Q (m-2)	N/A
Elevated Releases:	
Noble Gas X/Q (sec/m3)	2.42E-08
Particulate X/Q (sec/m3)	2.37E-08
Particulate D/Q (m-2)	1.29E-09

	Units	Quarter 3	Quarter 4	Quarters 3 and 4	Year to Ending Date
Bone	mrem	3.32E-06	7.61E-07	4.09E-06	3.35E-05
Liver	mrem	3.84E-06	9.57E-07	4.80E-06	3.53E-05
TBody	mrem	3.70E-06	9.53E-07	4.66E-06	3.48E-05
Thyroid	mrem	5.30E-05	2.97E-06	5.60E-05	2.27E-04
Kidney	mrem	4.00E-06	9.63E-07	4.96E-06	3.60E-05
Lung	mrem	3.89E-06	9.59E-07	4.85E-06	3.52E-05
GI-LLI	mrem	3.68E-06	9.51E-07	4.63E-06	3.47E-05

TABLE 4-1
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSE TO A MEMBER OF THE PUBLIC
DUE TO ACTIVITIES INSIDE THE SITE BOUNDARY
Unit: Site

Starting: 01-Jan-1995 Ending: 30-Jun-1995

Location Name	CAMPING AREA
Distance (kilometers)	1.27E+00
Sector	WNW
Occupancy Factor	5.48E-03 (4.80E+01 hr/yr)
Age Group	CHILD

Ground Level Releases:	
Noble Gas X/Q (sec/m3)	7.03E-06
Particulate X/Q (sec/m3)	6.27E-06
Particulate D/Q (m-2)	1.80E-08
Mixed Mode Releases:	
Noble Gas X/Q (sec/m3)	N/A
Particulate X/Q (sec/m3)	N/A
Particulate D/Q (m-2)	N/A
Elevated Releases:	
Noble Gas X/Q (sec/m3)	2.38E-08
Particulate X/Q (sec/m3)	2.33E-08
Particulate D/Q (m-2)	1.21E-09

	Units	Quarter 1	Quarter 2	Quarters 1 and 2	Year to Ending Date
Bone	mrem	2.53E-04	3.81E-04	6.34E-04	6.34E-04
Liver	mrem	2.67E-04	3.92E-04	6.59E-04	6.59E-04
TBody	mrem	2.62E-04	3.88E-04	6.50E-04	6.50E-04
Thyroid	mrem	1.84E-03	1.84E-03	3.68E-03	3.68E-03
Kidney	mrem	2.73E-04	3.97E-04	6.70E-04	6.70E-04
Lung	mrem	2.66E-04	3.90E-04	6.56E-04	6.56E-04
GI-LLI	mrem	2.62E-04	3.87E-04	6.49E-04	6.49E-04

TABLE 4-1
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSE TO A MEMBER OF THE PUBLIC
DUE TO ACTIVITIES INSIDE THE SITE BOUNDARY
Unit: Site

Starting: 01-Jul-1995 Ending: 31-Dec-1995

Location Name	CAMPING AREA	
Distance (kilometers)	1.27E+00	
Sector	WNW	
Occupancy Factor	5.48E-03	(4.80E+01 hr/yr)
Age Group	CHILD	

Ground Level Releases:	
Noble Gas X/Q (sec/m3)	7.03E-06
Particulate X/Q (sec/m3)	6.27E-06
Particulate D/Q (m-2)	1.80E-08
Mixed Mode Releases:	
Noble Gas X/Q (sec/m3)	N/A
Particulate X/Q (sec/m3)	N/A
Particulate D/Q (m-2)	N/A
Elevated Releases:	
Noble Gas X/Q (sec/m3)	2.38E-08
Particulate X/Q (sec/m3)	2.33E-08
Particulate D/Q (m-2)	1.21E-09

	Units	Quarter 3	Quarter 4	Quarters 3 and 4	Year to Ending Date
Bone	mrem	7.20E-05	1.68E-05	8.88E-05	7.23E-04
Liver	mrem	8.31E-05	2.10E-05	1.04E-04	7.64E-04
TBody	mrem	8.02E-05	2.09E-05	1.01E-04	7.51E-04
Thyroid	mrem	1.14E-03	6.44E-05	1.21E-03	4.89E-03
Kidney	mrem	8.65E-05	2.11E-05	1.08E-04	7.77E-04
Lung	mrem	8.42E-05	2.10E-05	1.05E-04	7.61E-04
GI-LLI	mrem	7.96E-05	2.09E-05	1.00E-04	7.49E-04

TABLE 4-1
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSE TO A MEMBER OF THE PUBLIC
DUE TO ACTIVITIES INSIDE THE SITE BOUNDARY
Unit: Site

Starting: 01-Jan-1995 Ending: 30-Jun-1995

Location Name	RECREATION AREA
Distance (kilometers)	1.03E+00
Sector	SSE
Occupancy Factor	2.37E-02 (2.08E+02 hr/yr)
Age Group	CHILD

Ground Level Releases:	
Noble Gas X/Q (sec/m3)	6.42E-06
Particulate X/Q (sec/m3)	5.73E-06
Particulate D/Q (m-2)	2.36E-08
Mixed Mode Releases:	
Noble Gas X/Q (sec/m3)	N/A
Particulate X/Q (sec/m3)	N/A
Particulate D/Q (m-2)	N/A
Elevated Releases:	
Noble Gas X/Q (sec/m3)	3.30E-08
Particulate X/Q (sec/m3)	3.21E-08
Particulate D/Q (m-2)	1.56E-09

	Units	Quarter 1	Quarter 2	Quarters 1 and 2	Year to Ending Date
Bone	mrem	1.01E-03	1.51E-03	2.52E-03	2.52E-03
Liver	mrem	1.07E-03	1.55E-03	2.62E-03	2.62E-03
TBody	mrem	1.05E-03	1.54E-03	2.59E-03	2.59E-03
Thyroid	mrem	7.30E-03	7.28E-03	1.46E-02	1.46E-02
Kidney	mrem	1.09E-03	1.57E-03	2.66E-03	2.66E-03
Lung	mrem	1.06E-03	1.55E-03	2.61E-03	2.61E-03
GI-LLI	mrem	1.04E-03	1.53E-03	2.58E-03	2.58E-03

TABLE 4-1
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSE TO A MEMBER OF THE PUBLIC
DUE TO ACTIVITIES INSIDE THE SITE BOUNDARY
Unit: Site

Starting: 01-Jul-1995 Ending: 31-Dec-1995

Location Name	RECREATION AREA
Distance (kilometers)	1.03E+00
Sector	SSE
Occupancy Factor	2.37E-02 (2.08E+02 hr/yr)
Age Group	CHILD

Ground Level Releases:

Noble Gas X/Q (sec/m3)	6.42E-06
Particulate X/Q (sec/m3)	5.73E-06
Particulate D/Q (m-2)	2.36E-08

Mixed Mode Releases:

Noble Gas X/Q (sec/m3)	N/A
Particulate X/Q (sec/m3)	N/A
Particulate D/Q (m-2)	N/A

Elevated Releases:

Noble Gas X/Q (sec/m3)	3.30E-08
Particulate X/Q (sec/m3)	3.21E-08
Particulate D/Q (m-2)	1.56E-09

	Units	Quarter 3	Quarter 4	Quarters 3 and 4	Year to Ending Date
Bone	mrem	2.89E-04	6.73E-05	3.57E-04	2.88E-03
Liver	mrem	3.33E-04	8.40E-05	4.17E-04	3.04E-03
TBody	mrem	3.22E-04	8.36E-05	4.05E-04	2.99E-03
Thyroid	mrem	4.52E-03	2.57E-04	4.78E-03	1.94E-02
Kidney	mrem	3.47E-04	8.45E-05	4.31E-04	3.09E-03
Lung	mrem	3.38E-04	8.42E-05	4.22E-04	3.03E-03
GI-LLI	mrem	3.19E-04	8.35E-05	4.03E-04	2.98E-03

TABLE 4-1
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSE TO A MEMBER OF THE PUBLIC
DUE TO ACTIVITIES INSIDE THE SITE BOUNDARY
Unit: Site

Starting: 01-Jan-1995 Ending: 30-Jun-1995

Location Name	VISITORS CENTER
Distance (kilometers)	6.94E-01
Sector	WSW
Occupancy Factor	4.57E-04 (4.00E+00 hr/yr)
Age Group	CHILD

Ground Level Releases:	
Noble Gas X/Q (sec/m3)	1.87E-05
Particulate X/Q (sec/m3)	1.72E-05
Particulate D/Q (m-2)	5.47E-08
Mixed Mode Releases:	
Noble Gas X/Q (sec/m3)	N/A
Particulate X/Q (sec/m3)	N/A
Particulate D/Q (m-2)	N/A
Elevated Releases:	
Noble Gas X/Q (sec/m3)	5.00E-08
Particulate X/Q (sec/m3)	4.97E-08
Particulate D/Q (m-2)	2.26E-09

	Units	Quarter 1	Quarter 2	Quarters 1 and 2	Year to Ending Date
Bone	mrem	5.59E-05	8.41E-05	1.40E-04	1.40E-04
Liver	mrem	5.91E-05	8.67E-05	1.46E-04	1.46E-04
TBody	mrem	5.80E-05	8.57E-05	1.44E-04	1.44E-04
Thyroid	mrem	4.20E-04	4.18E-04	8.38E-04	8.38E-04
Kidney	mrem	6.03E-05	8.78E-05	1.48E-04	1.48E-04
Lung	mrem	5.87E-05	8.63E-05	1.45E-04	1.45E-04
GI-LLI	mrem	5.78E-05	8.56E-05	1.43E-04	1.43E-04

TABLE 4-1
E. I. HATCH NUCLEAR PLANT
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 1995
DOSE TO A MEMBER OF THE PUBLIC
DUE TO ACTIVITIES INSIDE THE SITE BOUNDARY
Unit: Site

Starting: 01-Jul-1995 Ending: 31-Dec-1995

Location Name	VISITORS CENTER
Distance (kilometers)	6.94E-01
Sector	WSW
Occupancy Factor	4.57E-04 (4.00E+00 hr/yr)
Age Group	CHILD

Ground Level Releases:

Noble Gas X/Q (sec/m3)	1.87E-05
Particulate X/Q (sec/m3)	1.72E-05
Particulate D/Q (m-2)	5.47E-08

Mixed Mode Releases:

Noble Gas X/Q (sec/m3)	N/A
Particulate X/Q (sec/m3)	N/A
Particulate D/Q (m-2)	N/A

Elevated Releases:

Noble Gas X/Q (sec/m3)	5.00E-08
Particulate X/Q (sec/m3)	4.97E-08
Particulate D/Q (m-2)	2.26E-09

	Units	Quarter 3	Quarter 4	Quarters 3 and 4	Year to Ending Date
Bone	mrem	1.56E-05	3.09E-06	1.87E-05	1.59E-04
Liver	mrem	1.82E-05	4.05E-06	2.22E-05	1.68E-04
TBody	mrem	1.75E-05	4.03E-06	2.15E-05	1.65E-04
Thyroid	mrem	2.60E-04	1.40E-05	2.74E-04	1.11E-03
Kidney	mrem	1.90E-05	4.08E-06	2.30E-05	1.71E-04
Lung	mrem	1.84E-05	4.06E-06	2.25E-05	1.67E-04
GI-LLI	mrem	1.74E-05	4.02E-06	2.14E-05	1.65E-04

6.0 Major Changes to Liquid, Gaseous, and Solid Radwaste Treatment Systems

The Radioactive Effluent Release Report shall include. . . . any major change to liquid, gaseous, or solid radwaste treatment systems pursuant to ODCM Chapter 7, Section 7.2.2.7.

Gaseous Radwaste System

There were no major changes to the gaseous radwaste system during this reporting period.

Solid Radwaste System

There were no major changes to the solid radwaste system during this reporting period.

Liquid Radwaste System

There were no major changes to the Liquid Radwaste Treatment System during this reporting period.

7.0 Meteorological Data

The Radiological Effluent Release Report to be submitted by May 1 of each year shall include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing of wind speed, wind direction, atmospheric stability, and precipitation (if measured),on magnetic tape or in the form of joint frequency distributions of wind speed, wind direction and atmospheric stability.

In lieu of submission with the Radioactive Effluent Release Report, the licensee has retained this summary of required meteorological data on site in a file that shall be provided to the NRC upon request.

8.0 Inoperable Liquid or Gaseous Effluent Monitoring Instrumentation

The Offsite Dose Calculation Manual Chapter 7, Section 7.2.2.6.2 states that the Radiological Effluent Release Report shall include deviations from the liquid and gaseous effluent monitoring instrumentation operability requirements included in sections 2.1.1 and 3.1.1, respectively.

Specifically, Section 3.1.1, Table 3-1 Radioactive Gaseous Effluent Monitoring Instrumentation, Action 104 states that with the number of channels operable less than required by the minimum channels operable requirement, effluent releases via this pathway may continue provided the flowrate is estimated at least once per 4 hours. If the number of channels operable remains less than required by the minimum channels operable requirement for over 30 days, an explanation of the circumstances must be included in the next Radioactive Effluent Release Report.

The Main Stack flow recorder 1D11-R625 was tagged out of service on September 22, 1995, due to the flow recorder failing a channel check. The probe and monitor were repaired and reinstalled. After repair, a loop calibration was performed and all indications were reading correctly. The Main Stack flow recorder was placed back into service November 3, 1995.

9.0 Tanks Exceeding Curie Content Limits

3.15.1.4 (a) The contents within any outside temporary tank shall be limited to ≤ 10 curies, excluding tritium and dissolved or entrained noble gases.

There were no outside temporary tanks utilized during this reporting period.

GEORGIA POWER COMPANY

E. I. HATCH NUCLEAR PLANT

UNITS NO. 1 & 2

ANNUAL REPORT

JANUARY 1, 1995 - DECEMBER 31, 1995

APPENDIX A

OFFSITE DOSE CALCULATION MANUAL

FOR

GEORGIA POWER COMPANY

EDWIN I. HATCH NUCLEAR PLANT

Revision 10

July 13, 1995

EFFECTIVE PAGE LIST

Page	Revision No.	Date
i	10	7/95
ii	9	2/94
iii	8	1/94
iv	10	7/95
v, vi	9	2/94
vii	10	7/95
viii, ix	8	1/94
1-1	10	7/95
2-1	10	7/95
2-2	9	2/94
2-3	8	1/94
2-4	10	7/95
2-5	8	1/94
2-6	8	1/94
2-7	10	7/95
2-8	8	1/94
2-9	8	1/94
2-10	10	7/95
2-11	8	1/94
2-12	10	7/95
2-13	10	7/95
2-14 thru 2-33	8	1/94
2-34	9	2/94
2-35 thru 2-47	8	1/94
3-1	10	7/95
3-2	9	2/94
3-3	8	1/94
3-4	10	7/95
3-5	8	1/94
3-6	8	1/94
3-7	10	7/95
3-8	8	1/94
3-9	8	1/94
3-10	10	7/95
3-11	10	7/95
3-12	8	1/94
3-13	10	7/95
3-14	8	1/94
3-15	10	7/95
3-16	10	7/95
3-17 thru 3-30	8	1/94
3-31	10	7/95
3-32 thru 3-41	8	1/94
3-42	10	7/95
3-43 thru 3-55	8	1/94
4-1 thru 4-3	10	7/95
4-4 thru 4-8	8	1/94
4-9 thru 4-11	10	7/95
4-12 thru 4-19	8	1/94
5-1	10	7/95
5-2 thru 5-4	8	1/94
6-1 thru 6-6	8	1/94
7-1	10	7/95
7-2	8	1/94
7-3	10	7/95
7-4 thru 7-7	10	7/95
8-1 thru 8-20	8	1/94
9-1 thru 9-45	8	1/94
10-1 thru 10-8	10	7/95

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF FIGURES

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CHAPTER 1

INTRODUCTION

The Offsite Dose Calculation Manual is a supporting document of the Technical Specifications. As such, it describes the methodology and parameters to be used in the calculation of offsite doses due to radioactive liquid and gaseous effluents, and in the calculation of liquid and gaseous effluent monitoring instrumentation alarm setpoints. In addition, it contains the following:

- The controls required by the Technical Specifications, governing the radioactive effluent and radiological environmental monitoring programs.
- Schematics of liquid and gaseous radwaste effluent treatment systems, which include designation of release points to UNRESTRICTED AREAS.
- A list and maps indicating the specific sample locations for the Radiological Environmental Monitoring Program.
- Specifications and descriptions of the information that must be included ~~in the~~ Annual Radiological Environmental ~~Surveillance~~ Operating Report and the ~~Annual~~ Radioactive Effluent Release Report ~~required~~ by the Technical Specifications.

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

Equations and methods used in the ODCM are based on those presented in NUREG-0133 (Reference 1), in Regulatory Guide 1.109 (References 2 and 3), in Regulatory Guide 1.111 (References 4 and 5), and in Regulatory Guide 1.113 (Reference 6).

CHAPTER 2
LIQUID EFFLUENTS

2.1 LIMITS OF OPERATION

The following Liquid Effluent Controls implement requirements established by Technical Specifications Section ~~6.0.~~ 5.0. Terms printed in all capital letters are defined in Chapter 10.

2.1.1 Liquid Effluent Monitoring Instrumentation Control

In accordance with Technical Specification ~~6.18(1)~~ 5.5.4.a., the radioactive liquid effluent monitoring instrumentation channels shown in Table 2-1 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits specified in Section 2.1.2 are not exceeded. The alarm/trip setpoints of these channels shall be determined in accordance with Section 2.3.

2.1.1.1 Applicability

As shown in Table 2-1.

2.1.1.2 Actions

With a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above control, immediately suspend the release of radioactive liquid effluents monitored by the affected channel, declare the channel inoperable, or change the setpoint to a conservative value.

With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 2-1.

One instrument channel may be inoperable for up to 6 hours to perform required surveillances prior to entering other applicable ACTIONS.

When the ACTION statement or other requirements of this control cannot be met, steps need not be taken to change the Operational Mode of the unit. Entry into an Operational Mode or other specified CONDITION may be made if, as a minimum, the requirements of the ACTION statement are satisfied.

2.1.1.3 Surveillance Requirements

Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table 2-2.

2.1.1.4 Basis

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in Section 2.3 to ensure that the alarm/trip will occur prior to exceeding the limits of Section 2.1.2. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

Table 2-1. Radioactive Liquid Effluent Monitoring Instrumentation

Instrument	OPERABILITY Requirements[a]		
	Minimum Channels OPERABLE	Applicability[b]	ACTION
1. Gross Radioactivity Monitors Providing Automatic Termination of Release			
Liquid Radwaste Effluent Line	1	(1)	100
2. Gross Radioactivity Monitors not Providing Automatic Termination of Release			
Service Water System Effluent Line	1	(2)	101
3. Flowrate Measurement Devices[c]			
a. Liquid Radwaste Effluent Line	1	(1)	102
b. Discharge Canal	1	(1),(2)	102
4. Differential Pressure Measurement Devices			
Service Water System to Closed Cooling Water System	1	At all times	103

a. All requirements in this Table apply to each unit.

b. Applicability of requirements is as follows:

(1) Whenever the radwaste discharge valves are not locked closed.

(2) Whenever the Service Water System pressure is below the Closed Cooling Water System pressure, or ΔP indication is not available.

c. Pump curves may be used to estimate flow; in such cases, ACTION statement 102 is not required.

Table 2-1 (contd). Notation for Table 2-1 — ACTION Statements

ACTION 100 — With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases may continue provided that prior to initiating a release:

a. At least two independent samples are analyzed in accordance with Section 2.1.2.3, and

b. At least two technically qualified individuals independently verify the discharge line valving and verify the release rate calculations.

Otherwise, suspend release of radioactive effluents via this pathway. If the channel remains inoperable for over 30 ~~days,~~ an explanation of the circumstances must be included in the next ~~Annual~~ Radioactive Effluent Release Report.

ACTION 101 — With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue, provided that once per shift grab samples are collected and analyzed for gross radioactivity at a MINIMUM DETECTABLE CONCENTRATION no higher than 1×10^{-7} µCi/mL. If the channel remains inoperable for over ~~30 days~~, an explanation of the circumstances must be included in the next ~~Annual~~ Radioactive Effluent Release Report.

ACTION 102 — With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue, provided that the flowrate is estimated at least once per 4 hours during actual releases. If the channel remains inoperable for over 30 days, an explanation of the circumstances must be included in the next ~~Annual~~ Radioactive Effluent Release Report.

ACTION 103 — With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, assure that the Service Water System effluent monitor is OPERABLE.

Table 2-2. Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements

Instrument	Surveillance Requirements[a]			
	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
1. Gross Radioactivity Monitors Providing Automatic Termination of Release				
Liquid Radwaste Effluent Line	D[b]	P[c]	R	Q[c]
2. Gross Radioactivity Monitors not Providing Automatic Termination of Release				
Service Water System Effluent Line	D[b]	M	R	Q[f]
3. Flowrate Measurement Devices				
a. Liquid Radwaste Effluent Line	D[b,d]	NA	R	Q
b. Discharge Canal	D[b,d]	NA	R	Q
4. Differential Pressure Measurement Devices				
Service Water System to Closed Cooling Water System	D	NA	R	NA

Table 2-2 (contd). Notation for Table 2-2 – Surveillance Requirements

a. All requirements in this Table apply to each unit.

b. During releases via this pathway.

c. In addition to the basic functions of a CHANNEL FUNCTIONAL TEST (Section 10.2), the CHANNEL FUNCTIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation occur if any of the following conditions exists:

   (1) Instrument indicates measured levels above the alarm/trip setpoint;

   (2) Instrument indicates an isolation on high alarm; or

   (3) Instrument controls are not set in operate mode.

d. CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once daily on any day on which CONTINUOUS, periodic, or BATCH releases are made.

e. The SOURCE CHECK shall consist of verifying that the instrument is reading onscale.

f. In addition to the basic functions of a CHANNEL FUNCTIONAL TEST (Section 10.2), the CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

   (1) Instrument indicates measured levels above the alarm setpoint;

   (2) Instrument indicates a downscale failure; or

   (3) Instrument controls are not set in operate mode.

2.1.2 Liquid Effluent Concentration Control

In accordance with Technical Specifications ~~6.18(2)c~~ 5.5.4.b. and ~~6.18(3)~~ 5.5.4.c. the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS (see Figure 10-1) shall be limited at all times to ten times the concentrations specified in 10 CFR 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 1×10^{-4} µCi/mL total activity.

2.1.2.1 Applicability

This limit applies at all times.

2.1.2.2 Actions

With the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS exceeding the limits stated in Section 2.1.2, immediately restore the concentration to within the stated limits.

When the ACTION statement or other requirements of this control cannot be met, steps need not be taken to change the Operational Mode of the unit. Entry into an Operational Mode or other specified CONDITION may be made if, as a minimum, the requirements of the ACTION statement are satisfied.

2.1.2.3 Surveillance Requirements

The radioactivity content of each batch of radioactive liquid waste shall be determined by sampling and analysis in accordance with Table 2-3. The results of radioactive analyses shall be used with the calculational methods in Section 2.3 to assure that the concentration at the point of release is maintained within the limits of Section 2.1.2.

2.1.2.4 Basis

This control is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will be less than ten times the concentration levels specified in 10 CFR 20, Appendix B, Table 2, Column 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR 50, to a MEMBER OF THE PUBLIC, and (2) the limits of 10 CFR 20.1301 to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2 (1959). The resulting concentration of 2×10^{-4} was then multiplied by the ratio of the effluent concentration limit for Xe-135, stated in Appendix B, Table 2, Column 1 of 10 CFR 20 (paragraphs 20.1001 to 20.2401), to the MPC for Xe-135, stated in Appendix B, Table II, Column 1 of 10 CFR 20 (paragraphs 20.1 to 20.601), to obtain the limiting concentration of 1×10^{-4} μCi/mL.

Table 2-3. Radioactive Liquid Waste Sampling and Analysis Program

Liquid Release Type	Sampling and Analysis Requirements[a,b] Sampling FREQUENCY	Minimum Analysis FREQUENCY	Type of Activity Analysis	MINIMUM DETECTABLE CONCENTRATION (MDC) (μCi/mL)
Batch Waste Release Tanks	P Each BATCH	P Each BATCH	PRINCIPAL GAMMA EMITTERS	5 E-7[c]
			I-131	1 E-6
	P One BATCH/M	M	Dissolved and Entrained Gases (Gamma Emitters)	1 E-5
	P Each BATCH	M COMPOSITE	H-3	1 E-5
			Gross Alpha	1 E-7
	P Each BATCH	Q COMPOSITE	Sr-89, Sr-90	5 E-8
			Fe-55	2 E-6

a. All requirements in this table apply to each unit.

b. Terms printed in all capital letters are defined in Chapter 10.

c. For certain radionuclides with low gamma yield or low energies, or for certain radionuclide mixtures, it may not be possible to measure radionuclides at or near the required MINIMUM DETECTABLE CONCENTRATION. Under these circumstances, the required MINIMUM DETECTABLE CONCENTRATION may be increased inversely proportionally to the magnitude of the gamma yield (i.e., 5E-7/I, where I = photon abundance expressed as a decimal fraction). In no case shall the MINIMUM DETECTABLE CONCENTRATION, as calculated in this manner for a specific radionuclide, be greater than 10 percent of the corresponding Effluent Concentration Limit value specified in 10 CFR 20 Appendix B, Table 2, Column 2.

2.1.3 Liquid Effluent Dose Control

In accordance with Technical Specifications 5.5.4.d. ~~6.10(4)~~ and 5.5.4.e, ~~6.10(5)~~, the dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each unit, to UNRESTRICTED AREAS (see Figure 10-1) shall be limited:

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

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

2.1.3.1 Applicability

These limits apply at all times.

2.1.3.2 Actions

With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the limits of Section 2.1.3, prepare and submit to the Nuclear Regulatory Commission within 30 days, ~~pursuant to Technical Specification 6.9.2,~~ a Special Report which identifies the cause(s) for exceeding the limit(s); defines the corrective actions to be taken to reduce the releases; and defines the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the limits of Section 2.1.3. ~~For Unit 2, this report is in lieu of any other report required by Technical Specification 6.9.1.~~ This report shall also include (1) the results of radiological analyses of the drinking water source, and (2) the radiological impact on finished water supplies with regard to the requirements of 40 CFR 141, the Safe Drinking Water Act.

When the ACTION statement or other requirements of this control cannot be met, steps need not be taken to change the Operational Mode of the unit. Entry into an Operational Mode or other specified CONDITION may be made if, as a minimum, the requirements of the ACTION statement are satisfied.

2.1.3.3 Surveillance Requirements

At least once per 31 days, cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined, for each unit, in accordance with Section 2.4.

2.1.3.4 Basis

This control is provided to implement the requirements of Sections II.A, III.A and IV.A of Appendix I, 10 CFR Part 50. The limits stated in Section 2.1.3 implement the guides set forth in Section II.A of Appendix I. The ACTIONS stated in Section 2.1.3.2 provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable." Also, for fresh water sites with drinking water supplies that can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR Part 141. The dose calculations in Section 2.4 implement the requirements in Section III.A of Appendix I, which state that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The equations specified in Section 2.4 for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109 (Reference 3) and Regulatory Guide 1.113 (Reference 6).

This control applies to the release of liquid effluents from each unit at the site. The liquid effluents from shared LIQUID RADWASTE TREATMENT SYSTEMs are to be proportioned between the units.

2.1.4 Liquid Radwaste Treatment System Control

5.5.4.f.,

In accordance with Technical Specification ~~6.12(6),~~ the LIQUID RADWASTE TREATMENT SYSTEM shall be OPERABLE. The appropriate portions of the system shall be used to reduce radioactivity in liquid wastes prior to their discharge when the projected doses due to the liquid effluent, from each unit, to UNRESTRICTED AREAS (see Figure 10-1) would exceed 0.06 mrem to the total body or 0.2 mrem to any organ of a MEMBER OF THE PUBLIC in 31 days.

2.1.4.1 Applicability

This limit applies at all times.

2.1.4.2 Actions

With radioactive liquid waste being discharged without treatment and in excess of the above limits and any portion of the LIQUID RADWASTE TREATMENT SYSTEM not in operation, prepare and submit to the Nuclear Regulatory Commission within 30 days ~~pursuant to Technical Specification 6.9.2~~ a Special Report which includes the following information:

a. Explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems and the reason for inoperability,

b. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

c. Summary description of action(s) taken to prevent a recurrence.

When the ACTION statement or other requirements of this control cannot be met, steps need not be taken to change the Operational Mode of the unit. Entry into an Operational Mode or other specified CONDITION may be made if, as a minimum, the requirements of the ACTION statement are satisfied.

2.1.4.3 Surveillance Requirements

Doses due to liquid releases to UNRESTRICTED AREAS shall be projected at least once per 31 days, in accordance with Section 2.5, during per in which the discharge of untreated liquid effluent containing radioactiv rials occurs or is expected to occur.

The installed LIQUID RADWASTE TREATMENT SYSTEM shall be demonstrated OPERABLE by meeting the controls of Section 2.1.2 and 2.1.3.

2.1.4.4 Basis

The OPERABILITY of the LIQUID RADWASTE TREATMENT SYSTEM ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the UNRESTRICTED AREAS. The requirement that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable." This control implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objective given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the LIQUID RADWASTE TREATMENT SYSTEM were specified as a suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

This control applies to the release of radioactive materials in liquid effluents from each unit at the site. For units with shared radwaste systems, the liquid effluents from the shared system are to be proportioned among the units sharing that system.

2.1.5 Major Changes to Liquid Radioactive Waste Treatment Systems

Licensee initiated MAJOR CHANGES TO LIQUID RADIOACTIVE WASTE TREATMENT SYSTEMS:

a. Shall be reported to the Nuclear Regulatory Commission in the ~~Annual~~ Radioactive Effluents Release Report for the period in which the change was implemented, in accordance with Section 7.2.2.7.

b. Shall become effective upon review ~~and approval~~ by the Plant Review Board, and approval by the Nuclear Plant General Manager. 1

2.2 LIQUID RADWASTE TREATMENT SYSTEM

The Edwin I. Hatch Nuclear Plant is located on the south bank of the Altamaha River, which supplies make-up water to the circulating water system and receives blowdown from the cooling tower. There are two boiling water reactors on the site. Each unit is served by a separate liquid radwaste treatment system.

Schematics of the liquid radwaste treatment systems are presented in Figure 2-1 and Figure 2-2. The dotted lines indicate alternate pathways through which liquid radwaste may be routed.

The two units release liquid radwaste to separate discharge lines. Dilution flow is furnished by the cooling tower blowdown and plant service water systems, if necessary. Releases from plant service water systems are to the main condenser circulating flume, or to the cooling tower blowdown discharge line when needed for additional dilution. Since each unit is served by a separate dilution stream, liquid releases may be made independently from each of the two units.

Although no significant quantities of radioactivity are expected in the plant service water systems, these effluent pathways are monitored as a precautionary measure.

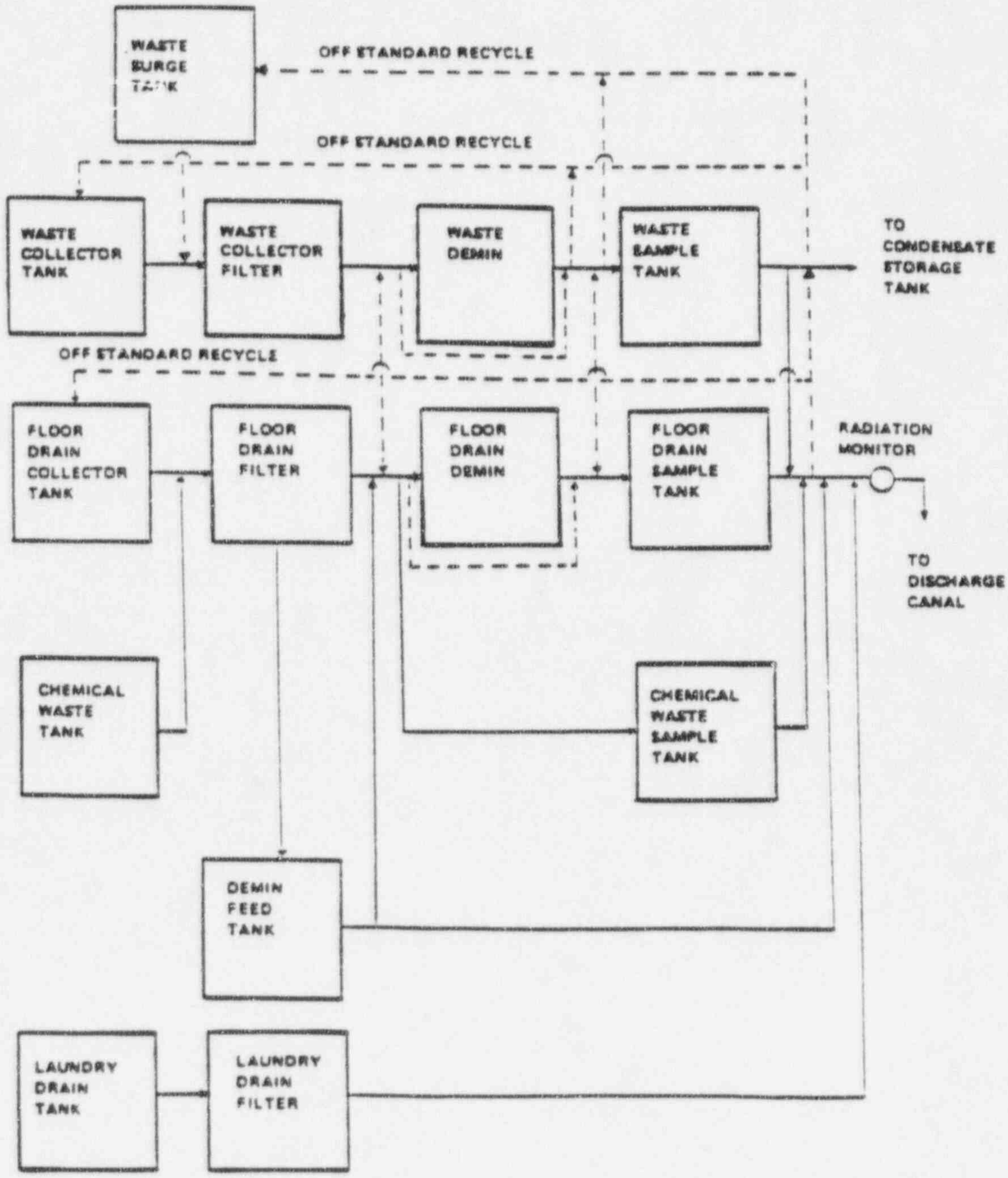

Figure 2-1. Unit 1 Liquid Radwaste Treatment System

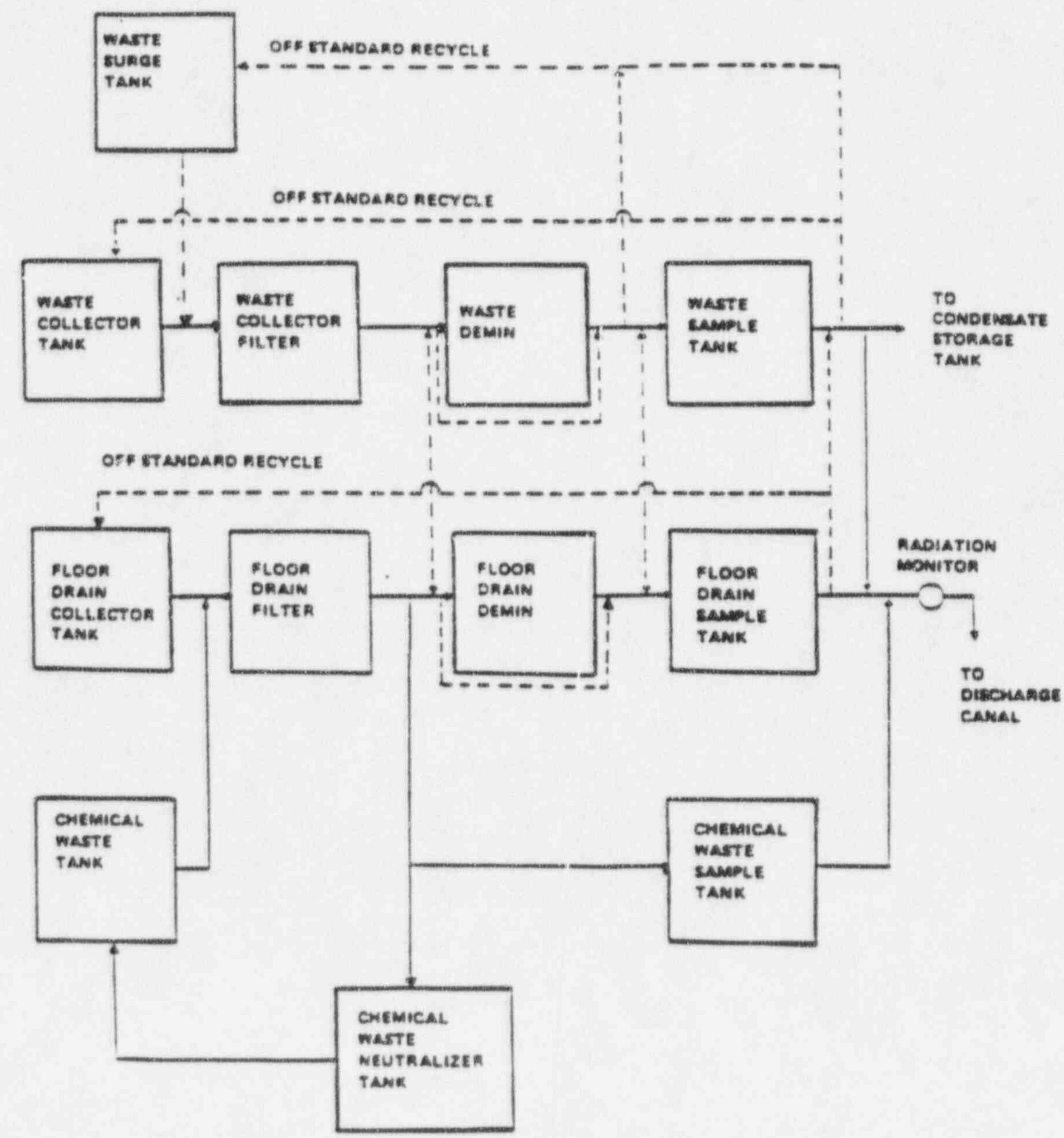

Figure 2-2. Unit 2 Liquid Radwaste Treatment System

2.3 LIQUID EFFLUENT MONITOR SETPOINTS

2.3.1 General Provisions Regarding Setpoints

Liquid monitor setpoints calculated in accordance with the methodology presented in this section will be regarded as upper bounds for the actual high alarm setpoints. That is, a lower value for the high alarm setpoint may be established or retained on the monitor, if desired. Intermediate level setpoints should be established at an appropriate level to give sufficient warning prior to reaching the high alarm setpoint. If no release is planned for a particular pathway, or if there is no detectable activity in the planned release, the monitor setpoint should be established as close to background as practical to prevent spurious alarms, and yet alarm should an inadvertent release occur.

Two basic setpoint methodologies are presented below. For radwaste system discharge monitors, setpoints are determined to assure that the limits of Section 2.1.2 are not exceeded. For monitors on streams that are not expected to contain significant radioactivity, the purpose of the monitor setpoints is to cause an alarm on low levels of radioactivity, and to terminate the release where this is possible. Section 2.1.1 establishes the requirements for liquid effluent monitoring instrumentation. Table 2-4 lists the monitors for which each of the setpoint methodologies is applicable.

Table 2-4. Applicability of Liquid Monitor Setpoint Methodologies

Liquid Radwaste Discharge Monitors

Setpoint Method: Section 2.3.2

Release Type: BATCH

Unit 1 or Unit 2 Liquid Radwaste System Effluent
Monitor: 1D11-N007 / 2D11-N007

Normally Low-Radioactivity Streams with Termination or Diversion upon Alarm

Plant Hatch has no liquid effluent streams in this category.

Normally Low-Radioactivity Streams with Alarm Only

Setpoint Method: Section 2.3.3

Release Type: CONTINUOUS

Unit 1 or Unit 2 Plant Service Water System Effluent
Monitor: 1D11-N008 / 2D11-N008

2.3.2 Setpoints for Radwaste System Discharge Monitors

2.3.2.1 Overview of Method

LIQUID RADWASTE TREATMENT SYSTEM effluent line radioactivity monitors are intended to provide alarm and automatic termination of release prior to exceeding the limits specified in Section 2.1.2 at the point of release of the diluted effluent into the UNRESTRICTED AREA. Therefore, their alarm/trip setpoints are established to ensure compliance with the following equation (equation adapted from Addendum to Reference 1):

$$\frac{c \cdot f}{F + f} \leq TF \cdot C_{ECL} \quad (2.1)$$

where:

C_{ECL} = the Effluent Concentration Limit corresponding to the mix of radionuclides in the effluent being considered for discharge, in µCi/mL.

c = the setpoint, in µCi/mL, of the radioactivity monitor measuring the concentration of radioactivity in the effluent line prior to dilution and subsequent release. The setpoint represents a concentration which, if exceeded, could result in concentrations exceeding the limits of Section 2.1.2 in the UNRESTRICTED AREA.

f = the effluent flowrate at the location of the radioactivity monitor, in gpm.

F = the dilution stream flowrate which can be assured prior to the release point to the UNRESTRICTED AREA, in gpm. A predetermined dilution flowrate must be assured for use in the calculation of the radioactivity monitor setpoint.

TF = the tolerance factor selected to allow flexibility in the establishment of a practical monitor setpoint which could accommodate effluent releases at concentrations higher than the ECL values stated in 10 CFR 20, Appendix B, Table 2, Column 2; the tolerance factor must not exceed a value of 10.

While equation (2.1) shows the relationships of the critical parameters that determine the setpoint, it cannot be applied practically to a mixture of radionuclides with different Effluent Concentration Limits (ECLs). For a mixture of radionuclides, equation (2.1) is satisfied in a practicable manner based on the calculated ECL fraction of the radionuclide mixture and the dilution stream flowrate that can be assured for the duration of the release (F_d), by calculating the maximum permissible effluent flowrate (f_m) and the radioactivity monitor setpoint (c).

The setpoint method presented below is applicable to the release of only one tank of liquid radwaste per reactor unit at a given time. Liquid releases must be controlled administratively to ensure that this condition is met; otherwise, the setpoint method may not ensure that the limits of Section 2.1.2 are not exceeded.

2.3.2.2 Setpoint Calculation Steps

Step 1: Determine the radionuclide concentrations in the liquid waste being considered for release in accordance with the sampling and analysis requirements of Section 2.1.2.

All liquid radwastes are collected in tanks for sampling and analysis prior to release. To ensure that a representative sample can be taken from a tank, its contents will be recirculated for a minimum time period to allow adequate mixing of the contents. Minimum recirculation times are as follows (Reference 22):

	Minimum Recirculation Time (minutes)	
Tank(s)	Unit 1	Unit 2
Waste sample tanks	40	40
Floor drain sample tanks	70	105
Chemical waste sample tanks	65	65
Demineralizer feed tank	115	NA
Laundry drain tanks	50	NA

The total concentration of the liquid waste is determined by the results of all required analyses on the collected sample, as follows:

$$\sum_i C_i = C_a + \sum_s C_s + C_f + C_t + \sum_g C_g \qquad (2.2)$$

where:

C_a = the gross concentration of alpha emitters in the liquid waste, not less than that measured in the most recent applicable composite sample.

C_s = the concentration of strontium radioisotope s (Sr-89 or Sr-90) in the liquid waste, not less than that measured in the most recent applicable composite sample.

C_f = the concentration of Fe-55 in the liquid waste, not less than that measured in the most recent applicable composite sample.

C_t = the concentration of H-3 in the liquid waste, not less than that measured in the most recent applicable composite sample.

C_g = the concentration of gamma emitter g in the liquid waste as measured by gamma ray spectroscopy performed on the sample for the release under consideration.

The C_g term will be included in the analysis of each waste sample; terms for gross concentrations of alpha emitters, Sr-89, Sr-90, Fe-55, and tritium will be included in accordance with the sampling and analysis program required for the waste stream (see Section 2.1.2). For each analysis, only radionuclides identified and detected above background for the given measurement should be included in the calculation. When using the alternate setpoint methodology of step 5.b, the historical maximum values of C_a, C_s, C_f, and C_t shall be used.

<u>Step 2</u>: Determine the required dilution factor for the mix of radionuclides detected in the waste.

Measured radionuclide concentrations are used to calculate ECL fractions. The ECL fractions are used along with a safety factor to calculate the required dilution factor; this is the minimum ratio of dilution flowrate to waste flowrate that must be maintained throughout the release to ensure that the limits of Section 2.1.2 are not exceeded at the point of discharge into the UNRESTRICTED AREA. The required dilution factor, RDF, is calculated as the sum of the dilution factors required for gamma emitters (RDF_γ) and for non-gamma-emitters ($RDF_{n\gamma}$):

$$RDF = \left[\sum_i \frac{C_i}{ECL_i}\right] + [(SF)\ (TF)] \tag{2.3}$$

$$= RDF_\gamma + RDF_{n\gamma}$$

$$RDF_{\gamma} = \frac{\left[\sum_{g} \frac{C_g}{ECL_g}\right]}{(SF)\ (TF)} \qquad (2.4)$$

$$RDF_{n\gamma} = \frac{\left[\frac{C_a}{ECL_a} + \sum_{s} \frac{C_s}{ECL_s} + \frac{C_f}{ECL_f} + \frac{C_t}{ECL_t}\right]}{(SF)\ (TF)} \qquad (2.5)$$

where:

C_i = the measured concentration of radionuclide i as defined in step 1, in μCi/mL. The C_a, C_s, C_f, and C_t terms will be included in the calculation as appropriate.

ECL_i = the Effluent Concentration Limit for radionuclide i from 10 CFR Part 20, Appendix B, Table 2, Column 2 (except for noble gases as discussed below). In the absence of information regarding the solubility classification of a given radionuclide in the waste stream, the solubility class with the lowest ECL shall be assumed. For dissolved or entrained noble gases, the concentration shall be limited to 1×10^{-4} μCi/mL. For gross alpha, the ECL shall be 2×10^{-9} μCi/mL; if specific alpha-emitting radionuclides are measured, the ECL for the specific radionuclide(s) should be used.

SF = the safety factor selected to compensate for statistical fluctuations and errors of measurement. The value for the safety factor must be between 0 and 1. A value of 0.5 is reasonable for liquid releases; a more precise value may be developed if desired.

TF = the tolerance factor (as defined in Section 2.3.2.1).

Step 3: Determine the release-specific assured dilution stream flowrate.

Determine the dilution stream flowrate that can be assured during the release period, designated F_d; this value is the setpoint for the dilution stream flowrate measurement device.

If simultaneous radioactive releases are planned from the same reactor unit, the unit's dilution stream must be allocated among all the simultaneous releases, whether or not they are monitored during release. Normally, only the batch tank effluents need be considered, unless there is detectable radioactivity in one of the normally low-radioactivity streams (see Table 2-4). Allocation of the dilution stream to multiple release paths is accomplished as follows:

$$F_{dp} = F_d \,(AF_p) \tag{2.6}$$

where:

F_{dp} = the dilution flowrate allocated to release pathway p, in gpm.

AF_p = the dilution allocation factor for release pathway p. AF_p may be assigned any value between 0 and 1 for each active release pathway, under the condition that the sum of the AF_p for all active release pathways for *each unit* does not exceed 1. [Note: Because the two units have separate dilution streams, the two units do not affect each other with respect to dilution allocation.]

F_d = the assured minimum dilution flow for the unit, in gpm. For Plant Hatch, F_d is normally established at 10,000 gpm.

If more precise allocation factor values are desired, they may be determined based on the relative radiological impact of each active release pathway; this may be approximated by multiplying the RDF of each effluent stream by its respective planned release flowrate, and comparing these values. If only one release pathway for a given reactor unit contains detectable radioactivity, its AF_p may be assigned the value of 1, making F_{dp} equal to F_d.

For the case where RDF ≤ 1, the planned release meets the limits of Section 2.1.2 without dilution, and may be released with any desired effluent flowrate and dilution flowrate.

Step 4: Determine the maximum allowable waste discharge flowrate.

For the case where RDF > 1, the maximum permissible effluent discharge flowrate for this release pathway, f_{mp} (in gpm), is calculated as follows:

$$f_{mp} = \frac{F_{dp}}{(RDF)} \tag{2.7}$$

For the case RDF ≤ 1, equation (2.7) is not valid. However, as discussed above, when RDF ≤ 1, the release may be made at full discharge pump capacity; the radioactivity monitor setpoint must still be calculated in accordance with Step 5 below.

NOTE 1: Discharge flowrates are actually limited by the discharge pump capacity. When the calculated maximum permissible release flowrate exceeds the pump capacity, the release may be made at full capacity. Discharge flowrates less than the pump capacity must be achieved by throttling if this is available; if throttling is not available, the release may not be made as planned.

NOTE 2: If, at the time of the planned release, there is detectable radioactivity due to plant operations in the dilution stream, the diluting capacity of the dilution stream is diminished. (In addition, sampling and analysis of the other radioactive effluents affecting the dilution stream must be sufficient to ensure that the liquid effluent dose limits specified in the controls of Section 2.1.3 are not exceeded.) Under these conditions, equation (2.7) must be modified to account for the radioactivity present in the dilution stream prior to the introduction of the planned release:

$$f_{mp} = \frac{F_{dp}}{RDF}\left(1 - \sum_r \left[\frac{f_r}{F_d} \sum_i \left(\frac{C_{ir}}{ECL_i}\right)\right]\right) \quad (2.8)$$

where:

C_{ir} = the measured concentration of radionuclide i in release pathway r that is contributing to radioactivity in the dilution stream.

f_r = the effluent discharge flowrate of release pathway r.

If the entire dilution stream contains detectable activity due to plant operations, whether or not its source is identified, $f_r = F_d$, and C_{ir} is the concentration in the total dilution system. This note does not apply: a) if the RDF of the planned release is ≤ 1; or b) if the release contributing radioactivity to the dilution stream has been accounted for by the assignment of an allocation factor.

Step 5: Determine the maximum radioactivity monitor setpoint concentration.

Based on the values determined in previous steps, the radioactivity monitor setpoint for the planned release is calculated to ensure that the limits of Section 2.1.2 will not be exceeded. Because the radioactivity monitor responds primarily to gamma radiation, the monitor setpoint c_p for release pathway p (in µCi/mL) is based on the concentration of gamma emitters in the waste stream, as follows:

$$c_p = A_p \sum_g C_g \tag{2.9}$$

where:

A_p = an adjustment factor which will allow the setpoint to be established in a practical manner to prevent spurious alarms while allowing a margin between measured concentrations and the limits of Section 2.1.2.

Step 5.a. If the concentration of gamma emitters in the effluent to be released is sufficient that the high alarm setpoint can be established at a level that will prevent spurious alarms, A_p should be calculated as follows:

$$\begin{aligned} A_p &= \frac{1}{RDF} \times ADF \\ &= \frac{1}{RDF} \times \frac{F_{dp}}{f_{ap}} \end{aligned} \tag{2.10}$$

where:

ADF = the assured dilution factor.

f_{ap} = the anticipated actual discharge flowrate for the planned release (in gpm), a value less than f_{mp}. The release must then be controlled so that the actual effluent discharge flowrate does not exceed f_{ap} at any time.

Step 5.b. Alternatively, A_p may be calculated as follows:

$$A_p = \frac{ADF - RDF_{n\gamma}}{RDF_\gamma} \tag{2.11}$$

Step 5.c. Evaluate the computed value of A_p as follows:

If $A_p \geq 1$, calculate the monitor setpoint, c_p. However, if c_p is within about 10 percent of C_g, it may be impractical to use this value of c_p. This situation indicates that measured concentrations are approaching values which would cause the limits of Section 2.1.2 to be exceeded. Therefore, steps should be taken to reduce potential concentrations at the point of discharge; these steps may include decreasing the planned effluent discharge flowrate, increasing the dilution stream flowrate, postponing simultaneous releases, and/or decreasing the effluent concentrations by further processing the liquid planned for release. Alternatively, allocation factors for the active liquid release pathways may be reassigned. When one or more of these actions has been taken, repeat Steps 1-5 to calculate a new radioactivity monitor setpoint.

If $A_p < 1$, the release may not be made as planned. Consider the alternatives discussed in the paragraph above, and calculate a new setpoint based on the results of the actions taken.

2.3.2.3 Use of the Calculated Setpoint

The setpoint calculated above is in the units μCi/mL. The monitor actually measures a count rate that includes background, so that the calculated setpoint must be converted accordingly:

$$c_p^* = c_p \cdot E_p + B_p \tag{2.7a}$$

where:

c_p^* = the monitor setpoint as a count rate.

E_p = the monitor calibration factor, in count rate/(μCi/mL). Monitor calibration data for conversion between count rate and concentration may include operational data obtained from determining the monitor response to stream concentrations measured by liquid sample analysis

B_p = the monitor background count rate. In all cases, monitor background must be controlled so that the monitor is capable of responding to concentrations in the range of the setpoint value.

The count rate units of c_p^*, E_p, and B_p in equation (2.7a) must be the same (cpm or cps).

2.3.3 Setpoints for Monitors on Normally Low-Radioactivity Streams

Radioactivity in these streams (listed in Table 2-4 above) is expected to be at very low levels, generally below detection limits. Accordingly, the purpose of these monitors is to alarm upon the occurrence of significant radioactivity in these streams, and to terminate or divert the release where this is possible.

2.3.3.1 Normal Conditions

When radioactivity in one of these streams is at its normal low level, its radioactivity monitor setpoint should be established as close to background as practical to prevent spurious alarms, and yet alarm should an inadvertent release occur.

2.3.3.2 Conditions Requiring an Elevated Setpoint

Under the following conditions, radionuclide concentrations must be determined and an elevated radioactivity monitor setpoint determined for these pathways:

- For streams that can be diverted or isolated, a new monitor setpoint must be established when it is desired to discharge the stream directly to the dilution water even though the radioactivity in the stream exceeds the level which would normally be diverted or isolated.

- For streams that cannot be diverted or isolated, a new monitor setpoint must be established whenever: the radioactivity in the stream becomes detectable above the background levels of the applicable laboratory analyses; or the associated radioactivity monitor detects activity in the stream at levels above the established alarm setpoint.

When an elevated monitor setpoint is required for any of these effluent streams, it should be determined in the same manner as described in Section 2.3.2.

However, special consideration must be given to Step 3. An allocation factor must be assigned to the normally low-radioactivity release pathway under consideration, and allocation factors for other release pathways discharging simultaneously must be adjusted downward (if necessary) to ensure that the sum of the allocation factors does not exceed 1. Sampling and analysis of the normally low-radioactivity streams must be sufficient to ensure that the liquid effluent dose limits specified in the controls of Section 2.1.3 are not exceeded.

2.4 LIQUID EFFLUENT DOSE CALCULATIONS

The following sub-sections present the methods required for liquid effluent dose calculations, in deepening levels of detail. Applicable site-specific pathways and parameter values for the calculation of D_τ, $A_{i\tau}$, and CF_{iv} are summarized in Table 2-5.

2.4.1 Calculation of Dose

The dose limits for a MEMBER OF THE PUBLIC specified in Section 2.1.3 are on a per-unit basis. Therefore, the doses calculated in accordance with this section must be determined and recorded on a per-unit basis, including apportionment of releases shared between the two units.

For the purpose of implementing Section 2.1.3, the dose to the maximum exposed individual due to radionuclides identified in liquid effluents released from each unit to UNRESTRICTED AREAS will be calculated as follows (equation from Reference 1, page 15):

$$D_\tau = \sum_i A_{i\tau} \left[\sum_{l=1}^{m} (\Delta t_l \, C_{il} \, F_l) \right] \tag{2.12}$$

where:

D_τ = the cumulative dose commitment to the total body or to any organ τ, in mrem, due to radioactivity in liquid effluents released during the total of the m time periods Δt_l.

$A_{i\tau}$ = the site-related adult ingestion dose commitment factor, for the total body or for any organ τ, due to identified radionuclide i, in (mrem·mL)/(h·μCi). Methods for the calculation of $A_{i\tau}$ are presented below in Section 2.4.2. The values of $A_{i\tau}$ to be used in dose calculations for releases from the plant site are listed in Table 2-8.

Δt_l = the length of time period l, over which C_{il} and F_l are averaged for liquid releases, in h.

C_{il} = the average concentration of radionuclide i in undiluted liquid effluent during time period l, in μCi/mL. Only radionuclides identified and detected above background in their respective samples should be included in the calculation.

F_l = the near-field average dilution factor in the receiving water of the UNRESTRICTED AREA:

$$F_l = \frac{f_t}{F_t \times Z} \tag{2.13}$$

where:

f_t = the average undiluted liquid waste flowrate actually observed during the period of radioactivity release, in gpm.

F_t = the average dilution stream flowrate actually observed during the period of radioactivity release, in gpm.

Z = the applicable dilution factor for the receiving water body, in the near field of the discharge structure, during the period of radioactivity release, from Table 2-5.

NOTE: In equation (2.13), the product (F_t × Z) is limited to 1000 cfs (= 448,000 gpm) or less. (Reference 1, Section 4.3.)

2.4.2 Calculation of $A_{i\tau}$

The site-related adult ingestion dose commitment factor, $A_{i\tau}$, is calculated as follows (equation adapted from Reference 1, page 16, by addition of the irrigated garden vegetation pathway):

$$A_{i\tau} = 1.14 \times 10^5 \left(\frac{U_w}{D_w} e^{-\lambda_i t_w} + U_f BF_i e^{-\lambda_i t_f} + U_v CF_{iv} \right) DF_{i\tau} \tag{2.14}$$

where:

1.14×10^5 = a units conversion factor, determined by:
10^6 pCi/μCi × 10^3 mL/L ÷ 8760 h/y.

U_w = the adult drinking water consumption rate applicable to the plant site (L/y).

D_w = the dilution factor from the near field of the discharge structure for the plant site to the potable water intake location.

λ_i = the decay constant for radionuclide i (h^{-1}). Values of λ_i used in effluent calculations should be based on decay data from a recognized and current source, such as Reference 26.

t_w = the transit time from release to receptor for potable water consumption (h).

U_f = the adult rate of fish consumption applicable to the plant site (kg/y).

BF_i = the bioaccumulation factor for radionuclide i applicable to freshwater fish in the receiving water body for the plant site, in (pCi/kg)/(pCi/L) = (L/kg). For specific values applicable to the plant site, see Table 2-6.

t_f = the transit time from release to receptor for fish consumption (h).

U_v = the adult consumption rate for irrigated garden vegetation applicable to the plant site (kg/y).

CF_{iv} = the concentration factor for radionuclide i in irrigated garden vegetation, as applicable to the vicinity of the plant site, in (pCi/kg)/(pCi/L). Methods for calculation of CF_{iv} are presented below in Section 2.4.3.

$DF_{i\tau}$ = the dose conversion factor for radionuclide i for adults, in organ τ (mrem/pCi). For specific values, see Table 2-7.

2.4.3 Calculation of CF_{iv}

The concentration factor for radionuclide i in irrigated garden vegetation, CF_{iv} in (L/kg), is calculated as follows:

o For radionuclides other than tritium (equation adapted from Reference 3, equations A-8 and A-9):

$$CF_{iv} = M \cdot I \left[\frac{r\,(1 - e^{-\lambda_{Ei}\, t_e})}{Y_v\, \lambda_{Ei}} + \frac{f_I\, B_{iv}\, (1 - e^{-\lambda_i\, t_b})}{P\, \lambda_i} \right] e^{-\lambda_i\, t_h} \qquad (2.15)$$

o For tritium (equation adapted from Reference 3. equations A-9 and A-10):

$$CF_{iv} = M \cdot L_v \qquad (2.16)$$

where:

M = the additional river dilution factor from the near field of the discharge structure for the plant site to the point of irrigation water usage.

I = the average irrigation rate during the growing season (L)/($m^2 \cdot h$).

r = the fraction of irrigation-deposited activity retained on the edible portions of leafy garden vegetation.

Y_v = the areal density (agricultural productivity) of leafy garden vegetation (kg/m^2)

f_I = the fraction of the year that garden vegetation is irrigated.

B_{iv} = the crop to soil concentration factor applicable to radionuclide i (pCi/kg garden vegetation)/(pCi/kg soil).

P = the effective surface density of soil (kg/m^2).

λ_i = the decay constant for radionuclide i (h^{-1}). Values of λ_i used in effluent calculations should be based on decay data from a recognized and current source, such as Reference 26.

λ_w = the rate constant for removal of activity from plant leaves by weathering (h^{-1}).

λ_{Ei} = the effective removal rate for activity deposited on crop leaves (h^{-1}) calculated as: $\lambda_{Ei} = \lambda_i + \lambda_w$.

t_e = the period of leafy garden vegetation exposure during the growing season (h).

t_b = the period of long-term buildup of activity in soil (h).

t_h = the time between harvest of garden vegetation and human consumption (h).

L_v = the water content of leafy garden vegetation edible parts (L/kg).

Table 2-5. Parameters for Calculation of Doses Due to Liquid Effluent Releases

Dose Calculation Receptor Locations:

Fish:	Vicinity of plant discharge
Drinking Water:	None ++
Irrigated Garden Vegetation:	None ++

Numerical Parameters: *

Parameter	Value	Reference
Z	10	Ref. 9, Sec. 5.1; Ref. 6, Sec. B; Ref. 21
U_w	0 L/y	(Pathway not applicable)
D_w	1.0 +	
t_w	12 h	Ref. 3, Sec. A.2
U_f	21 kg/y	Ref. 3, Table E-5
t_f	24 h	Ref. 3, Sec. A.2
U_v	0 kg/y	(Pathway not applicable)
M	1.0 +	
I	No value **	
r	0.25	Ref. 3, Table E-15
Y_v	2.0 kg/m^2	Ref. 3, Table E-15
f_I	1.0 +	
P	240 kg/m^2	Ref. 3, Table E-15
λ_w	0.0021 h^{-1} (i.e., half-life of 14 d)	Ref. 3, Table E-15
t_e	1440 h (= 60 d)	Ref. 3, Table E-15
t_b	1.31×10^5 h (= 15 y)	Ref. 3, Table E-15
t_h	24 h	Ref. 3, Table E-15
L_v	0.92 L/kg	Based on Ref. 27, Table 5.16 (for lettuce, cabbage, etc.)

* - Because there is no known drinking water pathway or irrigated garden vegetation pathway downstream of the plant site, the parameters for these pathways are default values, and the usage factors are set to 0.

\+ - There is no established default value for this parameter. The most conservative physically realistic value is 1.0.

** - There is no established default value for this parameter. A value will be supplied if the pathway is ever observed.

++ - Confirmed during the annual river water use survey.

Table 2-6. Element Transfer Factors

Element	Freshwater Fish BF_i*
H	9.0 E-01
C	4.6 E+03
Na	6.6 E+01
P	2.5 E+04
Cr	1.5 E+02
Mn	8.9 E+01
Fe	6.0 E+00
Co	1.7 E+02
Ni	1.0 E+02
Cu	4.4 E+01
Zn	2.9 E+02
Br	4.2 E+02
Rb	2.0 E+03
Sr	3.8 E+00
Y	2.5 E+01
Zr	1.9 E+02
Nb	4.1 E+01
Mo	1.8 E+02
Tc	1.5 E+01
Ru	4.6 E+00
Rh	1.0 E+01
Ag	3.5 E+02
Sb	1.0 E+00
Te	4.0 E+02
I	4.3 E+01
Cs	5.8 E+02
Ba	5.0 E+00
La	2.5 E+01
Ce	8.4 E+01
Pr	2.5 E+01
Nd	4.6 E+01
W	1.2 E+03
Np	1.0 E+01

*- Bioaccumulation Factors for freshwater fish, in (pCi/kg)/(pCi/L). They are obtained from Reference 9 (Appendix A, Table 2.3-1), except as follows: Reference 2 (Table A-8) for Sb.

Table 2-7. Adult Ingestion Dose Factors

Nuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
H-3	No Data	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07
C-14	2.84E-06	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07
Na-24	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06
P-32	1.93E-04	1.20E-05	7.46E-06	No Data	No Data	No Data	2.17E-05
Cr-51	No Data	No Data	2.66E-09	1.59E-09	5.86E-10	3.53E-09	6.69E-07
Mn-54	No Data	4.57E-06	8.72E-07	No Data	1.36E-06	No Data	1.40E-05
Mn-56	No Data	1.15E-07	2.04E-08	No Data	1.46E-07	No Data	3.67E-06
Fe-55	2.75E-06	1.90E-06	4.43E-07	No Data	No Data	1.06E-06	1.09E-06
Fe-59	4.34E-06	1.02E-05	3.91E-06	No Data	No Data	2.85E-06	3.40E-05
Co-58	No Data	7.45E-07	1.67E-06	No Data	No Data	No Data	1.51E-05
Co-60	No Data	2.14E-06	4.72E-06	No Data	No Data	No Data	4.02E-05
Ni-63	1.30E-04	9.01E-06	4.36E-06	No Data	No Data	No Data	1.88E-06
Ni-65	5.28E-07	6.86E-08	3.13E-08	No Data	No Data	No Data	1.74E-06
Cu-64	No Data	8.33E-08	3.91E-08	No Data	2.10E-07	No Data	7.10E-06
Zn-65	4.84E-06	1.54E-05	6.96E-06	No Data	1.03E-05	No Data	9.70E-06
Zn-69	1.03E-08	1.97E-08	1.37E-09	No Data	1.28E-08	No Data	2.96E-09
Br-83	No Data	No Data	4.02E-08	No Data	No Data	No Data	5.79E-08
Br-84	No Data	No Data	5.21E-08	No Data	No Data	No Data	4.09E-13
Br-85	No Data	No Data	2.14E-09	No Data	No Data	No Data	No Data
Rb-86	No Data	2.11E-05	9.83E-06	No Data	No Data	No Data	4.16E-06
Rb-88	No Data	6.05E-08	3.21E-08	No Data	No Data	No Data	8.36E-19
Rb-89	No Data	4.01E-08	2.82E-08	No Data	No Data	No Data	2.33E-21
Sr-89	3.08E-04	No Data	8.84E-06	No Data	No Data	No Data	4.94E-05
Sr-90	7.58E-03	No Data	1.86E-03	No Data	No Data	No Data	2.19E-04
Sr-91	5.67E-06	No Data	2.29E-07	No Data	No Data	No Data	2.70E-05

All values are in (mrem/pCi ingested). They are obtained from Reference 3 (Table E-11), except as follows: Reference 2 (Table A-3) for Rh-105, Sb-124, and Sb-125.

Table 2-7 (contd). Adult Ingestion Dose Factors

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Sr-92	2.15E-06	No Data	9.30E-08	No Data	No Data	No Data	4.26E-05
Y-90	9.62E-09	No Data	2.58E-10	No Data	No Data	No Data	1.02E-04
Y-91m	9.09E-11	No Data	3.52E-12	No Data	No Data	No Data	2.67E-10
Y-91	1.41E-07	No Data	3.77E-09	No Data	No Data	No Data	7.76E-05
Y-92	8.45E-10	No Data	2.47E-11	No Data	No Data	No Data	1.48E-05
Y-93	2.68E-09	No Data	7.40E-11	No Data	No Data	No Data	8.50E-05
Zr-95	3.04E-08	9.75E-09	6.60E-09	No Data	1.53E-08	No Data	3.09E-05
Zr-97	1.68E-09	3.39E-10	1.55E-10	No Data	5.12E-10	No Data	1.05E-04
Nb-95	6.22E-09	3.46E-09	1.86E-09	No Data	3.42E-09	No Data	2.10E-05
Mo-99	No Data	4.31E-06	8.20E-07	No Data	9.76E-06	No Data	9.99E-06
Tc-99m	2.47E-10	6.98E-10	8.89E-09	No Data	1.06E-08	3.42E-10	4.13E-07
Tc-101	2.54E-10	3.66E-10	3.59E-09	No Data	6.59E-09	1.87E-10	1.10E-21
Ru-103	1.85E-07	No Data	7.97E-08	No Data	7.06E-07	No Data	2.16E-05
Ru-105	1.54E-08	No Data	6.08E-09	No Data	1.99E-07	No Data	9.42E-06
Ru-106	2.75E-06	No Data	3.48E-07	No Data	5.31E-06	No Data	1.78E-04
Rh-105	1.22E-07	8.86E-08	5.83E-08	No Data	3.76E-07	No Data	1.41E-05
Ag-110m	1.60E-07	1.48E-07	8.79E-08	No Data	2.91E-07	No Data	6.04E-05
Sb-124	2.81E-06	5.30E-08	1.11E-06	6.79E-09	No Data	2.18E-06	7.95E-05
Sb-125	2.23E-06	2.40E-08	4.48E-07	1.98E-09	No Data	2.33E-04	1.97E-05
Te-125m	2.68E-06	9.71E-07	3.59E-07	8.06E-07	1.09E-05	No Data	1.07E-05
Te-127m	6.77E-06	2.42E-06	8.25E-07	1.73E-06	2.75E-05	No Data	2.27E-05
Te-127	1.10E-07	3.95E-08	2.38E-08	8.15E-08	4.48E-07	No Data	8.68E-06
Te-129m	1.15E-05	4.29E-06	1.82E-06	3.95E-06	4.80E-05	No Data	5.79E-05
Te-129	3.14E-08	1.18E-08	7.65E-09	2.41E-08	1.32E-07	No Data	2.37E-08
Te-131m	1.73E-06	8.46E-07	7.05E-07	1.34E-06	8.57E-06	No Data	8.40E-05
Te-131	1.97E-08	8.23E-09	6.22E-09	1.62E-08	8.63E-08	No Data	2.79E-09

Table 2-7 (contd). Adult Ingestion Dose Factors

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Te-132	2.52E-06	1.63E-06	1.53E-06	1.80E-06	1.57E-05	No Data	7.71E-05
I-130	7.56E-07	2.23E-06	8.80E-07	1.89E-04	3.48E-06	No Data	1.92E-06
I-131	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	No Data	1.57E-06
I-132	2.03E-07	5.43E-07	1.90E-07	1.90E-05	8.65E-07	No Data	1.02E-07
I-133	1.42E-06	2.47E-06	7.53E-07	3.63E-04	4.31E-06	No Data	2.22E-06
I-134	1.06E-07	2.88E-07	1.03E-07	4.99E-06	4.58E-07	No Data	2.51E-10
I-135	4.43E-07	1.16E-06	4.28E-07	7.65E-05	1.86E-06	No Data	1.31E-06
Cs-134	6.22E-05	1.48E-04	1.21E-04	No Data	4.79E-05	1.59E-05	2.59E-06
Cs-136	6.51E-06	2.57E-05	1.85E-05	No Data	1.43E-05	1.96E-06	2.92E-06
Cs-137	7.97E-05	1.09E-04	7.14E-05	No Data	3.70E-05	1.23E-05	2.11E-06
Cs-138	5.52E-08	1.09E-07	5.40E-08	No Data	8.01E-08	7.91E-09	4.65E-13
Ba-139	9.70E-08	6.91E-11	2.84E-09	No Data	6.46E-11	3.92E-11	1.72E-07
Ba-140	2.03E-05	2.55E-08	1.33E-06	No Data	8.67E-09	1.46E-08	4.18E-05
Ba-141	4.71E-08	3.56E-11	1.59E-09	No Data	3.31E-11	2.02E-11	2.22E-17
Ba-142	2.13E-08	2.19E-11	1.34E-09	No Data	1.85E-11	1.24E-11	3.00E-26
La-140	2.50E-09	1.26E-09	3.33E-10	No Data	No Data	No Data	9.25E-05
La-142	1.28E-10	5.82E-11	1.45E-11	No Data	No Data	No Data	4.25E-07
Ce-141	9.36E-09	6.33E-09	7.18E-10	No Data	2.94E-09	No Data	2.42E-05
Ce-143	1.65E-09	1.22E-06	1.35E-10	No Data	5.37E-10	No Data	4.56E-05
Ce-144	4.88E-07	2.04E-07	2.62E-08	No Data	1.21E-07	No Data	1.65E-04
Pr-143	9.20E-09	3.69E-09	4.56E-10	No Data	2.13E-09	No Data	4.03E-05
Pr-144	3.01E-11	1.25E-11	1.53E-12	No Data	7.05E-12	No Data	4.33E-18
Nd-147	6.29E-09	7.27E-09	4.35E-10	No Data	4.25E-09	No Data	3.49E-05
W-187	1.03E-07	8.61E-08	3.01E-08	No Data	No Data	No Data	2.82E-05
Np-239	1.19E-09	1.17E-10	6.45E-11	No Data	3.65E-10	No Data	2.40E-05

Table 2-8. Site-Related Ingestion Dose Factors, $A_{i\tau}$

Nuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01
C-14	3.13E+04	6.26E+03	6.26E+03	6.26E+03	6.26E+03	6.26E+03	6.26E+03
Na-24	8.86E+01	8.86E+01	8.86E+01	8.86E+01	8.86E+01	8.86E+01	8.86E+01
P-32	1.10E+07	6.84E+05	4.25E+05	0.00	0.00	0.00	1.24E+06
Cr-51	0.00	0.00	9.32E-01	5.57E-01	2.05E-01	1.24E+00	2.34E+02
Mn-54	0.00	9.72E+02	1.85E+02	0.00	2.89E+02	0.00	2.98E+03
Mn-56	0.00	3.87E-02	6.86E-03	0.00	4.91E-02	0.00	1.23E+00
Fe-55	3.95E+01	2.73E+01	6.36E+00	0.00	0.00	1.52E+01	1.56E+01
Fe-59	6.14E+01	1.44E+02	5.53E+01	0.00	0.00	4.03E+01	4.81E+02
Co-58	0.00	3.00E+02	6.73E+02	0.00	0.00	0.00	6.09E+03
Co-60	0.00	8.71E+02	1.92E+03	0.00	0.00	0.00	1.64E+04
Ni-63	3.11E+04	2.16E+03	1.04E+03	0.00	0.00	0.00	4.50E+02
Ni-65	1.72E-01	2.23E-02	1.02E-02	0.00	0.00	0.00	5.66E-01
Cu-64	0.00	2.37E+00	1.11E+00	0.00	5.97E+00	0.00	2.02E+02
Zn-65	3.35E+03	1.07E+04	4.82E+03	0.00	7.13E+03	0.00	6.72E+03
Zn-69	1.14E-07	2.19E-07	1.52E-08	0.00	1.42E-07	0.00	3.28E-08
Br-83	0.00	0.00	3.83E-02	0.00	0.00	0.00	5.52E-02
Br-84	0.00	0.00	1.22E-12	0.00	0.00	0.00	9.61E-18
Br-85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rb-86	0.00	9.73E+04	4.53E+04	0.00	0.00	0.00	1.92E+04
Rb-88	0.00	1.29E-22	6.82E-23	0.00	0.00	0.00	1.78E-33
Rb-89	0.00	1.61E-26	1.14E-26	0.00	0.00	0.00	0.00
Sr-89	2.76E+03	0.00	7.93E+01	0.00	0.00	0.00	4.43E+02
Sr-90	6.90E+04	0.00	1.69E+04	0.00	0.00	0.00	1.99E+03
Sr-91	8.95E+00	0.00	3.62E-01	0.00	0.00	0.00	4.26E+01
Sr-92	4.22E-02	0.00	1.83E-03	0.00	0.00	0.00	8.36E-01
Y-90	4.44E-01	0.00	1.19E-02	0.00	0.00	0.00	4.71E+03
Y-91m	1.04E-11	0.00	4.01E-13	0.00	0.00	0.00	3.04E-11
Y-91	8.34E+00	0.00	2.23E-01	0.00	0.00	0.00	4.59E+03
Y-92	4.60E-04	0.00	1.35E-05	0.00	0.00	0.00	8.06E+00
Y-93	3.09E-02	0.00	8.53E-04	0.00	0.00	0.00	9.80E+02
Zr-95	1.37E+01	4.39E+00	2.97E+00	0.00	6.88E+00	0.00	1.39E+04
Zr-97	2.86E-01	5.76E-02	2.63E-02	0.00	8.70E-02	0.00	1.78E+04
Nb-95	5.99E-01	3.33E-01	1.79E-01	0.00	3.29E-01	0.00	2.02E+03
Mo-99	0.00	1.44E+03	2.75E+02	0.00	3.27E+03	0.00	3.35E+03
Tc-99m	5.59E-04	1.58E-03	2.01E-02	0.00	2.40E-02	7.75E-04	9.36E-01

All values are in (mrem·mL)/(h·µCi). They are calculated using equation (2.14), and data from Table 2-5, Table 2-6, and Table 2-7. When "No Data" is shown for a radionuclide-organ combination in Table 2-7, $A_{i\tau}$ factors in this table are presented as zero.

Table 2-8 (contd). Site-Related Ingestion Dose Factors, $A_{i\tau}$

Nuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
Tc-101	2.71E-33	3.91E-33	3.83E-32	0.00	7.03E-32	2.00E-33	0.00
Ru-103	2.00E+0[illegible]	0.00	8.62E-01	0.00	7.64E+00	0.00	2.34E+02
Ru-105	4.00E-0[illegible]	0.00	1.58E-03	0.00	5.17E-02	0.00	2.45E+00
Ru-106	3.02E+01	0.00	3.83E+00	0.00	5.84E+01	0.00	1.96E+03
Rh-105	1.83E+00	1.33E+00	8.72E-01	0.00	5.63E+00	0.00	2.11E+02
Ag-110m	1.34E+02	1.24E+02	7.34E+01	0.00	2.43E+02	0.00	5.05E+04
Sb-124	6.65E+00	1.25E-01	2.63E+00	1.61E-02	0.00	5.16E+00	1.88E+02
Sb-125	5.33E+00	5.74E-02	1.07E+00	4.74E-03	0.00	5.57E+02	4.71E+01
Te-125m	2.54E+03	9.19E+02	3.40E+02	7.63E+02	1.03E+04	0.00	1.01E+04
Te-127m	6.44E+03	2.30E+03	7.85E+02	1.65E+03	2.62E+04	0.00	2.16E+04
Te-127	1.78E+01	6.38E+00	3.85E+00	1.32E+01	7.24E+01	0.00	1.40E+03
Te-129m	1.08E+04	4.02E+03	1.71E+03	3.71E+03	4.50E+04	0.00	5.43E+04
Te-129	1.78E-05	6.68E-06	4.33E-06	1.36E-05	7.47E-05	0.00	1.34E-05
Te-131m	9.51E+02	4.65E+02	3.88E+02	7.37E+02	4.71E+03	0.00	4.62E+04
Te-131	8.64E-17	3.61E-17	2.73E-17	7.10E-17	3.78E-16	0.00	1.22E-17
Te-132	1.95E+03	1.26E+03	1.18E+03	1.39E+03	1.22E+04	0.00	5.97E+04
I-130	2.03E+01	5.98E+01	2.36E+01	5.06E+03	9.32E+01	0.00	5.14E+01
I-131	3.93E+02	5.62E+02	3.22E+02	1.84E+05	9.63E+02	0.00	1.48E+02
I-132	1.51E-02	4.04E-02	1.41E-02	1.41E+00	6.43E-02	0.00	7.59E-03
I-133	6.57E+01	1.14E+02	3.48E+01	1.68E+04	1.99E+02	0.00	1.03E+02
I-134	6.26E-08	1.70E-07	6.09E-08	2.95E-06	2.71E-07	0.00	1.48E-10
I-135	3.68E+00	9.64E+00	3.56E+00	6.36E+02	1.55E+01	0.00	1.09E+01
Cs-134	8.63E+04	2.05E+05	1.68E+05	0.00	6.64E+04	2.21E+04	3.59E+03
Cs-136	8.58E+03	3.39E+04	2.44E+04	0.00	1.88E+04	2.58E+03	3.85E+03
Cs-137	1.11E+05	1.51E+05	9.91E+04	0.00	5.14E+04	1.71E+04	2.93E+03
Cs-138	2.64E-12	5.22E-12	2.59E-12	0.00	3.84E-12	3.79E-13	2.23E-17
Ba-139	7.05E-06	5.03E-09	2.07E-07	0.00	4.70E-09	2.85E-09	1.25E-05
Ba-140	2.30E+02	2.89E-01	1.51E+01	0.00	9.83E-02	1.66E-01	4.74E+02
Ba-141	1.06E-24	8.00E-28	3.57E-26	0.00	7.44E-28	4.54E-28	4.99E-34
Ba-142	0.00	0.00	0.00	0.00	0.00	0.00	0.00
La-140	9.89E-02	4.99E-02	1.32E-02	0.00	0.00	0.00	3.66E+03
La-142	2.19E-07	9.96E-08	2.48E-08	0.00	0.00	0.00	7.27E-04
Ce-141	1.84E+00	1.25E+00	1.41E-01	0.00	5.79E-01	0.00	4.76E+03
Ce-143	2.00E-01	1.48E+02	1.64E-02	0.00	6.52E-02	0.00	5.54E+03
Ce-144	9.79E+01	4.09E+01	5.26E+00	0.00	2.43E+01	0.00	3.31E+04
Pr-143	5.23E-01	2.10E-01	2.59E-02	0.00	1.21E-01	0.00	2.29E+03
Pr-144	1.48E-28	6.14E-29	7.51E-30	0.00	3.46E-29	0.00	2.13E-35
Nd-147	6.50E-01	7.52E-01	4.50E-02	0.00	4.39E-01	0.00	3.61E+03
W-187	1.47E+02	1.23E+02	4.30E+01	0.00	0.00	0.00	4.03E+04
Np-239	2.12E-02	2.09E-03	1.15E-03	0.00	6.51E-03	0.00	4.28E+02

2.5 LIQUID EFFLUENT DOSE PROJECTIONS

2.5.1 Thirty-One Day Dose Projections

In order to meet the requirements for operation of the LIQUID RADWASTE TREATMENT SYSTEM (see Section 2.1.4), dose projections must be made at least once each 31 days; this applies during periods in which a discharge to UNRESTRICTED AREAS of liquid effluents containing radioactive materials occurs or is expected.

Projected 31-day doses to individuals due to liquid effluents may be determined as follows:

$$D_{\tau p} = \left(\frac{D_{\tau c}}{t}\right) \times 31 + D_{\tau a} \quad (2.17)$$

where:

$D_{\tau p}$ = the projected dose to the total body or organ τ, for the next 31 days of liquid releases.

$D_{\tau c}$ = the cumulative dose to the total body or organ τ, for liquid releases that have occurred in the elapsed portion of the current quarter, plus the release under consideration.

t = the number of whole or partial days elapsed into the current quarter, including the time to the end of the release under consideration (even if the release continues into the next quarter).

$D_{\tau a}$ = the anticipated dose contribution to the total body or any organ τ, due to any planned activities during the next 31-day period, if those activities will result in liquid releases that are in addition to routine liquid effluents. If only routine liquid effluents are anticipated, $D_{\tau a}$ may be set to zero.

2.5.2 Dose Projections for Specific Releases

Dose projections may be performed for a particular release by performing a pre-release dose calculation assuming that the planned release will proceed as anticipated. For individual dose projections due to liquid releases, follow the methodology of Section 2.4, using sample analysis results for the source to be released, and parameter values expected to exist during the release period.

2.6 DEFINITIONS OF LIQUID EFFLUENT TERMS

The following symbolic terms are used in the presentation of liquid effluent calculations in the sub-sections above.

Term	Definition	Section of Initial Use
A_p =	the adjustment factor used in calculating the effluent monitor setpoint for liquid release pathway p: the ratio of the assured dilution to the required dilution [unitless].	2.3.2.2
ADF =	the assured dilution factor for a planned release [unitless].	2.3.2.2
AF_p =	the dilution allocation factor for liquid release pathway p [unitless].	2.3.2.2
$A_{i\tau}$ =	the site-related adult ingestion dose commitment factor, for the total body or for any organ τ, due to identified radionuclide i [(mrem·mL)/(h·μCi)]. The values of $A_{i\tau}$ are listed in Table 2-8.	2.4.1
B_{iv} =	the crop to soil concentration factor applicable to radionuclide i, [(pCi/kg garden vegetation)/(pCi/kg soil)].	2.4.3
BF_i =	the bioaccumulation factor for radionuclide i for freshwater fish [(pCi/kg)/(pCi/L)]. Values are listed in Table 2-6.	2.4.2
c =	the setpoint of the radioactivity monitor measuring the concentration of radioactivity in the effluent line, prior to dilution and subsequent release [μCi/mL].	2.3.2.1
c_p =	the calculated effluent radioactivity monitor setpoint for liquid release pathway p [μCi/mL].	2.3.2.2
C_a =	the gross concentration of alpha emitters in the liquid waste as measured in the applicable composite sample [μCi/mL].	2.3.2.2

Term	Definition	Section of Initial Use
C_{ECL} =	the Effluent Concentration Limit stated in 10 CFR 20, Appendix B, Table 2, Column 2 [μCi/mL].	2.3.2.1
C_f =	the concentration of Fe-55 in the liquid waste as measured in the applicable composite sample [μCi/mL].	2.3.2.2
C_g =	the concentration of gamma emitter g in the liquid waste as measured by gamma ray spectroscopy performed on the applicable pre-release waste sample [μCi/mL].	2.3.2.2
C_i =	the measured concentration of radionuclide i in a sample of liquid effluent [μCi/mL].	2.3.2.2
C_{il} =	the average concentration of radionuclide i in undiluted liquid effluent during time period l [μCi/mL].	2.4.1
C_{ir} =	the measured concentration of radionuclide i in release pathway r that is contributing to radioactivity in the dilution stream [μCi/mL].	2.3.2.2
C_s =	the concentration of strontium radioisotope s (Sr-89 or Sr-90) in the liquid waste as measured in the applicable composite sample [μCi/mL].	2.3.2.2
C_t =	the concentration of H-3 in the liquid waste as measured in the applicable composite sample [μCi/mL].	2.3.2.2
CF_{iv} =	the concentration factor for radionuclide i in irrigated garden vegetation [(pCi/kg)/(pCi/L)].	2.4.2
D_w =	the dilution factor from the near field of the discharge structure to the potable water intake location [unitless].	2.4.2

Term	Definition	Section of Initial Use
D_τ =	the cumulative dose commitment to the total body or to any organ τ, due to radioactivity in liquid effluents released during a given time period [mrem].	2.4.1
$D_{\tau a}$ =	the anticipated dose contribution to the total body or any organ τ, due to any planned activities during the next 31-day period [mrem].	2.5.1
$D_{\tau c}$ =	the cumulative dose to the total body or organ τ, for liquid releases that have occurred in the elapsed portion of the current quarter, plus the release under consideration [mrem].	2.5.1
$D_{\tau p}$ =	the projected dose to the total body or organ τ, for the next 31 days of liquid releases [mrem].	2.5.1
$DF_{i\tau}$ =	the dose conversion factor for radionuclide i for adults, in organ τ [mrem/pCi]. Values are listed in Table 2-7.	2.4.2
ECL_i =	the liquid Effluent Concentration Limit for radionuclide i from 10 CFR Part 20, Appendix B, Table 2, Column 2 [μCi/mL].	2.3.2.2
f =	the effluent flowrate at the location of the radioactivity monitor [gpm].	2.3.2.1
f_{ap} =	the anticipated actual discharge flowrate for a planned release from liquid release pathway p [gpm].	2.3.2.2
f_I =	the fraction of the year that garden vegetation is irrigated [unitless].	2.4.3
f_{mp} =	the maximum permissible effluent discharge flowrate for release pathway p [gpm].	2.3.2.2

Term	Definition	Section of Initial Use
f_r =	the effluent discharge flowrate of release pathway r [gpm].	2.3.2.2
f_t =	the average undiluted liquid waste flowrate actually observed during the period of a liquid release [gpm].	2.4.1
F =	the dilution stream flowrate which can be assured prior to the release point to the UNRESTRICTED AREA [gpm].	2.3.2.1
F_d =	the entire assured dilution flowrate for the plant site during the release period [gpm].	2.3.2.2
F_{dp} =	the dilution flowrate allocated to release pathway p [gpm].	2.3.2.2
F_l =	the near-field average dilution factor in the receiving water of the UNRESTRICTED AREA [unitless].	2.4.1
F_t =	the average dilution stream flowrate actually observed during the period of a liquid release [gpm].	2.4.1
I =	the average irrigation rate during the growing season [$L/(m^2 \cdot h)$].	2.4.3
L_v =	the water content of leafy garden vegetation edible parts [L/kg].	2.4.3
M =	the additional river dilution factor from the near field of the discharge structure for the plant site to the point of irrigation water usage [unitless].	2.4.3
P =	the effective surface density of soil [kg/m^2].	2.4.3

Term	Definition	Section of Initial Use
r =	the fraction of irrigation-deposited activity retained on the edible portions of leafy garden vegetation.	2.4.3
RDF =	the required dilution factor: the minimum ratio by which liquid effluent must be diluted before reaching the UNRESTRICTED AREA, in order to ensure that the limits of Section 2.1.2 are not exceeded [unitless].	2.3.2.2
RDF_{γ} =	the RDF for a liquid release due only to its concentration of gamma-emitting radionuclides [unitless].	2.3.2.2
$RDF_{n\gamma}$ =	the RDF for a liquid release due only to its concentration of non-gamma-emitting radionuclides [unitless].	2.3.2.2
SF =	the safety factor selected to compensate for statistical fluctuations and errors of measurement [unitless].	2.3.2.2
t =	the number of whole or partial days elapsed into the current quarter, including the time to the end of the release under consideration.	2.5.1
t_b =	the period of long-term buildup of activity in soil [h].	2.4.3
t_e =	the period of leafy garden vegetation exposure during the growing season [h].	2.4.3
t_f =	the transit time from release to receptor for fish consumption [h].	2.4.2
t_h =	the time between harvest of garden vegetation and human consumption [h].	2.4.3
t_w =	the transit time from release to receptor for potable water consumption [h].	2.4.2

Term	Definition	Section of Initial Use
TF =	the tolerance factor selected to allow flexibility in the establishment of a practical monitor setpoint which could accommodate effluent releases at concentrations higher than the ECL values stated in 10 CFR 20, Appendix B, Table 2, Column 2 [unitless]; the tolerance factor must not exceed a value of 10.	3.3.2.2
U_f =	the adult rate of fish consumption [kg/y].	2.4.2
U_v =	the adult consumption rate for irrigated garden vegetation [kg/y].	2.4.2
U_w =	the adult drinking water consumption rate applicable to the plant site [L/y].	2.4.2
Y_v =	the areal density (agricultural productivity) of leafy garden vegetation [kg/m^2].	2.4.3
Z =	the applicable dilution factor for the receiving water body, in the near field of the discharge structure, during the period of radioactivity release [unitless].	2.4.1
Δt_l =	the length of time period l, over which C_{il} and F_l are averaged for liquid releases [h].	2.4.1
λ_{Ei} =	the effective removal rate for activity deposited on crop leaves [h^{-1}].	2.4.3
λ_i =	the decay constant for radionuclide i [h^{-1}].	2.4.2
λ_w =	the rate constant for removal of activity from plant leaves by weathering [h^{-1}].	2.4.3

CHAPTER 3
GASEOUS EFFLUENTS

3.1 LIMITS OF OPERATION

The following Limits of Operation implement requirements established by Technical Specifications Section ~~6~~ 5 .0. Terms printed in all capital letters are defined in Chapter 10.

3.1.1 Gaseous Effluent Monitoring Instrumentation Control

In accordance with Technical Specification 5.5.4.a., ~~6.10(1).~~ the radioactive gaseous effluent monitoring instrumentation channels shown in Table 3-1 shall be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Section 3.1.2.a are not exceeded. The alarm/trip setpoints of these channels shall be determined in accordance with Section 3.3.

3.1.1.1 Applicability

These limits apply as shown in Table 3-1.

3.1.1.2 Actions

With a radioactive gaseous effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above control, immediately suspend the release of radioactive gaseous effluents monitored by the affected channel, declare the channel inoperable, or restore the setpoint to a value that will ensure that the limits of Section 3.1.2.a are met.

With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3-1.

One instrument channel may be inoperable for up to 6 hours to perform required surveillances prior to entering other applicable ACTIONS.

When the ACTION statement or other requirements of this control cannot be met, steps need not be taken to change the Operational Mode of the unit. Entry into an Operational Mode or other specified CONDITION may be made if, as a minimum, the requirements of the ACTION statement are satisfied.

3.1.1.3 Surveillance Requirements

Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST operations at the frequencies shown in Table 3-2.

3.1.1.4 Basis

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in Section 3.3 to ensure that the alarm/trip will occur prior to exceeding the limits of Section 3.1.2.a. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

Table 3-1. Radioactive Gaseous Effluent Monitoring Instrumentation

Instrument	Minimum Channels OPERABLE	Applica-bility	ACTION
1. Reactor Building Vent Stack Monitoring System (Each Unit)			
a. Noble Gas Activity Monitor[c]	1	(a)	105
b. Iodine Sampler Cartridge	1	(a)	107
c. Particulate Sampler Filter	1	(a)	107
d. Effluent System Flowrate Measurement Device	1	(a)	104
e. Sampler Flowrate Measurement Device	1	(a)	104
2. Recombiner Building Ventilation Monitoring System			
a. Noble Gas Activity Monitor[c]	1	(a)	105
b. Iodine Sampler Cartridge	1	(a)	107
c. Particulate Sampler Filter	1	(a)	107
d. Sampler Flowrate Monitor	1	(a)	104
3. Main Stack Monitoring System			
a. Noble Gas Activity Monitor[c]	1	(a)	105
b. Iodine Sampler Cartridge	1	(a)	107
c. Particulate Sampler Filter	1	(a)	107
d. Effluent System Flowrate Measurement Device	1	(a)	104
e. Sampler Flowrate Measurement Device	1	(a)	104
4. Condenser Offgas Pretreatment Monitor (Each Unit)			
a. Noble Gas Activity Monitor	1	(b)	108

Table 3-1 (contd). Notation for Table 3-1

a. During radioactive releases via this pathway.

b. During operation of the main condenser air ejector.

c. Monitor must be capable of responding to a MINIMUM DETECTABLE CONCENTRATION of 1×10^{-4} μCi/mL.

ACTION 104 – With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the flowrate is estimated at least once per 4 hours. If the number of channels OPERABLE remains less than required by the minimum channels OPERABLE requirement for over 30 days, an explanation of the circumstances shall be included in the next ~~Annual~~ Radioactive Effluent Release Report.

ACTION 105 – With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided grab samples are taken daily and these samples are analyzed for gross activity within 24 hours. With the number of main stack monitoring system channels OPERABLE less than required by the minimum channels OPERABLE requirement, immediately suspend drywell purge. If the number of channels OPERABLE remains less than required by the minimum channels OPERABLE requirement for over 30 days, an explanation of the circumstances shall be included in the next ~~Annual~~ Radioactive Effluent Release Report.

ACTION 107 – With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue, provided samples are continuously collected with auxiliary equipment for periods on the order of 7 days and analyzed within 48 hours after the end of the sampling period. If the number of channels OPERABLE remains less than required by the minimum channels OPERABLE requirement for over 30 days, an explanation of the circumstances shall be included in the next ~~Annual~~ Radioactive Effluent Release Report.

ACTION 108 – With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 72 hours, provided:

a. The offgas treatment system is not bypassed; and

b. The offgas post-treatment monitor (D11-K615) or the main stack monitor (D11-K600) is OPERABLE.

Otherwise, be in at least HOT STANDBY within 12 hours. If the number of channels OPERABLE remains less than required by the minimum channels OPERABLE requirement for over 30 days, an explanation of the circumstances shall be included in the next ~~Annual~~ Radioactive Effluent Release Report.

Table 3-2. Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements

Instrument	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
1. Reactor Building Vent Stack Monitoring System (Each Unit)				
a. Noble Gas Activity Monitor	D[a]	M	R	Q[c]
b. Iodine Sampler Cartridge	W[a,d]	NA	NA	NA
c. Particulate Sampler Filter	W[a,d]	NA	NA	NA
d. Effluent System Flowrate Measuring Device	D[a]	NA	R	Q
e. Sampler Flowrate Measuring Device	D[a]	NA	R	Q
2. Recombiner Building Ventilation Monitoring System				
a. Noble Gas Activity Monitor	D[a]	M	R	Q[c]
b. Iodine Sampler Cartridge	W[a,d]	NA	NA	NA
c. Particulate Sampler Filter	W[a,d]	NA	NA	NA
d. Sampler Flowrate Measuring Device	D[a]	NA	R	Q
3. Main Stack Monitoring System				
a. Noble Gas Activity Monitor	D[a]	M	R	Q[c]
b. Iodine Sampler Cartridge	W[a,d]	NA	NA	NA
c. Particulate Sampler Filter	W[a,d]	NA	NA	NA
d. Effluent Flowrate Monitor	D[a]	NA	R	Q
e. Sampler Flowrate Monitor	D[a]	NA	R	Q
4. Condenser Offgas Pretreatment Monitor (Each Unit)				
a. Noble Gas Activity Monitor	D[b]	M	R	Q[c]

Table 3-2 (contd). Notation for Table 3-2

a. Requirement applies during releases via this pathway.

b. Requirement applies during operation of the main condenser air ejector.

c. In addition to the basic functions of a CHANNEL FUNCTIONAL TEST (Section 10.2), the CHANNEL FUNCTIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

(1) Instrument indicates measured levels above the alarm/trip setpoint.

(2) Circuit failure occurs.

(3) Instrument indicates a downscale failure.

d. The CHANNEL CHECK shall consist of verifying sampler flow and the presence of the collection device (i.e., particulate filter or charcoal cartridge, etc.) at the weekly changeout.

3.1.2 Gaseous Effluent Dose Rate Control

In accordance with Technical Specifications ~~6.18(3)~~ 5.5.4.c. and ~~6.18(7)~~ 5.5.4.g., the licensee shall conduct operations so that the dose rates due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY (see Figure 10-1) are limited as follows:

a. For noble gases: Less than or equal to a dose rate of 500 mrem/y to the total body and less than or equal to a dose rate of 3000 mrem/y to the skin, and

b. For Iodine-131, Iodine-133, tritium, and for all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to a dose rate of 1500 mrem/y to any organ.

3.1.2.1 Applicability

This limit applies at all times.

3.1.2.2 Actions

With a dose rate due to radioactive material released in gaseous effluents exceeding the limit stated in Section 3.1.2, immediately decrease the release rate to within the stated limit.

When the ACTION statement or other requirements of this control cannot be met, steps need not be taken to change the Operational Mode of the unit. Entry into an Operational Mode or other specified CONDITION may be made if, as a minimum, the requirements of the ACTION statement are satisfied.

3.1.2.3 Surveillance Requirements

The dose rates due to radioactive materials in areas at or beyond the SITE BOUNDARY due to releases of gaseous effluents shall be determined to be within the above limits, in accordance with the methods and procedures in Section 3.4.1, by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 3-3.

3.1.2.4 Basis

This control is provided to ensure that gaseous effluent dose rates will be maintained within the limits that historically have provided reasonable assurance that radioactive material discharged in gaseous effluents will not result in a dose to a MEMBER OF THE PUBLIC in an UNRESTRICTED AREA, either within or outside the SITE BOUNDARY, exceeding the limits specified in Appendix I of 10 CFR Part 50, while allowing operational flexibility for effluent releases. For MEMBERS OF THE PUBLIC who may at times be within the SITE BOUNDARY, the occupancy of the MEMBER OF THE PUBLIC will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY.

The dose rate limit for Iodine-131, Iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days specifically applies to dose rates to a child via the inhalation pathway.

This control applies to the release of gaseous effluents from all reactors at the site.

Table 3-3. Radioactive Gaseous Waste Sampling and Analysis Program

Gaseous Release Type	Sampling and Analysis Requirements[a] Sampling FREQUENCY	Minimum Analysis FREQUENCY	Type of Activity Analysis	MINIMUM DETECTABLE CONCENTRATION (MDC) (μCi/mL)
Environmental Release Points 1. Main Stack 2. Reactor Building Vent (Each Unit) 3. Recombiner Building Vent[b]	M[c] Grab Sample	M[c]	PRINCIPAL GAMMA EMITTERS H-3	1 E-4 1 E-6
	CONTINUOUS[e]	W[d] Charcoal or Silver Zeolite Sample	I-131 I-133	1 E-12 1 E-10
	CONTINUOUS[e]	W[d] Particulate Sample	PRINCIPAL GAMMA EMITTERS	1 E-11
	CONTINUOUS[e]	M COMPOSITE Particulate Sample	Gross Alpha	1 E-11
	CONTINUOUS[e]	Q COMPOSITE Particulate Sample	Sr-89, Sr-90	1 E-11

Table 3-3 (contd). Notation for Table 3-3

a. Terms printed in all capital letters are defined in Chapter 10. When unusual circumstances result in a MINIMUM DETECTABLE CONCENTRATION ~~higher~~ than required, the reasons shall be documented in the next ~~Annual~~ Radioactive Effluent Release Report.

b. The Recombiner Building Vent serves Unit 1. Sample analysis results and associated source terms must be assigned to Unit 1 for the purpose of release accountability and dose calculations.

c. Sampling and analyses for PRINCIPAL GAMMA EMITTERS shall also be performed following shutdown, startup, or a THERMAL POWER change exceeding 15% of the RATED THERMAL POWER within a one-hour period. The more frequent sampling and analysis requirement applies only if analysis shows that the DOSE EQUIVALENT I-131 concentration in the primary coolant and the Main Stack Noble Gas Activity Monitor reading have both increased by a factor of 3.

d. Sampling shall be performed weekly, and analyses completed within 48 hours of changing (or after removal from sampler). Sampling shall also be performed once per 24 hours for 7 days following each shutdown, startup, or a THERMAL POWER change exceeding 15% of the RATED THERMAL POWER within a one-hour period, with analyses completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding MINIMUM DETECTABLE CONCENTRATIONs may be increased by a factor of 10. The more frequent sampling and analysis requirement applies only if analysis shows that the DOSE EQUIVALENT I-131 concentration in the primary coolant and the Main Stack Noble Gas Activity Monitor reading have both increased by a factor of 3.

e. The ratio of the sample flowrate to the sampled stream flowrate shall be known for the time period covered by each dose or dose rate calculation made in accordance with controls specified in Sections 3.1.2, 3.1.3, and 3.1.4.

3.1.3 Gaseous Effluent Air Dose Control

5.5.4.e.7 5.5.4.h.

In accordance with Technical Specifications ~~6.18(5)~~ and ~~6.18(8),~~ the air dose due to noble gases released in gaseous effluents, from each reactor unit, to areas at and beyond the SITE BOUNDARY (see Figure 10-1) shall be limited to the following:

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

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

3.1.3.1 Applicability

This limit applies at all times.

3.1.3.2 Actions

With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, prepare and submit to the Nuclear Regulatory Commission within 30 days, ~~pursuant to Technical Specification 6.9.2,~~ a Special Report which identifies the cause(s) for exceeding the limit(s); defines the corrective actions that have been taken to reduce the releases; and defines the proposed corrective actions to be taken to assure that subsequent releases of radioactive noble gases in gaseous effluents will be in compliance with the limits of Section 3.1.3.

When the ACTION statement or other requirements of this control cannot be met, steps need not be taken to change the Operational Mode of the unit. Entry into an Operational Mode or other specified CONDITION may be made if, as a minimum, the requirements of the ACTION statement are satisfied.

3.1.3.3 Surveillance Requirements

Cumulative air dose contributions from noble gas radionuclides released in gaseous effluents from each unit to areas at and beyond the SITE BOUNDARY, for the current calendar quarter and current calendar year, shall be determined in accordance with Section 3.4.2 at least once per 31 days.

3.1.3.4 Basis

This control is provided to implement the requirements of Sections II.B, III.A and IV.A of Appendix I, 10 CFR Part 50. Section 3.1.3 implements the guides set forth in Section II.B of Appendix I. The ACTION statements in Section 3.1.3.2 provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I, assuring that the releases of radioactive material in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The Surveillance requirements in Section 3.1.3.3 implement the requirements in Section III.A of Appendix I, which require that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The dose calculations established in Section 3.4.2 for calculating the doses due to the actual releases of noble gases in gaseous effluents are consistent with the methodology provided in Regulatory Guide 1.109 (Reference 3), and Regulatory Guide 1.111 (Reference 5). The equations in Section 3.4.2 provided for determining the air doses at the SITE BOUNDARY are based upon the historical annual average atmospheric conditions.

3.1.4 ~~Control on Gaseous Effluent Dose to a Member of the Public~~

5.5.4.e.7 5.5.4.i.,

In accordance with Technical Specifications ~~6.18(5)~~ and ~~6.18(9)~~, the dose to a MEMBER OF THE PUBLIC from I-131, I-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released, from each reactor unit, to areas at and beyond the SITE BOUNDARY (see Figure 10-1) shall be limited to the following:

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

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

3.1.4.1 Applicability

This limit applies at all times.

3.1.4.2 Actions

With the calculated dose from the release of I-131, I-133, tritium, or radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents exceeding any of the above limits, prepare and submit to the Nuclear Regulatory Commission within 30 days~~, pursuant to Technical Specification 6.9.2,~~ a Special Report which identifies the cause(s) for exceeding the limit; defines the corrective actions that have been taken to reduce the releases of radioiodines and radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents; and defines proposed corrective actions to assure that subsequent releases will be in compliance with the limits stated in Section 3.1.4.

When the ACTION statement or other requirements of this control cannot be met, steps need not be taken to change the Operational Mode of the unit. Entry into an Operational Mode or other specified CONDITION may be made if, as a minimum, the requirements of the ACTION statement are satisfied.

3.1.4.3 Surveillance Requirements

Cumulative organ dose contributions to a MEMBER OF THE PUBLIC from I-131, I-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days released in gaseous effluents from each unit to areas at and beyond the SITE BOUNDARY, for the current calendar quarter and current calendar year, shall be determined in accordance with Section 3.4.3 at least once per 31 days.

3.1.4.4 Basis

This control is provided to implement the requirements of Section II.C, III.A and IV.A of Appendix I, 10 CFR Part 50. The limits stated in Section 3.1.4 are the guides set forth in Section II.C of Appendix I. The ACTION statements in Section 3.1.4.2 provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The calculational methods specified in the Surveillance Requirements of Section 3.1.4.3 implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The calculational methods in Section 3.4.3 for calculating the doses due to the actual releases of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109 (Reference 3), and Regulatory Guide 1.111 (Reference 5). These equations provide for determining the actual doses based upon the historical annual average atmospheric conditions. The release specifications for radioiodines, radioactive materials in particulate form and radionuclides other than noble gases are dependent on the existing radionuclide pathways to man, in the areas at and beyond the SITE BOUNDARY. The pathways which were examined in the development of these calculations were: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy garden vegetation with subsequent consumption by man, 3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

3.1.5 Gaseous Radwaste Treatment System ~~Control~~

In accordance with Technical Specification 5.5.4.f. ~~6.8(6)~~, the GASEOUS RADWASTE TREATMENT SYSTEM as described in Section 3.2 shall be in operation.

3.1.5.1 Applicability

Whenever the main condenser air ejector is in operation.

3.1.5.2 Actions

With gaseous radwaste from the main condenser air ejector system being discharged without treatment for more than 7 ~~days, prepare and submit to the~~ Nuclear Regulatory Commission within 30 days~~, pursuant to Technical Specification 6.9.2,~~ a Special Report which includes the following information:

a. Identification of the inoperable equipment or subsystem and the reason for inoperability,

b. Action(s) taken to restore the inoperable equipment to OPERABLE status, and

c. Summary description of action(s) taken to prevent a recurrence.

When the ACTION statement or other requirements of this control cannot be met, steps need not be taken to change the Operational Mode of the unit. Entry into an Operational Mode or other specified CONDITION may be made if, as a minimum, the requirements of the ACTION statement are satisfied.

3.1.5.3 Surveillance Requirements

The GASEOUS RADWASTE TREATMENT SYSTEM shall be demonstrated to be OPERABLE by administrative controls which ensure that the offgas treatment system is not bypassed.

3.1.5.4 Basis

The OPERABILITY of the GASEOUS RADWASTE TREATMENT SYSTEM ensures that the system will be available for use whenever gaseous effluents require treatment prior to release to the environment. The requirement that the appropriate portions of this system be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable." This control implements the requirements of 10 CFR

3.2 GASEOUS RADWASTE TREATMENT SYSTEM

At Plant Hatch, there are four points where radioactivity normally is released to the atmosphere in gaseous discharges. These four release pathways are: the Unit 1 and Unit 2 reactor building vent stacks; the Unit 1 recombiner building vent; and the main stack, which serves both units. In addition, releases may be made from any of the building exhaust augmented ventilation systems that have been included in Table 3-1, Table 3-2, and Table 3-3.

The main stack serves as the discharge point from the following release sources from each unit:

- Mechanical vacuum pumps;
- Offgas treatment system (see Figure 3-1);
- Gland seal exhaust; and
- Standby gas treatment system (through which drywell purges are discharged).

In addition, the waste gas treatment building ventilation also discharges through the main stack.

Each reactor building vent stack serves as the discharge point for the following release sources of its respective unit:

- Reactor building;
- Refueling floor ventilation;
- Turbine building; and
- Radwaste building.

The Unit 1 recombiner building vent discharges directly to the atmosphere.

Releases from all of the above discharge points except the main stack are considered to be ground-level releases; releases from the main stack are considered to be elevated releases. Chapter 8 discusses the calculation of atmospheric dispersion parameters using the ground-level and elevated models. All release pathways are considered to be CONTINUOUS (as opposed to BATCH) in nature.

Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the system were specified as a suitable fraction of the dose design objectives set forth in Section II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

This control applies to the release of radioactive materials in gaseous effluents from each unit at the site. For units with shared radwaste systems, the gaseous effluents from the shared system are proportioned among the units sharing that system.

3.1.6 Major Changes to Gaseous Radioactive Waste Treatment Systems

Licensee initiated MAJOR CHANGES TO GASEOUS RADIOACTIVE WASTE TREATMENT SYSTEMS:

a. Shall be reported to the Nuclear Regulatory Commission in the ~~Annual~~ Radioactive Effluents Release Report for the period in which the change was implemented, in accordance with Section 7.2.2.7.

b. Shall become effective upon review ~~and approval~~ by the Plant Review Board
And approval by the Nuclear Plant General Manager.

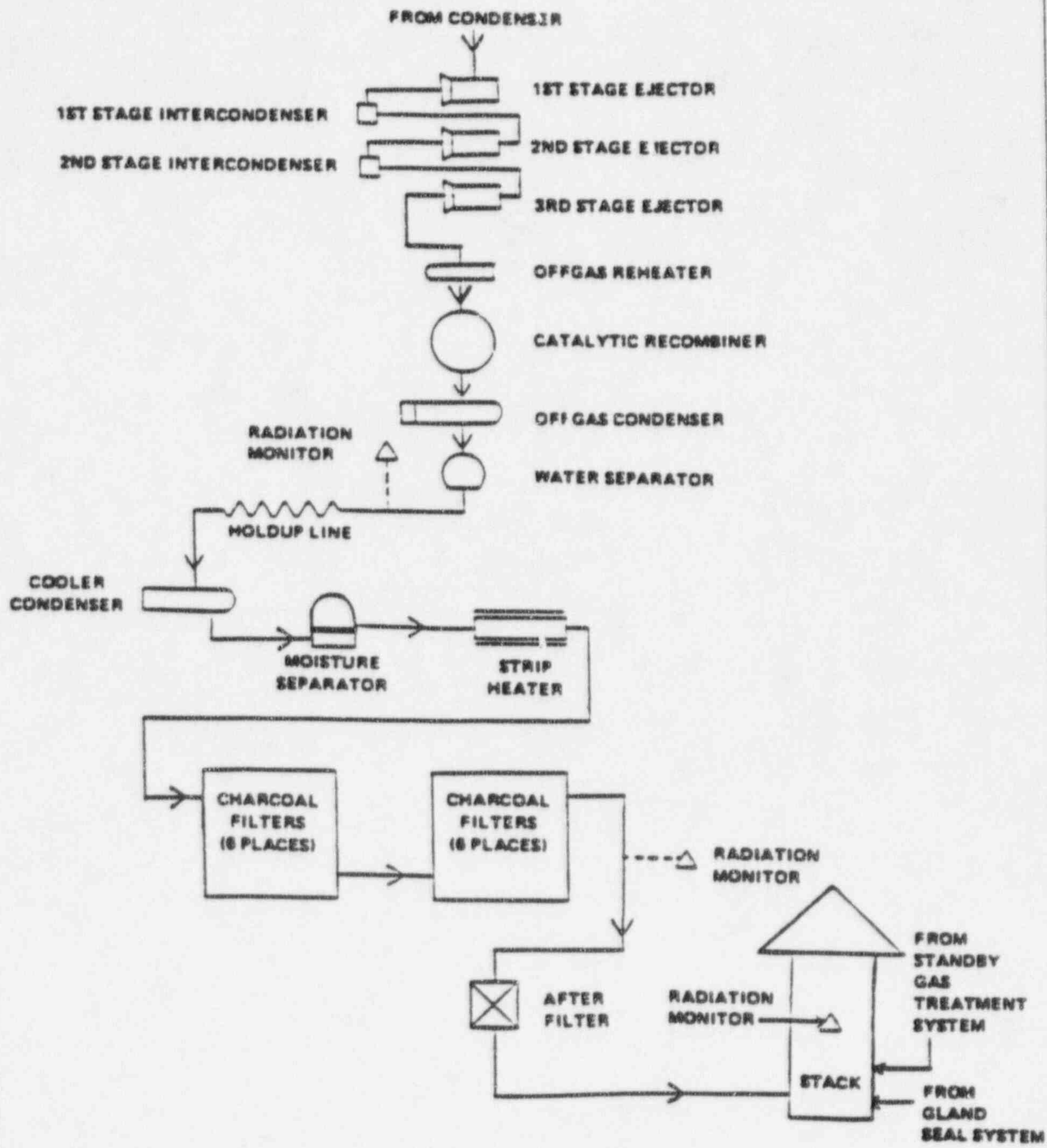

Figure 3-1. Schematic Diagram of the Condenser Offgas Treatment System

3.3 GASEOUS EFFLUENT MONITOR SETPOINTS

3.3.1 General Provisions Regarding Noble Gas Monitor Setpoints

Noble gas radioactivity monitor setpoints calculated in accordance with the methodology presented in this section are intended to ensure that the limits of Section 3.1.2.a are not exceeded. They will be regarded as upper bounds for the actual high alarm setpoints. That is, a lower high alarm setpoint may be established or retained on the monitor, if desired. Intermediate level setpoints should be established at an appropriate level to give sufficient warning prior to reaching the high alarm setpoint.

If no release is planned for a given pathway, or if there is no detectable activity in the gaseous stream being evaluated for release, the setpoint should be established as close to background as practical to prevent spurious alarms, and yet alarm should a significant inadvertent release occur.

As established in Section 3.1.1, gaseous effluent monitor setpoints are *required* only for the noble gas monitors on the release streams listed above. However, Section 3.3.6 discusses setpoint methodologies for particulate and iodine monitors on an information-only basis.

Note: Section 3.3.3 is included for section numbering compatibility with the ODCMs of the other Southern Company nuclear power plants. This section is not required by the existing release source and discharge point configuration of Plant Hatch.

Table 3-4. Applicability of Gaseous Monitor Setpoint Methodologies

Final Release Pathways with no Monitored Source Streams

Setpoint Method: Section 3.3.2
Release Type: CONTINUOUS

<u>Main Stack</u>
Release Elevation: Elevated
Monitor: D11-K600 A and B
Maximum Flowrate: 20,000 cfm (9.44 E+06 mL/s)

<u>Unit 1 or Unit 2 Reactor Building Vent</u>
Release Elevation: Ground-level
Monitor: D11-K619 A and B / 2D11-K636 A and B
Maximum Flowrate: 300,000 cfm (1.42 E+08 mL/s)

<u>Unit 1 Recombiner Building Vent</u>
Release Elevation: Ground-level
Monitor: D11-P003 A and B
Maximum Flowrate: 500 cfm (2.36 E+05 mL/s)

<u>Building Exhaust Augmented Ventilation</u>
The systems in this category are not currently vented to the atmosphere.

Final Release Pathways with One or More Monitored Source Streams

Plant Hatch currently has no release pathways in this category.

$(\overline{X}/\overline{Q})_{vb}$ Values for Use in Setpoint Calculations

<u>Ground-Level Releases</u>: 8.37×10^{-6} s/m^3 [ENE Sector]

<u>Elevated Releases</u>: 4.10×10^{-8} s/m^3 [ENE Sector]

3.3.2 Setpoint for the Final Noble Gas Monitor on Each Release Pathway

3.3.2.1 Overview of Method

Gaseous effluent radioactivity monitors are intended to alarm prior to exceeding the limits of Section 3.1.2.a. Therefore, their alarm setpoints are established to ensure compliance with the following equation:

$$c = \text{the lesser of} \begin{cases} AG \cdot SF \cdot X \cdot R_t \\ AG \cdot SF \cdot X \cdot R_k \end{cases} \tag{3.1}$$

where:

c = the setpoint, in μCi/mL, of the radioactivity monitor measuring the concentration of radioactivity in the effluent line prior to release. The setpoint represents a concentration which, if exceeded, could result in dose rates exceeding the limits of Section 3.1.2.a at or beyond the SITE BOUNDARY.

AG = an administrative allocation factor applied to divide the release limit among all the gaseous release pathways at the site.

SF = the safety factor selected to compensate for statistical fluctuations and errors of measurement.

X = the noble gas concentration for the release under consideration.

R_t = the ratio of the dose rate limit for the total body, 500 mrem/y, to the dose rate to the total body for the conditions of the release under consideration.

R_k = the ratio of the dose rate limit for the skin, 3000 mrem/y, to the dose rate to the skin for the conditions of the release under consideration.

Equation (3.1) shows the relationships of the critical parameters that determine the setpoint. However, in order to apply the methodology presented in the equation to a mixture of noble gas radionuclides, radionuclide-specific concentrations and dose factors must be taken into account under conditions of maximum flowrate for the release point and annual average meteorology.

The basic setpoint method presented below is applicable to the radioactivity monitor nearest the point of release for the release pathway. For monitors measuring the radioactivity in source streams that merge with other streams prior to subsequent monitoring and release, the modifications presented in Section 3.3.3 must be applied.

3.3.2.2 Setpoint Calculation Steps

Step 1: Determine the concentration, X_{iv}, of each noble gas radionuclide i in the gaseous stream v being considered for release, in accordance with the sampling and analysis requirements of Section 3.1.2. Then sum these concentrations to determine the total noble gas concentration, $\sum_i X_{iv}$.

Step 2: Determine R_t, the ratio of the dose rate limit for the total body, 500 mrem/y, to the total body dose rate due to noble gases detected in the release under consideration, as follows,

a. for release pathways for which the release elevation is ground-level:

$$R_t = \frac{500}{(\overline{X/Q})_{vb} \sum_i [K_i \cdot Q_{iv}]} \tag{3.2}$$

b. for release pathways for which the release elevation is elevated:

$$R_t = \frac{500}{\sum_i [V_i \cdot Q_{iv}]} \tag{3.3}$$

where:

500 = the dose rate limit for the total body, 500 mrem/y.

$(\overline{X}/\overline{Q})_{vb}$ = the highest annual average relative concentration at the SITE BOUNDARY for the discharge point of release pathway v. Table 3-4 includes an indication of what release elevation is applicable to each release pathway; release elevation determines the appropriate value of $(\overline{X}/\overline{Q})_{vb}$.

K_i = the total-body dose factor due to gamma emissions from noble gas radionuclide i, in (mrem/y)/(μCi/m^3), from Table 3-5.

Q_{iv} = the release rate of noble gas radionuclide i from the release pathway under consideration, in μCi/s, calculated as the product of X_{iv} and f_{av}, where:

X_{iv} = the concentration of noble gas radionuclide i for the particular release, in μCi/mL.

f_{av} = the maximum anticipated flowrate for release pathway v during the period of the release under consideration, in mL/s.

V_i = the elevated finite-plume total body dose factor due to gamma emissions from noble gas radionuclide i in effluents released from the main stack, in (mrem/y)/(μCi/s), from Table 3-6.

Step 3: Determine R_k, the ratio of the dose rate limit for the skin, 3000 mrem/y, to the skin dose rate due to noble gases detected in the release under consideration, as follows,

a. for release pathways for which the release elevation is ground-level:

$$R_k = \frac{3000}{(\overline{X/Q})_{vb} \sum_i \left[(L_i + 1.1 M_i) \cdot Q_{iv} \right]} \tag{3.4}$$

b. for release pathways for which the release elevation is elevated:

$$R_k = \frac{3000}{\sum_i \left\{ \left[L_i (\overline{X/Q})_{vb} + 1.1 B_i \right] \cdot Q_{iv} \right\}} \tag{3.5}$$

where:

3000 = the dose rate limit for the skin, 3000 mrem/y.

L_i = the skin dose factor due to beta emissions from noble gas radionuclide i, in (mrem/y)/(μCi/m^3), from Table 3-5.

M_i = the air dose factor due to gamma emissions from noble gas radionuclide i, in (mrad/y)/(μCi/m^3), from Table 3-5.

1.1 = the factor to convert air dose in mrad to skin dose in mrem.

B_i = the elevated finite-plume air dose factor due to gamma emissions from noble gas radionuclide i in effluents released from the main stack, in (mrad/y)/(μCi/s), from Table 3-6.

All other terms were defined previously.

Step 4: Determine the maximum noble gas radioactivity monitor setpoint concentration.

Based on the values determined in previous steps, the radioactivity monitor setpoint for the planned release is calculated to ensure that the limits of Section 3.1.2.a will not be exceeded. Because the radioactivity monitor responds primarily to radiation from noble gas radionuclides, the monitor setpoint c_{nv} (in μCi/mL) is based on the concentration of all noble gases in the waste stream, as follows:

$$c_{nv} = \text{the lesser of} \begin{cases} AG_v \cdot SF \cdot \sum_i X_{iv} \cdot R_t \\ AG_v \cdot SF \cdot \sum_i X_{iv} \cdot R_k \end{cases} \qquad (3.6)$$

where:

c_{nv} = the calculated setpoint, in μCi/mL, for the noble gas monitor serving gaseous release pathway v.

AG_v = the administrative allocation factor for gaseous release pathway v, applied to divide the release limit among all the gaseous release pathways at the site. The allocation factor may be assigned any value between 0 and 1, under the condition that the sum of the allocation factors for all simultaneously-active final release pathways at the entire plant site does not exceed 1.

Alternative methods for determination of AG_v are presented in Section 3.3.4.

SF = the safety factor selected to compensate for statistical fluctuations and errors of measurement. The value for the safety factor must be between 0 and 1. A value of 0.5 is reasonable for gaseous releases; a more precise value may be developed if desired.

X_{iv} = the measured concentration of noble gas radionuclide i in gaseous stream v, as defined in Step 1, in μCi/mL.

The values of R_t and R_k to be used in the calculation are those which were determined in Steps 2 and 3 above.

Step 5: Determine whether the release is permissible, as follows:

If $c_{nv} \geq \sum_i X_{iv}$, the release is permissible. However, if c_{nv} is within about 10 percent of $\sum_i X_{iv}$, it may be impractical to use this value of c_{nv}. This situation indicates that measured concentrations are approaching values which would cause the limits of Section 3.1.2.a to be exceeded. Therefore, steps should be taken to reduce contributing source terms of gaseous radioactive material, or to adjust the allocation of the limits among the active release points. The setpoint calculations (steps 1-4) must then be repeated with parameters that reflect the modified conditions.

If $c_{nv} < \sum_i X_{iv}$, the release may not be made as planned. Consider the alternatives discussed in the paragraph above, and calculate a new setpoint based on the results of the actions taken.

3.3.2.3 Use of the Calculated Setpoint

The setpoint calculated above is in the units μCi/mL. The monitor actually measures a count rate that includes background, so that the calculated setpoint must be converted accordingly:

$$c^*_{nv} = (c_{nv} \cdot E_v) + B_v \qquad (3.7)$$

where:

c_{nv}^* = the monitor setpoint as a count rate.

E_v = the monitor calibration factor, in count rate/(μCi/mL). Monitor calibration data for conversion between count rate and concentration may include operational data obtained from determining the monitor response to effluent stream concentrations measured by sample analysis.

B_v = the monitor background count rate. In all cases, monitor background must be controlled so that the monitor is capable of responding to concentrations in the range of the setpoint value. Contributions to the monitor background may include any or all of the following factors: ambient background radiation, plant-related radiation levels at the monitor location (which may change between shutdown and power conditions), and internal background due to contamination of the monitor's sample chamber.

The count rate units for c_{nv}^*, E_v, and B_v in equation (3.7) must be the same, cpm or cps.

3.3.3 Setpoints for Noble Gas Monitors on Effluent Source Streams

The listing in Table 3-4 shows that Plant Hatch currently has no gaseous release pathways that meet the following criteria: a setpoint is required for them under the effluent controls of this ODCM; and they are monitored prior to merging with other streams, and passing a final radioactivity monitor. This section, which presents a setpoint methodology for such monitors, is included in the Plant Hatch ODCM for compatibility with the ODCMs of the other Southern Company nuclear power plants.

3.3.3.1 Setpoint of the Monitor on the Source Stream

Step 1: Determine the concentration X_{is} of each noble gas radionuclide i in source stream s (in μCi/mL) according to the results of its required sample analyses [see Section 3.1.2].

Step 2: Determine r_t, the ratio of the dose rate limit for the total body, 500 mrem/y, to the total body dose rate due to noble gases detected in the source stream under consideration. Use the X_{is} values and the maximum anticipated source stream flow rate f_{as} in equation

(3.2) (or in equation (3.3) if the release is elevated) to determine the total body dose rate for the source stream, substituting r_t for R_t.

The SITE BOUNDARY relative dispersion value used in Steps 2 and 3 for the source stream is the same as the $(\bar{X}/\bar{Q})_{vb}$ that applies to the respective merged stream. This is because the $(\bar{X}/\bar{Q})$ value is determined by the meteorology of the plant site and the physical attributes of the release point, and is unaffected by whether or not a given source stream is operating.

Step 3: Determine r_k, the ratio of the dose rate limit for the skin, 3000 mrem/y, to the skin dose rate due to noble gases detected in the source stream under consideration. Use the X_{is} values and the maximum anticipated source stream flow rate f_{as} in equation (3.4) (or in equation (3.5) if the release is elevated) to determine the skin dose rate for the source stream, substituting r_k for R_k.

Step 4: Determine the maximum noble gas radioactivity monitor setpoint concentration, as follows:

$$c_{ns} = \text{the lesser of} \begin{cases} AG_s \cdot SF \cdot \sum_i X_{is} \cdot r_t \\ AG_s \cdot SF \cdot \sum_i X_{is} \cdot r_k \end{cases} \quad (3.8)$$

where:

c_{ns} = the calculated setpoint (in µCi/mL) for the noble gas monitor serving gaseous source stream s.

AG_s = the administrative allocation factor applied to gaseous source stream s. For a given final release point v, the sum of all the AG_s values for source streams contributing to the final release point must not exceed the release point's allocation factor AG_v.

X_{is} = the measured concentration of noble gas radionuclide i in gaseous source stream s, as defined in Step 1, in µCi/mL.

The values of r_t and r_k to be used in the calculation are those which were determined in Steps 2 and 3 above. The safety factor, SF, was defined previously.

Step 5: Determine whether the release is permissible, as follows:

If $c_{ns} \geq \sum_i X_{is}$, the release is permissible. However, if c_{ns} is within about 10 percent of $\sum_i X_{is}$, it may be impractical to use this value of c_{ns}. This situation indicates that measured concentrations are approaching values which would cause the limits of Section 3.1.2.a to be exceeded. Therefore, steps should be taken to reduce contributing source terms of gaseous radioactive material, or to adjust the allocation of the limits among the active release points. The setpoint calculations (steps 1-4) must then be repeated with parameters that reflect the modified conditions.

If $c_{ns} < \sum_i X_{is}$, the release may not be made as planned. Consider the alternatives discussed in the paragraph above, and calculate a new setpoint based on the results of the actions taken.

3.3.3.2 Effect on the Setpoint of the Monitor on the Merged Stream

Before beginning a release from a monitored source stream, a setpoint must be determined for the source stream monitor as presented in Section 3.3.3.1. In addition, whether or not the source stream has its own effluent monitor, the previously-determined maximum allowable setpoint for the downstream final monitor on the merged stream must be redetermined. This is accomplished by repeating the steps of Section 3.3.2, with the following modifications.

Modification 1: The new maximum anticipated flowrate of the merged stream is the sum of the old merged stream maximum flowrate, and the maximum flowrate of the source stream being considered for release.

$$(f_{av})_{new} = (f_{av})_{old} + f_{as} \qquad (3.9)$$

Modification 2: The new concentration of noble gas radionuclide i in the merged stream includes both the contribution of the merged stream *without* the source stream, *and* the source stream being considered for release.

$$(X_{iv})_{new} = \frac{(f_{av})_{old} \cdot (X_{iv})_{old} + f_{as} \cdot X_{is}}{(f_{av})_{new}} \quad (3.10)$$

3.3.4 Determination of Allocation Factors, AG

When simultaneous gaseous releases are conducted, an administrative allocation factor must be applied to divide the release limit among the active gaseous release pathways. This is to assure that the dose rate limit for areas at and beyond the SITE BOUNDARY (see Section 3.1.2) will not be exceeded by simultaneous releases. The allocation factor for any pathway may be assigned any value between 0 and 1, under the following two conditions:

1. The sum of the allocation factors for all simultaneously-active *final* release paths at the plant site may not exceed 1.

2. The sum of the allocation factors for all simultaneously-active *source streams* merging into a given final release pathway may not exceed the allocation factor of that final release pathway.

Any of the following three methods may be used to assign the allocation factors to the active gaseous release pathways:

1. For ease of implementation, AG_v may be equal for all release pathways:

$$AG_v = \frac{1}{N} \quad (3.11)$$

where:

N = the number of simultaneously active gaseous release pathways.

2. AG_v for a given release pathway may be selected based on an *estimate* of the portion of the total SITE BOUNDARY dose rate (from all simultaneous releases) that is contributed by the release pathway. During periods when a given building or release pathway is not subject to gaseous radioactive releases, it may be assigned an allocation factor of zero.

3. AG_v for a given release pathway may be selected based on a *calculation* of the portion of the total SITE BOUNDARY dose rate that is contributed by the release pathway, as follows,

a. for ground-level release points:

$$AG_v = \frac{(\overline{X/Q})_{vb} \sum_i (K_i Q_{iv})}{\sum_i (V_i Q_{is}) + \sum_{r=1}^{N} \left[(\overline{X/Q})_{rb} \sum_i (K_i Q_{ir}) \right]} \tag{3.12}$$

b. for the elevated release point (main stack):

$$AG_v = \frac{\sum_i (V_i Q_{is})}{\sum_i (V_i Q_{is}) + \sum_{r=1}^{N} \left[(\overline{X/Q})_{rb} \sum_i (K_i Q_{ir}) \right]} \tag{3.13}$$

where:

$(\overline{X/Q})_{vb}$ = the annual average SITE BOUNDARY relative concentration applicable to the gaseous release pathway v for which the allocation factor is being determined, in s/m^3.

K_i = the total-body dose factor due to gamma emissions from noble gas radionuclide i, in (mrem/y)/(μCi/m^3), from Table 3-5.

Q_{iv} = the release rate of noble gas radionuclide i from release pathway v, in μCi/s, calculated as the product of X_{iv} and f_{av}, where:

X_{iv} = the concentration of noble gas radionuclide i applicable to the gaseous release pathway v for which the allocation factor is being determined, in μCi/mL.

f_{av} = the discharge flowrate applicable to gaseous release pathway v for which the allocation factor is being determined, in mL/s.

Note: As applied in equations (3.12) and (3.13), Q_{iv} is restricted to ground-level release pathways.

V_i = the elev. d finite-plume total body dose factor due to gamma emissions from noble gas radionuclide i in effluents released from the main stack, in (mrem/y)/(μCi/s), from Table 3-6.

Q_{is} = the release rate of noble gas radionuclide i from the main stack, in $\mu Ci/s$, calculated as the product of the X_{iv} and f_{av} values specific to the main stack.

$(\bar{X}/\bar{Q})_{rb}$ = the annual average SITE BOUNDARY relative concentration applicable to active gaseous release pathway r, in s/m^3.

Q_{ir} = the value of Q_{iv} applicable to active release pathway r, in $\mu Ci/s$.

N = the number of simultaneously active gaseous release pathways (including pathway v that is of interest).

NOTE: Although equations (3.11), (3.12), and (3.13) are written to illustrate the assignment of the allocation factors for final release pathways, they may also be used to assign allocation factors to the source streams that merge into a given final release pathway.

3.3.5 Setpoints for Noble Gas Monitors with Special Requirements

Unit 1 Condenser Offgas Pretreatment Monitor

Monitor: 1D11-K601 and 1D11-K602

Unit 2 Condenser Offgas Pretreatment Monitor

Monitor: 2D11-K601 and 2D11-K602

For the purpose of implementing Section 3.1.1, the alarm setpoint level for these noble gas monitors will be calculated as follows:

$$c_{nco} = \frac{2.40 \times 10^5}{E_{co} \cdot f_{co}} \tag{3.14}$$

where:

2.40×10^5 = the release rate limit for pretreatment condenser offgas as specified in Technical Specifications ~~3.15.2.7 (Unit 1) and 3.11.2.7 (Unit 2),~~ 3.7.6 in $\mu Ci/s$.

c_{nco} = the reading of the condenser offgas pretreatment monitor at the alarm setpoint, in mR/h.

E_{co} = the calibration factor for the condenser offgas pretreatment monitor, in ($\mu Ci/s$) per (cfm·mR/h).

f_{co} = the condenser offgas flowrate, in cfm.

3.3.6 Setpoints for Particulate and Iodine Monitors

In accordance with Section 5.1.1 of NRC NUREG-0133 (Reference 1), the effluent controls of Section 3.1.1 do not require that the ODCM establish setpoint calculation methods for particulate and iodine monitors.

3.4 GASEOUS EFFLUENT COMPLIANCE CALCULATIONS

3.4.1 Dose Rates at and Beyond the Site Boundary

Because the dose rate limits for areas at and beyond the SITE specified in Section 3.1.2 are *site* limits applicable at any instant in time, the summations extend over all simultaneously active gaseous final release pathways at the *plant site*. Table 3-4 identifies the gaseous final release pathways at the plant site, and indicates the $(\overline{X}/\overline{Q})_{vb}$ [or $(\overline{X}/\overline{Q})_{sb}$] value for each.

3.4.1.1 Dose Rates Due to Noble Gases

For the purpose of implementing the controls of Section 3.1.2.a, the dose rates due to noble gas radionuclides in areas at or beyond the SITE BOUNDARY, due to releases of gaseous effluents, shall be calculated as follows:

For total body dose rates:

$$DR_t = \sum_v \left\{ (\overline{X/Q})_{vb} \sum_i \left[K_i \, Q_{iv} \right] \right\} + \sum_i \left(V_i \, Q_{is} \right) \qquad (3.15)$$

For skin dose rates:

$$DR_k = \sum_v \left\{ (\overline{X/Q})_{vb} \sum_i \left[(L_i + 1.1 M_i) \, Q_{iv} \right] \right\} + \left\{ \sum_i \left[(\overline{X/Q})_{sb} \, L_i + 1.1 B_i \right] Q_{is} \right\} \qquad (3.16)$$

where:

DR_t = the total body dose rate at the time of the release, in mrem/y.

DR_k = the skin dose rate at the time of the release, in mrem/y.

Q_{iv} = the release rate of noble gas radionuclide i, in μCi/s, equal to the product of f_{tv} and X_{iv}, where:

f_{tv} = the actual average flowrate for release pathway v during the period of the release, in mL/s.

Note: For equations (3.15) and (3.16), the definition of Q_{iv}, and the summations over v, are restricted to ground-level release pathways.

Q_{is} = the release rate of noble gas radionuclide i from the main stack, in μCi/s, equal to the product of the f_{tv} and X_{iv} values specific to the main stack. [This definition applies to both equations (3.15) and (3.16).]

$(\overline{X}/\overline{Q})_{sb}$ = the value of $(\overline{X}/\overline{Q})_{vb}$ for the main stack; that is, the highest annual average relative concentration at the SITE BOUNDARY, for the main stack, in s/m^3. Table 3-4 includes the value of $(\overline{X}/\overline{Q})_{sb}$.

All other terms were defined previously.

3.4.1.2 Dose Rates Due to Iodine-131, Iodine-133, Tritium, and Radionuclides in Particulate Form with Half-Lives Greater than 8 Days

For the purpose of implementing the controls of Section 3.1.2.b, the dose rates due to Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days, in areas at or beyond the SITE BOUNDARY, due to releases of gaseous effluents, shall be calculated as follows:

$$DR_o = \sum_v \left\{ (\overline{X/Q})_{vb} \sum_i \left[P_{io}\, Q'_{iv} \right] \right\} + (\overline{X/Q})_{sb} \sum_i \left[P_{io}\, Q'_{is} \right] \qquad (3.17)$$

where:

DR_o = the dose rate to organ o at the time of the release, in mrem/y.

P_{io} = the site-specific dose factor for radionuclide i and organ o, in (mrem/y)/(μCi/m^3). Since the dose rate limits specified in Section 3.1.2.b apply only to the child age group exposed to the inhalation pathway, the values of P_{io} may be obtained from Table 3-9, "R_{aipj} for Inhalation Pathway, Child Age Group."

Q'_{iv} = the release rate of radionuclide i from gaseous release pathway v, in μCi/s. For the purpose of implementing the controls of Section 3.1.2.b, only I-131, I-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days should be included in this calculation.

All other terms were defined previously.

3.4.2 Noble Gas Air Dose at or Beyond Site Boundary

For the purpose of implementing the controls of Section 3.1.3, air doses in areas at or beyond the SITE BOUNDARY due to releases of noble gases from each unit shall be calculated as follows (adapted from Reference 1, page 28, by including only long-term releases):

$$D_\beta = 3.17 \times 10^{-8} \left[\sum_v \left\{ (\overline{X/Q})_{vb} \sum_i \left(N_i \cdot \tilde{Q}_{iv}\right) \right\} + (\overline{X/Q})_{sb} \sum_i \left(N_i \cdot \tilde{Q}_{is}\right) \right] \quad (3.18)$$

$$D_\gamma = 3.17 \times 10^{-8} \left[\sum_v \left\{ (\overline{X/Q})_{vb} \sum_i \left(M_i \cdot \tilde{Q}_{iv}\right) \right\} + \sum_i \left(B_i \cdot \tilde{Q}_{is}\right) \right] \quad (3.19)$$

where:

3.17×10^{-8} = a units conversion factor: 1 y/(3.15×10^7 s).

D_β = the air dose due to beta emissions from noble gas radionuclides, in mrad.

D_γ = the air dose due to gamma emissions from noble gas radionuclides, in mrad.

N_i = the air dose factor due to beta emissions from noble gas radionuclide i, in (mrad/y)/(μCi/m^3), from Table 3-5.

$(\bar{X}/\bar{Q})_{sb}$ = the value of $(\bar{X}/\bar{Q})_{vb}$ for the main stack; that is, the highest annual average relative concentration at the SITE BOUNDARY, for the main stack, in s/m^3. Table 3-4 includes the value of $(\bar{X}/\bar{Q})_{sb}$.

M_i = the air dose factor due to gamma emissions from noble gas radionuclide i, in (mrad/y)/(μCi/m^3), from Table 3-5.

B_i = the elevated finite-plume air dose factor due to gamma emissions from noble gas radionuclide i in effluents released from the main stack, in (mrad/y)/(μCi/s), from Table 3-6.

$\tilde{Q}_{iv}$ = the cumulative release of noble gas radionuclide i from non-elevated release pathway v, in μCi, during the period of interest.

$\tilde{Q}_{is}$ = the value of $\tilde{Q}_{iv}$ for the main stack; that is, the cumulative release of noble gas radionuclide i from the main stack, in μCi, during the period of interest.

and all other terms are as defined above.

Because the air dose limit is on a per-reactor-unit basis, the summations extend over all gaseous final release pathways (other than the main stack, which has its own term) for a given *unit*. For a release pathway discharging materials originating in both reactor units, the activity discharged from the release point may be apportioned to the two units in any reasonable manner, provided that all activity released via the particular shared release pathway is apportioned to one or the other unit.

The gaseous final release pathways at the plant site, and the $(\bar{X}/\bar{Q})_{vb}$ for each, are identified in Table 3-4.

Table 3-5. Dose Factors for Exposure to a Semi-Infinite Cloud of Noble Gases

Nuclide	γ - Body (K) (mrem/y) per (μCi/m^3)	β - Skin (L) (mrem/y) per (μCi/m^3)	γ - Air (M) (mrad/y) per (μCi/m^3)	β - Air (N) (mrad/y) per (μCi/m^3)
Kr-83m	7.56 E-02	0.00 E+00	1.93 E+01	2.88 E+02
Kr-85m	1.17 E+03	1.46 E+03	1.23 E+03	1.97 E+03
Kr-85	1.61 E+01	1.34 E+03	1.72 E+01	1.95 E+03
Kr-87	5.92 E+03	9.73 E+03	6.17 E+03	1.03 E+04
Kr-88	1.47 E+04	2.37 E+03	1.52 E+04	2.93 E+03
Kr-89	1.66 E+04	1.01 E+04	1.73 E+04	1.06 E+04
Kr-90	1.56 E+04	7.29 E+03	1.63 E+04	7.83 E+03
Xe-131m	9.15 E+01	4.76 E+02	1.56 E+02	1.11 E+03
Xe-133m	2.51 E+02	9.94 E+02	3.27 E+02	1.48 E+03
Xe-133	2.94 E+02	3.06 E+02	3.53 E+02	1.05 E+03
Xe-135m	3.12 E+03	7.11 E+02	3.36 E+03	7.39 E+02
Xe-135	1.81 E+03	1.86 E+03	1.92 E+03	2.46 E+03
Xe-137	1.42 E+03	1.22 E+04	1.51 E+03	1.27 E+04
Xe-138	8.83 E+03	4.13 E+03	9.21 E+03	4.75 E+03
Ar-41	8.84 E+03	2.69 E+03	9.30 E+03	3.28 E+03

All values in this table were obtained from Reference 3 (Table B-1), with units converted.

Table 3-6. Dose Factors for Exposure to Direct Radiation from Noble Gases in an Elevated Finite Plume

Nuclide	γ - Total Body (V) (mrem/y) per (μCi/s)	γ - Air (B) (mrad/y) per (μCi/s)
Kr-83m	0.00 E-00	0.00 E-00
Kr-85m	8.25 E-05	8.69 E-05
Kr-85	1.26 E-06	1.35 E-06
Kr-87	4.40 E-04	4.59 E-04
Kr-88	1.09 E-03	1.13 E-03
Kr-89	9.44 E-04	9.87 E-04
Kr-90	7.00 E-04	7.38 E-04
Xe-131m	1.68 E-06	1.76 E-06
Xe-133m	1.29 E-05	1.37 E-05
Xe-133	1.38 E-05	1.43 E-05
Xe-135m	2.42 E-04	2.59 E-04
Xe-135	1.33 E-04	1.42 E-04
Xe-137	9.55 E-05	1.02 E-04
Xe-138	6.16 E-04	6.44 E-04
Ar-41	7.34 E-04	7.72 E-04

Values are as reported in Reference 24. They were calculated in accordance with Reference 1 (Section 5.2.1) and Reference 3 (Appendix F), using the meteorological joint frequency distributions presented in Reference 14. All values in this table are for the Site Boundary (1545 m) in the ENE sector.

3.4.3 Dose to a Member of the Public at or Beyond Site Boundary

The dose received by an individual due to gaseous releases from each reactor unit, to areas at or beyond the SITE BOUNDARY, depends on the individual's location, age group, and exposure pathways. The MEMBER OF THE PUBLIC expected to receive the highest dose in the plant vicinity is referred to as the controlling receptor. The dosimetrically-significant attributes of the currently-defined controlling receptor are presented in Table 3-7.

Doses to a MEMBER OF THE PUBLIC due to gaseous releases of I-131, I-133, tritium, and all radionuclides in particulate form from each unit shall be calculated as follows (equation adapted from Reference 1, page 29, by considering only long-term releases):

$$D_{ja} = 3.17 \times 10^{-8} \sum_{p} \left\{ \sum_{i} R_{aipj} \sum_{v} \left[W_{vip} \cdot \bar{Q}'_{iv} \right] \right\} \tag{3.20}$$

where:

D_{ja} = the dose to organ j of an individual in age group a, due to gaseous releases of I-131, I-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days, in mrem.

3.17×10^{-8} = a units conversion factor: $1\ y/(3.15 \times 10^{7}\ s)$.

R_{aipj} = the site-specific dose factor for age group a, radionuclide i, exposure pathway p, and organ j. For the purpose of implementing the controls of Section 3.1.4, the exposure pathways applicable to calculating the dose to the currently-defined controlling receptor are included in Table 3-7; values of R_{aipj} for each exposure pathway and radionuclide applicable to calculations of dose to the controlling receptor are listed in Table 3-8 through Table 3-10.

A detailed discussion of the methods and parameters used for calculating R_{aipj} for the plant site is presented in Chapter 9. That information may be used for recalculating the R_{aipj} values if the underlying parameters change, or for calculating R_{aipj} values for special radionuclides and age groups when performing the assessments discussed in Section 3.4.4 below.

W_{vip} = the annual average relative dispersion or deposition at the location of the controlling receptor, for release pathway v, as appropriate to exposure pathway p and radionuclide i.

For all tritium pathways, and for the inhalation of any radionuclide: W_{vip} is $(\bar{X}/\bar{Q})_{vp}$, the annual average relative dispersion factor for release pathway v, at the location of the controlling receptor (s/m^3). For the ground-plane exposure pathway, and for all ingestion-related pathways for radionuclides other than tritium: W_{vip} is $(\bar{D}/\bar{Q})_{vp}$, the annual average relative deposition factor for release pathway v, at the location of the controlling receptor (m^{-2}). Values of $(\bar{X}/\bar{Q})_{vp}$ and $(\bar{D}/\bar{Q})_{vp}$ for use in calculating the dose to the currently-defined controlling receptor are included in Table 3-7.

$\tilde{Q}'_{iv}$= the cumulative release of radionuclide i from release pathway v, during the period of interest (μCi). For the purpose of implementing the controls of Section 3.1.4, only I-131, I-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days should be included in this calculation. In any dose assessment using the methods of this sub-section, only radionuclides detectable above background in their respective samples should be included in the calculation.

Because the MEMBER OF THE PUBLIC dose limit is on a per-unit basis, the summations extend over all gaseous final release pathways for a given *unit*. For a release pathway discharging materials originating in both reactor units, the activity discharged from the release point may be apportioned between the two units in any reasonable manner, provided that all activity released from the plant site is apportioned to one or the other unit.

The gaseous final release pathways at the plant site, and the release elevation for each, are identified in Table 3-4.

Table 3-7. Attributes of the Controlling Receptor

The locations of members of the public in the vicinity of the plant site, and the exposure pathways associated with those locations, were determined in the Annual Land Use Census (Reference 12). Dispersion and deposition values were calculated based on site meteorological data collected for the period 1984 through 1986 (Reference 16).

Based on an analysis of this information, the current controlling receptor for the HNP site is described as follows.

Sector: WSW

Distance: 1.2 miles

Age Group: Child

Exposure Pathways: Ground plane
Inhalation
Garden vegetation

Dispersion Factors $(\overline{X/Q})_{vp}$:

Ground-Level: 3.18×10^{-6} s/m^3

Elevated: 6.53×10^{-8} s/m^3

Deposition Factors $(\overline{D/Q})_{vp}$:

Ground-Level: 8.80×10^{-9} m^{-2}

Elevated: 1.37×10^{-9} m^{-2}

Elevated Plume Dose Factors:+

Radionuclide	V_i (mrem/y)/(μCi/s)
Kr-85m	6.92 E-05
Kr-85	9.95 E-07
Kr-87	3.36 E-04
Kr-88	8.23 E-04
Kr-89	7.20 E-04
Kr-90	5.39 E-04
Xe-131m	1.42 E-06

Radionuclide	V_i (mrem/y)/(μCi/s)
Xe-133m	1.07 E-05
Xe-133	1.23 E-05
Xe-135m	1.90 E-04
Xe-135	1.09 E-04
Xe-137	7.54 E-05
Xe-138	4.71 E-04
Ar-41	5.59 E-04

\+ These values were calculated using the methods and data described in Reference 29. They are necessary when performing calculations for the purpose of demonstrating compliance with the limits of Section 5.1.

3.4.4 Dose Calculations to Support Other Requirements

Case 1: Under ~~Technical Specification 6.6.1~~ 10 CFR 50.73, a radiological impact assessment may be required to support evaluation of a reportable event.

Dose calculations may be performed using the equations in Section 3.4.3, with the substitution of the dispersion and deposition parameters [(X/Q) and (D/Q)] for the period covered by the report, and using the appropriate pathway dose factors (R_{aipj}) for the receptor of interest. Methods for calculating (X/Q) and (D/Q) from meteorological data are presented in Chapter 8.

The values of R_{aipj} presented in Table 3-8 through Table 3-10 are applicable only to the currently-defined controlling receptor, so that when dose calculations must be performed for a different receptor, R_{aipj} values applicable to that receptor must first be calculated. Methods and parameters for calculating R_{aipj} for radionuclides and age groups other than those required in Section 3.4.3 are presented in Chapter 9. When calculating R_{aipj} for evaluation of an event, pathway and usage factors specific to the receptor involved in the event may be used in place of the values in Chapter 9, if the specific values are known.

Case 2: A dose calculation is required to evaluate the results of the Land Use Census, under the provisions of Section 4.1.2.

In the event that the Land Use Census reveals that exposure pathways have changed at previously-identified locations, or if new locations are identified, it may be necessary to calculate doses at two or more locations to determine which should be designated as the controlling receptor. Such dose calculations may be performed using the equations in Section 3.4.3, with the substitution of the annual average dispersion and deposition values [$(\overline{X}/\overline{Q})$ and $(\overline{D}/\overline{Q})$] for the locations of interest, and using the appropriate pathway dose factors (R_{aipj}) for the receptors of interest.

Methodr for calculating (X/Q) and (D/Q) from meteorological data are presented in Chapter 8. The values of R_{aipj} presented in Table 3-8 through Table 3-10 are applicable only to the currently-defined controlling receptor, so that when dose calculations must be performed for a different receptor, R_{aipj} values applicable to that receptor must first be calculated. Methods and parameters for calculating R_{aipj} for radionuclides and age

Methods and parameters for calculating R_{aipj} for radionuclides and age groups other than those required in Section 3.4.3 are presented in Chapter 9.

Case 3: Under Section 5.2, a dose calculation is required to support determination of total dose to a receptor of age group other than that currently defined as the controlling receptor.

Dose calculations shall be performed using the equations in Section 3.4.3, using the dispersion and deposition parameters defined in Table 3-7 for the controlling receptor, but substituting the appropriate pathway dose factors (R_{aipj}) for the receptor age group of interest.

The values of R_{aipj} presented in Table 3-8 through Table 3-10 are applicable only to the currently-defined controlling receptor, so that when dose calculations must be performed for a different receptor age group, R_{aipj} values applicable to that receptor must first be calculated. Methods and parameters for calculating R_{aipj} for radionuclides and age groups other than those required in Section 3.4.3 are presented in Chapter 9.

Table 3-8. R_{aipj} for Ground Plane Pathway, All Age Groups

Nuclide	T. Body	Skin
H-3	0.00	0.00
C-14	0.00	0.00
P-32	0.00	0.00
Cr-51	4.66E+06	5.51E+06
Mn-54	1.39E+09	1.63E+09
Fe-55	0.00	0.00
Fe-59	2.73E+08	3.21E+08
Co-58	3.79E+08	4.44E+08
Co-60	2.15E+10	2.53E+10
Ni-63	0.00	0.00
Zn-65	7.47E+08	8.59E+08
Rb-86	8.99E+06	1.03E+07
Sr-89	2.16E+04	2.51E+04
Sr-90	0.00	0.00
Y-91	1.07E+06	1.21E+06
Zr-95	2.45E+08	2.84E+08
Nb-95	1.37E+08	1.61E+08
Ru-103	1.08E+08	1.26E+08
Ru-106	4.22E+08	5.07E+08
Ag-110m	3.44E+09	4.01E+09
Sb-124	5.98E+08	6.90E+08
Sb-125	2.34E+09	2.64E+09
Te-125m	1.55E+06	2.13E+06
Te-127m	9.16E+04	1.08E+05
Te-129m	1.98E+07	2.31E+07
I-131	1.72E+07	2.09E+07
I-133	2.45E+06	2.98E+06
Cs-134	6.86E+09	8.00E+09
Cs-136	1.51E+08	1.71E+08
Cs-137	1.03E+10	1.20E+10
Ba-140	2.05E+07	2.35E+07
Ce-141	1.37E+07	1.54E+07
Ce-144	6.95E+07	8.04E+07
Pr-143	0.00	0.00
Nd-147	8.39E+06	1.01E+07

1. Units are $m^2 \cdot (mrem/yr)/(\mu Ci/s)$.
2. The values in the Total Body column also apply to the Bone, Liver, Thyroid, Kidney, Lung, and GI-LLI organs.
3. This table also supports the calculations of Section 6.2.

Table 3-9. R_{aipj} for Inhalation Pathway, Child Age Group

Nuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03	1.12E+03
C-14	3.59E+04	6.73E+03	6.73E+03	6.73E+03	6.73E+03	6.73E+03	6.73E+03
P-32	2.60E+06	1.14E+05	9.88E+04	0.00	0.00	0.00	4.22E+04
Cr-51	0.00	0.00	1.54E+02	8.55E+01	2.43E+01	1.70E+04	1.08E+03
Mn-54	0.00	4.29E+04	9.51E+03	0.00	1.00E+04	1.58E+06	2.29E+04
Fe-55	4.74E+04	2.52E+04	7.77E+03	0.00	0.00	1.11E+05	2.87E+03
Fe-59	2.07E+04	3.34E+04	1.67E+04	0.00	0.00	1.27E+06	7.07E+04
Co-58	0.00	1.77E+03	3.16E+03	0.00	0.00	1.11E+06	3.44E+04
Co-60	0.00	1.31E+04	2.26E+04	0.00	0.00	7.07E+06	9.62E+04
Ni-63	8.21E+05	4.63E+04	2.80E+04	0.00	0.00	2.75E+05	6.33E+03
Zn-65	4.26E+04	1.13E+05	7.03E+04	0.00	7.14E+04	9.95E+05	1.63E+04
Rb-86	0.00	1.98E+05	1.14E+05	0.00	0.00	0.00	7.99E+03
Sr-89	5.99E+05	0.00	1.72E+04	0.00	0.00	2.16E+06	1.67E+05
Sr-90	1.01E+08	0.00	6.44E+06	0.00	0.00	1.48E+07	3.43E+05
Y-91	9.14E+05	0.00	2.44E+04	0.00	0.00	2.63E+06	1.84E+05
Zr-95	1.90E+05	4.18E+04	3.70E+04	0.00	5.96E+04	2.23E+06	6.11E+04
Nb-95	2.35E+04	9.18E+03	6.55E+03	0.00	8.62E+03	6.14E+05	3.70E+04
Ru-103	2.79E+03	0.00	1.07E+03	0.00	7.03E+03	6.62E+05	4.48E+04
Ru-106	1.36E+05	0.00	1.69E+04	0.00	1.84E+05	1.43E+07	4.29E+05
Ag-110m	1.69E+04	1.14E+04	9.14E+03	0.00	2.12E+04	5.48E+06	1.00E+05
Sb-124	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sb-125	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Te-125m	6.73E+03	2.33E+03	9.14E+02	1.92E+03	0.00	4.77E+05	3.38E+04
Te-127m	2.49E+04	8.55E+03	3.02E+03	6.07E+03	6.36E+04	1.48E+06	7.14E+04
Te-129m	1.92E+04	6.85E+03	3.04E+03	6.33E+03	5.03E+04	1.76E+06	1.82E+05
I-131	4.81E+04	4.81E+04	2.73E+04	1.62E+07	7.88E+04	0.00	2.84E+03
I-133	1.66E+04	2.03E+04	7.70E+03	3.85E+06	3.38E+04	0.00	5.48E+03
Cs-134	6.51E+05	1.01E+06	2.25E+05	0.00	3.30E+05	1.21E+05	3.85E+03
Cs-136	6.51E+04	1.71E+05	1.16E+05	0.00	9.55E+04	1.45E+04	4.18E+03
Cs-137	9.07E+05	8.25E+05	1.28E+05	0.00	2.82E+05	1.04E+05	3.62E+03
Ba-140	7.40E+04	6.48E+01	4.33E+03	0.00	2.11E+01	1.74E+06	1.02E+05
Ce-141	3.92E+04	1.95E+04	2.90E+03	0.00	8.55E+03	5.44E+05	5.66E+04
Ce-144	6.77E+06	2.12E+06	3.61E+05	0.00	1.17E+06	1.20E+07	3.89E+05
Pr-143	1.85E+04	5.55E+03	9.14E+02	0.00	3.00E+03	4.33E+05	9.73E+04
Nd-147	1.08E+04	8.73E+03	6.81E+02	0.00	4.81E+03	3.28E+05	8.21E+04

1. Units are (mrem/yr)/(μCi/m^3) for all radionuclides.
2. This table also supports the calculations of Section 6.2.

Table 3-10. R_{aipj} for Garden Vegetation Pathway, Child Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
H-3	0.00	4.01E+03	4.01E+03	4.01E+03	4.01E+03	4.01E+03	4.01E+03
C-14	8.89E+08	1.78E+08	1.78E+08	1.78E+08	1.78E+08	1.78E+08	1.78E+08
P-32	3.37E+09	1.58E+08	1.30E+08	0.00	0.00	0.00	9.31E+07
Cr-51	0.00	0.00	1.17E+05	6.50E+04	1.78E+04	1.19E+05	6.21E+06
Mn-54	0.00	6.65E+08	1.77E+08	0.00	1.86E+08	0.00	5.58E+08
Fe-55	8.01E+08	4.25E+08	1.32E+08	0.00	0.00	2.40E+08	7.87E+07
Fe-59	3.98E+08	6.43E+08	3.20E+08	0.00	0.00	1.86E+08	6.70E+08
Co-58	0.00	6.44E+07	1.97E+08	0.00	0.00	0.00	3.76E+08
Co-60	0.00	3.78E+08	1.12E+09	0.00	0.00	0.00	2.10E+09
Ni-63	3.95E+10	2.11E+09	1.34E+09	0.00	0.00	0.00	1.42E+08
Zn-65	8.13E+08	2.16E+09	1.35E+09	0.00	1.36E+09	0.00	3.80E+08
Rb-86	0.00	4.52E+08	2.78E+08	0.00	0.00	0.00	2.91E+07
Sr-89	3.60E+10	0.00	1.03E+09	0.00	0.00	0.00	1.39E+09
Sr-90	1.24E+12	0.00	3.15E+11	0.00	0.00	0.00	1.67E+10
Y-91	1.86E+07	0.00	4.99E+05	0.00	0.00	0.00	2.48E+09
Zr-95	3.86E+06	6.48E+05	7.55E+05	0.00	1.21E+06	0.00	8.85E+08
Nb-95	4.10E+05	1.60E+05	1.14E+05	0.00	1.50E+05	0.00	2.96E+08
Ru-103	1.53E+07	0.00	5.90E+06	0.00	3.86E+07	0.00	3.97E+08
Ru-106	7.45E+08	0.00	9.30E+07	0.00	1.01E+09	0.00	1.16E+10
Ag-110m	3.21E+07	2.17E+07	1.73E+07	0.00	4.04E+07	0.00	2.58E+09
Sb-124	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sb-125	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Te-125m	3.51E+08	9.50E+07	4.67E+07	9.84E+07	0.00	0.00	3.38E+08
Te-127m	1.32E+09	3.56E+08	1.57E+08	3.16E+08	3.77E+09	0.00	1.07E+09
Te-129m	8.41E+08	2.35E+08	1.31E+08	2.71E+08	2.47E+09	0.00	1.03E+09
I-131	1.43E+08	1.44E+08	8.17E+07	4.75E+10	2.36E+08	0.00	1.28E+07
I-133	3.53E+06	4.37E+06	1.65E+06	8.11E+08	7.28E+06	0.00	1.76E+06
Cs-134	1.60E+10	2.63E+10	5.55E+09	0.00	8.15E+09	2.93E+09	1.42E+08
Cs-136	8.24E+07	2.27E+08	1.47E+08	0.00	1.21E+08	1.80E+07	7.96E+06
Cs-137	2.39E+10	2.29E+10	3.38E+09	0.00	7.46E+09	2.68E+09	1.43E+08
Ba-140	2.77E+08	2.42E+05	1.61E+07	0.00	7.89E+04	1.45E+05	1.40E+08
Ce-141	6.56E+05	3.27E+05	4.86E+04	0.00	1.43E+05	0.00	4.08E+08
Ce-144	1.27E+08	3.98E+07	6.78E+06	0.00	2.21E+07	0.00	1.04E+10
Pr-143	1.46E+05	4.37E+04	7.23E+03	0.00	2.37E+04	0.00	1.57E+08
Nd-147	7.15E+04	5.79E+04	4.48E+03	0.00	3.18E+04	0.00	9.17E+07

Units are (mrem/yr)/(μCi/m^3) for tritium, and m^2·(mrem/yr)/(μCi/s) for all other radionuclides.

3.5 GASEOUS EFFLUENT DOSE PROJECTIONS

3.5.1 Thirty-One Day Dose Projections

Because continuous operation of the gaseous radwaste treatment system is required (see Section 3.1.5), routine 31-day dose projections are not required for effluent control compliance at Plant Hatch. However, whenever it is desired to perform such projections, projected 31-day air doses and doses to individuals due to gaseous effluents may be determined as follows:

For air doses:

$$D_{\beta p} = \left(\frac{D_{\beta c}}{t}\right) \times 31 + D_{\beta a}$$
$$D_{\gamma p} = \left(\frac{D_{\gamma c}}{t}\right) \times 31 + D_{\gamma a} \quad (3.21)$$

For individual doses:

$$D_{op} = \left(\frac{D_{oc}}{t}\right) \times 31 + D_{oa} \quad (3.22)$$

where:

$D_{\beta p}$ = the projected air dose due to beta emissions from noble gases, for the next 31 days of gaseous releases.

$D_{\beta c}$ = the cumulative air dose due to beta emissions from noble gas releases that have occurred in the elapsed portion of the current quarter, plus the release under consideration.

$D_{\beta a}$ = the anticipated air dose due to beta emissions from noble gas releases, contributed by any planned activities during the next 31-day period, if those activities will result in gaseous releases that are in addition to routine gaseous effluents. If only routine gaseous effluents are anticipated, $D_{\beta a}$ may be set to zero.

$D_{\gamma p}$ = the projected air dose due to gamma emissions from noble gases for the next 31 days of gaseous releases.

$D_{\gamma c}$ = the cumulative air dose due to gamma emissions from noble gas releases that have occurred in the elapsed portion of the current quarter, plus the release under consideration.

$D_{\gamma a}$ = the anticipated air dose due to gamma emissions from noble gas releases, contributed by any planned activities during the next 31-day period, if those activities will result in gaseous releases that are in addition to routine gaseous effluents. If only routine gaseous effluents are anticipated, $D_{\gamma a}$ may be set to zero.

D_{op} = the projected dose to the total body or organ o, due to releases of I-131, I-133, tritium, and particulates for the next 31 days of gaseous releases.

D_{oc} = the cumulative dose to the total body or organ o, due to releases of I-131, I-133, tritium, and particulates that have occurred in the elapsed portion of the current quarter, plus the release under consideration.

D_{oa} = the anticipated dose to the total body or organ o, due to releases of I-131, I-133, tritium, and particulates, contributed by any planned activities during the next 31-day period, if those activities will result in gaseous releases that are in addition to routine gaseous effluents. If only routine gaseous effluents are anticipated, D_{oa} may be set to zero.

t = the number of whole or partial days elapsed into the current quarter, including the time to the end of the release under consideration (even if the release continues into the next quarter).

3.5.2 Dose Projections for Specific Releases

Dose projections may be performed for a particular release by performing a pre-release dose calculation assuming that the planned release will proceed as anticipated. For air dose and individual dose projections due to gaseous effluent releases, follow the methodology of Section 3.4, using sample analysis results for the gaseous stream to be released, and parameter values expected to exist during the release period.

3.6 DEFINITIONS OF GASEOUS EFFLUENT TERMS

Term	Definition	Section of Initial Use
AG =	the administrative allocation factor for gaseous streams, applied to divide the gaseous release limit among all the release pathways [unitless].	3.3.2.1
AG_s =	the administrative allocation factor for gaseous source stream s, applied to divide the gaseous release limit among all the release pathways [unitless].	3.3.3
AG_v =	the administrative allocation factor for gaseous release pathway v, applied to divide the gaseous release limit among all the release pathways [unitless].	3.3.2.2
B_i =	the elevated finite plume air dose factor due to gamma emissions from noble gas radionuclide i in the effluents released from the main stack [(mrad/y)/(μCi/s)].	3.3.2.2
c =	the setpoint of the radioactivity monitor measuring the concentration of radioactivity in the effluent line prior to release [μCi/mL].	3.3.2.1
c_{nco} =	the reading of the condenser offgas pretreatment monitor at the alarm setpoint [mR/h].	3.3.5
c_{ns} =	the calculated noble gas effluent monitor setpoint for gaseous source stream s [μCi/mL].	3.3.3
c_{nv} =	the calculated noble gas effluent monitor setpoint for release pathway v [μCi/mL].	3.3.2.2
D_{ja} =	the dose to organ j of an individual in age group a, due to gaseous releases of I-131, I-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days [mrem].	3.4.3

Term	Definition	Section of Initial Use
D_{oa} =	the anticipated dose to organ o due to releases of non-noble-gas radionuclides, contributed by any planned activities during the next 31-day period [mrem].	3.5.1
D_{oc} =	the cumulative dose to organ o due releases of non-noble-gas radionuclides that have occurred in the elapsed portion of the current quarter, plus the release under consideration [mrem].	3.5.1
D_{op} =	the projected dose to organ o due the next 31 days of gaseous releases of non-noble-gas radionuclides [mrem].	3.5.1
D_{β} =	the air dose due to beta emissions from noble gas radionuclides [mrad].	3.4.2
$D_{\beta a}$ =	the anticipated air dose due to beta emissions from noble gas releases, contributed by any planned activities during the next 31-day period [mrad].	3.5.1
$D_{\beta c}$ =	the cumulative air dose due to beta emissions from noble gas releases that have occurred in the elapsed portion of the current quarter, plus the release under consideration [mrad].	3.5.1
$D_{\beta p}$ =	the projected air dose due to beta emissions from noble gases, for the next 31 days of gaseous releases [mrad].	3.5.1
D_{γ} =	the air dose due to gamma emissions from noble gas radionuclides [mrad].	3.4.2
$D_{\gamma a}$ =	the anticipated air dose due to gamma emissions from noble gas releases, contributed by any planned activities during the next 31-day period [mrad].	3.5.1

Term	Definition	Section of Initial Use
$D_{\gamma c}$ =	the cumulative air dose due to gamma emissions from noble gas releases that have occurred in the elapsed portion of the current quarter, plus the release under consideration [mrad].	3.5.1
$D_{\gamma p}$ =	the projected air dose due to gamma emissions from noble gases, for the next 31 days of gaseous releases [mrad].	3.5.1
$(\bar{D}/\bar{Q})_{vp}$ =	the annual average relative deposition factor for release pathway v, at the location of the controlling receptor, from Table 3-7 [m^{-2}].	3.4.3
DR_k =	the skin dose rate at the time of the release [mrem/y].	3.4.1.1
DR_o =	the dose rate to organ o at the time of the release [mrem/y].	3.4.1.2
DR_t =	the total body dose rate at the time of the release [mrem/y].	3.4.1.1
E_{co} =	the calibration factor for the condenser offgas pretreatment monitor [(μCi/s) per (cfm·mR/h)].	3.3.5
f_{av} =	the maximum anticipated actual discharge flowrate for release pathway v during the period of the planned release [mL/s].	3.3.2.2
f_{co} =	the condenser offgas flowrate [cfm].	3.3.5
f_{as} =	the maximum anticipated actual discharge flowrate for gaseous source stream s during the period of the planned release [mL/s].	3.3.3
K_i =	the total body dose factor due to gamma emissions from noble gas radionuclide i, from Table 3-5 [(mrem/y)/(μCi/m^3)].	3.3.2.2

Term	Definition	Section of Initial Use
L_i =	the skin dose factor due to beta emissions from noble gas radionuclide i, from Table 3-5 [(mrem/y)/(μCi/m^3)].	3.3.2.2
M_i =	the air dose factor due to gamma emissions from noble gas radionuclide i, from Table 3-5 [(mrad/y)/(μCi/m^3)].	3.4.2
N =	the number of simultaneously active gaseous release pathways [unitless].	3.3.4
N_i =	the air dose factor due to beta emissions from noble gas radionuclide i, from Table 3-5 [(mrad/y)/(μCi/m^3)].	3.4.2
P_{io} =	the site-specific dose factor for radionuclide i (I-131, I-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days) and organ o. The values of P_{io} are equal to the site-specific R_{aipj} values presented in Table 3-9 [(mrem/y)/(μCi/m^3)].	3.4.1.2
Q_{iv} =	the release rate of noble gas radionuclide i from release pathway v during the period of interest [μCi/s].	3.3.2.2
Q'_{iv}=	the release rate of radionuclide i (I-131, I-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days) from gaseous release pathway v during the period of interest [μCi/s].	3.4.1.2
$\tilde{Q}_{is}$ =	the cumulative release of noble gas radionuclide i from the main stack during the period of interest [μCi].	3.4.2
$\tilde{Q}_{iv}$ =	the cumulative release of noble gas radionuclide i from release pathway v during the period of interest [μCi].	3.4.2

Term	Definition	Section of Initial Use
$\tilde{Q}'_{iv}$ =	the cumulative release of non-noble-gas radionuclide i from release pathway v, during the period of interest [μCi].	3.4.3
R_{aipj} =	the site-specific dose factor for age group a, radionuclide i, exposure pathway p, and organ j. Values and units of R_{aipj} for each exposure pathway, age group, and radionuclide that may arise in calculations for implementing Section 3.1.4 are listed in Table 3-8 through Table 3-10.	3.4.3
R_k =	the ratio of the skin dose rate limit for noble gases, to the skin dose rate due to noble gases in the release under consideration [unitless].	3.3.2.1
R_t =	the ratio of the total body dose rate limit for noble gases, to the total body dose rate due to noble gases in the release under consideration [unitless].	3.3.2.1
r_k =	the ratio of the skin dose rate limit for noble gases, to the skin dose rate due to noble gases in the source stream under consideration [unitless].	3.3.3.1
r_t =	the ratio of the total body dose rate limit for noble gases, to the total body dose rate due to noble gases in the source stream under consideration [unitless].	3.3.3.1
SF =	the safety factor used in gaseous setpoint calculations to compensate for statistical fluctuations and errors of measurement [unitless].	3.3.2.2
t =	the number of whole or partial days elapsed in the current quarter, including the period of the release under consideration.	3.5.1
V_i =	the elevated finite plume total body dose factor due to gamma emissions from noble gas radionuclide i in	

Term	Definition	Section of Initial Use
	the effluents released from the main stack [(mrem/y)/(μCi/s)].	3.3.2.2
W_{vip} =	the annual average relative dispersion $[(\bar{X}/\bar{Q})_{vp}]$ or deposition $[(\bar{D}/\bar{Q})_{vp}]$ at the location of the controlling receptor, for release pathway v, as appropriate to exposure pathway p and radionuclide i.	3.4.3
X =	the noble gas concentration for the release under consideration [μCi/mL].	3.3.2.1
X_{ir} =	the concentration of radionuclide i applicable to active gaseous release pathway r [μCi/mL].	3.3.4
X_{is} =	the measured concentration of radionuclide i in gaseous source stream s [μCi/mL].	3.3.3
X_{iv} =	the measured concentration of radionuclide i in gaseous stream v [μCi/mL].	3.3.2.2
(X/Q) =	the highest relative concentration at any point at or beyond the SITE BOUNDARY [s/m^3].	3.3.2.1
$(\bar{X}/\bar{Q})_{rb}$ =	the annual average SITE BOUNDARY relative concentration applicable to active gaseous release pathway r [s/m^3].	3.3.4
$(\bar{X}/\bar{Q})_{sb}$ =	the highest annual average relative concentration at the SITE BOUNDARY for the main stack, from Table 3-4 [s/m^3].	3.4.2
$(\bar{X}/\bar{Q})_{vb}$ =	the highest annual average relative concentration at the SITE BOUNDARY for the discharge point of release pathway v, from Table 3-4 [s/m^3].	3.3.2.2

Term	Definition	Section of Initial Use
$(\overline{X}/\overline{Q})_{vp}$ =	annual average relative dispersion factor for release pathway v, at the location of the controlling receptor, from Table 3-7 [s/m^3].	3.4.3

Term	Definition	Section of Initial Use
$(\bar{X}/\bar{Q})_{vp}$ =	annual average relative dispersion factor for release pathway v, at the location of the controlling receptor, from Table 3-7 [s/m^3].	3.4.3

CHAPTER 4

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

4.1 LIMITS OF OPERATION

The following limits are the same for both units at the site. Thus, a single program including monitoring, land use survey, and quality assurance serves both units.

4.1.1 Radiological Environmental Monitoring

~~In accordance with Technical Specification 6.10(1),~~ The Radiological Environmental Monitoring Program (REMP) shall be conducted as specified in Table 4-1.

4.1.1.1 Applicability

This control applies at all times.

4.1.1.2 Actions

4.1.1.2.1 With the REMP not being conducted as specified in Table 4-1, submit to the Nuclear Regulatory Commission (NRC), in the Annual Radiological Environmental Operating ~~Surveillance~~ Report, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence. Deviations from the required sampling schedule are permitted if specimens are unobtainable due to hazardous conditions, unavailability, inclement weather, equipment malfunction, or other just reasons. If deviations are due to equipment malfunction, efforts shall be made to complete corrective action prior to the end of the next sampling period.

4.1.1.2.2 With the confirmed[1] measured level of radioactivity as a result of plant effluents in an environmental sampling medium specified in Table 4-1 exceeding the reporting levels of Table 4-2 when averaged over any calendar quarter, submit within 30 days a Special Report to the NRC. ~~pursuant to Technical Specification 6.9.2.~~ The Special Report shall identify the cause(s) for exceeding the limit(s) and define the corrective action(s) to be taken to reduce radioactive effluents so that the potential annual dose to a MEMBER OF THE PUBLIC

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1 Defined as confirmed by reanalysis of the original sample, or analysis of a duplicate or new sample, as appropriate. The results of the confirmatory analysis shall be completed at the earliest time consistent with the analysis.

is less than the calendar year limits of Sections 2.1.3, 3.1.3, and 3.1.4. The methodology and parameters used to estimate the potential annual dose to a MEMBER OF THE PUBLIC shall be indicated in the Special Report.

When more than one of the radionuclides in Table 4-2 are detected in the sampling medium, this report shall be submitted if:

$$\frac{concentration\ (1)}{reporting\ level\ (1)} + \frac{concentration\ (2)}{reporting\ level\ (2)} + \ldots \geq 1.0$$

When radionuclides other than those in Table 4-2 are detected and are the result of plant effluents, this Special Report shall be submitted if the potential annual dose to a MEMBER OF THE PUBLIC is equal to or greater than the calendar year limits stated in Sections 2.1.3, 3.1.3, and 3.1.4. This Special Report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, the condition shall be described in the Annual Radiological Environmental ~~Surveillance~~ Operating Report. The levels of naturally-occurring radionuclides which are not included in the plant's effluent releases need not be reported.

4.1.1.2.3 If adequate samples of milk, or during the growing season, grass or leafy vegetation, can no longer be obtained from one or more of the sample locations required by Table 4-1, or if the availability is frequently or persistently wanting, efforts shall be made: to identify specific locations for obtaining suitable replacement samples; and to add any replacement locations to the REMP given in the ODCM within 30 days. The specific locations from which samples became unavailable may be deleted from the REMP. Pursuant to Technical Specification ~~6.17~~ 5.5.1, documentation shall be submitted in the next ~~Annual~~ Radioactive Effluent Release Report for the change(s) in the ODCM, including revised figure(s) and table(s) reflecting the changes to the location(s), with supporting information identifying the cause of the unavailability of samples and justifying the selection of any new location(s).

When the ACTION statement or other requirements of this control cannot be met, steps need not be taken to change the Operational Mode of the unit. Entry into an Operational Mode or other specified CONDITION may be made if, as a minimum, the requirements of the ACTION statement are satisfied.

4.1.1.3 Surveillance Requirements

The REMP samples shall be collected pursuant to Table 4-1 from the locations described in Section 4.2, and shall be analyzed pursuant to the requirements of Table 4-1 and Table 4-3. Required detection capabilities for thermoluminescent dosimeters used for environmental measurements shall be in accordance with the recommendations of Regulatory Guide 4.13. Program changes may be initiated based on operational experience.

Analyses shall be performed in such a manner that the stated MINIMUM DETECTABLE CONCENTRATIONs (MDCs) will be achieved under routine conditions. Occasionally background fluctuations, unavoidable small sample sizes, the presence of interfering radionuclides, or other uncontrollable circumstances may render these MDCs unachievable. In such cases, the contributing factors will be identified and described in the ~~Annual~~ Annual Radiological Environmental ~~Surveillance~~ Operating Report.

4.1.1.4 Basis

The REMP required by this control provides representative measurements of radiation and of radioactive materials in those exposure pathways, and for those radionuclides, which lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from the plant operation. The REMP implements Section IV.B.2, Appendix I, 10 CFR 50, and thereby supplements the radiological effluent monitoring program by measuring concentrations of radioactive materials and levels of radiation, which may then be compared with those expected on the basis of the effluent measurements and modeling of the environmental exposure pathways.

The detection capabilities required by Table 4-3 are within state-of-the-art for routine environmental measurements in industrial laboratories.

Table 4-1. Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Approximate Number of Sample Locations[a]	Sampling and Collection Frequency	Type of Analysis and Frequency
1. AIRBORNE			
Radioiodines and Particulates	6	Continuous operation of sampler with sample collection weekly.	Radioiodine canister. I-131 weekly. Particulate sampler. Analyze for gross beta radioactivity not less than 24 hours following filter change and analyze for I-131 weekly. Perform gamma isotopic analysis on affected sample when gross beta activity is 10 times the yearly mean of control samples. Composite (by location) for gamma isotopic analysis quarterly.
2. DIRECT RADIATION			
Direct Radiation	37	Quarterly.	Gamma dose quarterly.
3. INGESTION			
Milk	4[b]	Bi-weekly.	Gamma isotopic and I-131 analyses bi-weekly.
Fish[c] or clams	2	Semi-annually.	Gamma isotopic analysis on edible portions semi-annually.
Grass or Leafy Vegetation	3	Monthly during growing season.	Gamma isotopic analysis monthly.[d]
4. WATERBORNE			
Surface	2	Composite[e] sample collected monthly.	Gamma isotopic analysis monthly. Composite (by location) for tritium analysis quarterly.
Sediment	2	Semiannually	Gamma isotopic analysis yearly.

Table 4-1 (contd). Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Approximate Number of Sample Locations[a]	Sampling and Collection Frequency	Type of Analysis and Frequency
Drinking Water[f,g]	From each of the one to three nearest water supplies which could be affected by HNP discharge: one sample of river water near the intake and one sample of finished water.	River Water collected near the intake will be a composite sample; the finished water will be a grab sample. These samples will be collected monthly unless the calculated dose due to consumption of the water is greater than 1 mrem/year; then the collections will be bi-weekly. The collection may revert to monthly should the calculated doses become less than 1 mrem/year.	I-131 analysis on each sample when bi-weekly collections are required. Gross beta and gamma isotopic analyses on each sample; composite (by location) for tritium quarterly.

TABLE NOTATIONS

a. Sample locations are shown in Table 4-4, and in Figure 4-1 through Figure 4-5.

b. Up to three sampling locations within 5 miles and in different sectors will be used as available. In addition, one or more control locations beyond 10 miles will be used.

c. Commercially or recreationally important fish may be sampled. Clams will be sampled if difficulties are encountered in obtaining sufficient fish samples.

d. If gamma isotopic analysis is not sensitive enough to meet the required MINIMUM DETECTABLE CONCENTRATION (MDC), a separate analysis for I-131 may be performed.

e. Composite samples shall be collected by collecting an aliquot at intervals not exceeding a few hours.

f. If it is found that river water downstream of HNP is used for drinking, water samples will be collected and analyzed as specified herein.

g. A survey shall be conducted annually at least 50 river miles downstream of HNP to identify those who use the Altamaha River water for drinking.

Table 4-2. Reporting Levels for Radioactivity Concentrations in Environmental Samples

Analysis	Reporting Level				
	Water (pCi/L)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/kg, wet)	Milk (pCi/L)	Grass or Leafy Vegetation (pCi/kg, wet)
H-3	2 E+4[a]				
Mn-54	1 E+3		3 E+4		
Fe-59	4 E+2		1 E+4		
Co-58	1 E+3		3 E+4		
Co-60	3 E+2		1 E+4		
Zn-65	3 E+2		2 E+4		
Zr-95	4 E+2				
Nb-95	7 E+2				
I-131	2 E+0[b]	9 E-1		3 E+0	1 E+2
Cs-134	3 E+1	1 E+1	1 E+3	6 E+1	1 E+3
Cs-137	5 E+1	2 E+1	2 E+3	7 E+1	2 E+3
Ba-140	2 E+2			3 E+2	
La-140	1 E+2			4 E+2	

a. This is the 40 CFR 141 value for drinking water samples. If no drinking water pathway exists, a value of 3 E+04 pCi/L may be used.

b. If no drinking water pathway exists, a value of 20 pCi/L may be used.

Table 4-3. Values for the Minimum Detectable Concentration

Analysis	Minimum Detectable Concentration (MDC)[a]					
	Water (pCi/L)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/kg, wet)	Milk (pCi/L)	Grass or Leafy Vegetation (pCi/kg, wet)	Sediment (pCi/kg, dry)
Gross Beta	4 E+0	1 E-2				
H-3	2 E+3[b]					
Mn-54	1.5 E+1		1.3 E+2			
Fe-59	3 E+1		2.6 E+2			
Co-58, Co-60	1.5 E+1		1.3 E+2			
Zn-65	3 E+1		2.6 E+2			
Zr-95	3 E+1					
Nb-95	1.5 E+1					
I-131	1 E+0[c]	7 E-2		1 E+0	6 E+1	
Cs-134	1.5 E+1	5 E-2	1.3 E+2	1.5 E+1	6 E+1	1.5 E+2
Cs-137	1.8 E+1	6 E-2	1.5 E+2	1.8 E+1	8 E+1	1.8 E+2
Ba-140	6 E+1			6 E+1		
La-140	1.5 E+1			1.5 E+1		

a. See the definition of MINIMUM DETECTABLE CONCENTRATION in Section 10.1. Other peaks which are measurable and identifiable as plant effluents, together with the radionuclides in this table, shall be analyzed and reported in accordance with Section 7.1.

b. If no drinking water pathway exists, a value of 3 E+3 pCi/L may be used.

c. If no drinking water pathway exists, a value of 1.5 E+1 pCi/L may be used.

4.1.2 Land Use Census

~~In accordance with Technical Specification 6.19(2),~~ A land use census shall be conducted and shall identify the locations of the following: the nearest MILK ANIMAL[1] and the nearest permanent residence in each of the 16 meteorological sectors within a distance of 5 miles; and all MILK ANIMALS within a distance of 3 miles.

4.1.2.1 Applicability

This control applies at all times.

4.1.2.2 Actions

4.1.2.2.1 With a land use census identifying a location(s) which yields a calculated dose or dose commitment greater than values currently being calculated in accordance with Section 3.4.3, identify the new location(s) in the next ~~Annual~~ Radioactive Effluent Release Report.

4.1.2.2.2 With a land use census identifying a location(s) which yields a calculated dose or dose commitment (via the same exposure pathway) 20 percent greater than at a location from which samples are currently being obtained in accordance with Section 4.1.1, add the new location(s) to the REMP within 30 days if samples are available. The sampling location, excluding control station location(s), having the lowest calculated dose or dose commitment (via the same exposure pathway) may be deleted from the REMP if new sampling locations are added. Pursuant to Technical Specification ~~6.17~~ 5.5.1 submit in the next ~~Annual~~ Radioactive Effluent Release Report any change(s) in the ODCM, including the revised figure(s) and table(s) reflecting any new location(s) and information supporting the change(s).

When the ACTION statement or other requirements of this control cannot be met, steps need not be taken to change the Operational Mode of the unit. Entry into an Operational Mode or other specified CONDITION may be made if, as a minimum, the requirements of the ACTION statement are satisfied.

1 Defined as a cow or goat that is producing milk for human consumption.

4.1.2.3 Surveillance Requirements

The land use census shall be conducted annually, using that information which will provide good results, such as a door-to-door census, a visual census from automobile or aircraft, consultation with local agriculture authorities, or some combination of these methods, as feasible. Results of the land use census shall be included in the Annual Radiological Environmental ~~Surveillance~~ Operating Report.

4.1.2.4 Basis

This control is provided to ensure that changes in the use of UNRESTRICTED AREAS are identified and that modifications to the REMP are made if required by the results of this census. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50.

4.1.3 Interlaboratory Comparison Program

~~In accordance with Technical Specification 6.19(3),~~ Analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program which has been approved by the NRC. Analyses are required to be performed only in cases in which the sample type and analysis are the same as the sample type and analysis included in Table 4-1.

4.1.3.1 Applicability

This control applies at all times.

4.1.3.2 Actions

With analyses not being performed as required by Section 4.1.3, report the corrective actions taken to prevent a recurrence in the Annual Radiological Environmental ~~Surveillance~~ Report.

Operating

When the ACTION statement or other requirements of this control cannot be met, steps need not be taken to change the Operational Mode of the unit. Entry into an Operational Mode or other specified CONDITION may be made if, as a minimum, the requirements of the ACTION statement are satisfied.

Operating Report

4.1.3.3 Surveillance Requirements

Either a summary of the results obtained as part of the required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental ~~Surveillance Report~~, or participants in the EPA cross-check program shall provide the EPA program code designation for the plant in the Annual Radiological Environmental ~~Surveillance~~ Report.

Operating

4.1.3.4 Basis

The requirement for participation in an approved Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring, in order to demonstrate that the results are reasonably valid for the purposes of Section IV.B.2, Appendix I, 10 CFR 50.

4.2 RADIOLOGICAL ENVIRONMENTAL MONITORING LOCATIONS

Table 4-4, and Figure 4-1 through Figure 4-5 specify the locations at which the measurements and samples are taken for the REMP required by Section 4.1.1.

Table 4-4. Radiological Environmental Monitoring Locations

Location Number	Descriptive Location	Direction	Distance (miles)	Sample Type*
064	Roadside park	WNW	0.8	D
101	Inner ring	N	1.9	D
102	Inner ring	NNE	2.5	D
103	Inner ring	NE	1.8	AD
104	Inner ring	ENE	1.6	D
105	Inner ring	E	3.7	D
106	Inner ring	ESE	1.1	DV
107	Inner ring	SE	1.2	AD
108	Inner ring	SSE	1.6	D
109	Inner ring	S	0.9	D
110	Inner ring	SSW	1.0	D
111	Inner ring	SW	0.9	D
112	Inner ring	WSW	1.0	ADV
113	Inner ring	W	1.1	D
114	Inner ring	WNW	1.2	D
115	Inner ring	NW	1.1	D
116	Inner ring	NNW	1.6	AD
170	Upriver	WNW	**	R
172	Downriver	E	**	R
201	Outer ring	N	5.0	D
202	Outer ring	NNE	4.9	D
203	Outer ring	NE	5.0	D
204	Outer ring	ENE	5.0	D
205	Outer ring	E	7.2	D
206	Outer ring	ESE	4.8	D
207	Outer ring	SE	4.3	D
208	Outer ring	SSE	4.8	D
209	Outer ring	S	4.4	D
210	Outer ring	SSW	4.3	D

Table 4-4 (contd). Radiological Environmental Monitoring Locations

Location Number	Descriptive Location	Direction	Distance (miles)	Sample Type*
211	Outer ring	SW	4.7	D
212	Outer ring	WSW	4.4	D
213	Outer ring	W	4.3	D
214	Outer ring	WNW	5.4	D
215	Outer ring	NW	4.4	D
216	Outer ring	NNW	4.8	D
301	Toombs Central School	N	8.0	D
304	State Prison	ENE	11.2	AD
304	State Prison	ENE	10.3	M
309	Baxley substation	S	10.0	AD
416	Emergency News Center	NNW	21.0	DV

* Sample Types:

A - Airborne Radioactivity
D - Direct radiation
M - Milk
R - River (fish or clams, shoreline sediment, and surface water)
V - Vegetation

** Station 170 is located at approximately 0.6 river miles upstream of the intake structure for river water, 1.1 river miles for sediment and clams, and 1.5 river miles for fish.

Station 172 is located at approximately 3.0 river miles downstream of the discharge structure for river water, sediment, and clams, and 1.7 river miles for fish.

The location from which river water and sediment may be taken can be rather precisely defined. Often, the sampling locations for clams have to be extended over a wide area to obtain a sufficient quantity. High water adds to the difficulty in obtaining clam samples; high water might also make an otherwise suitable location for sediment sampling unavailable. A stretch of the river on the order of a few miles or so is generally needed to obtain adequate fish samples. The mile locations given above represent approximations of the locations about which the catches are taken.

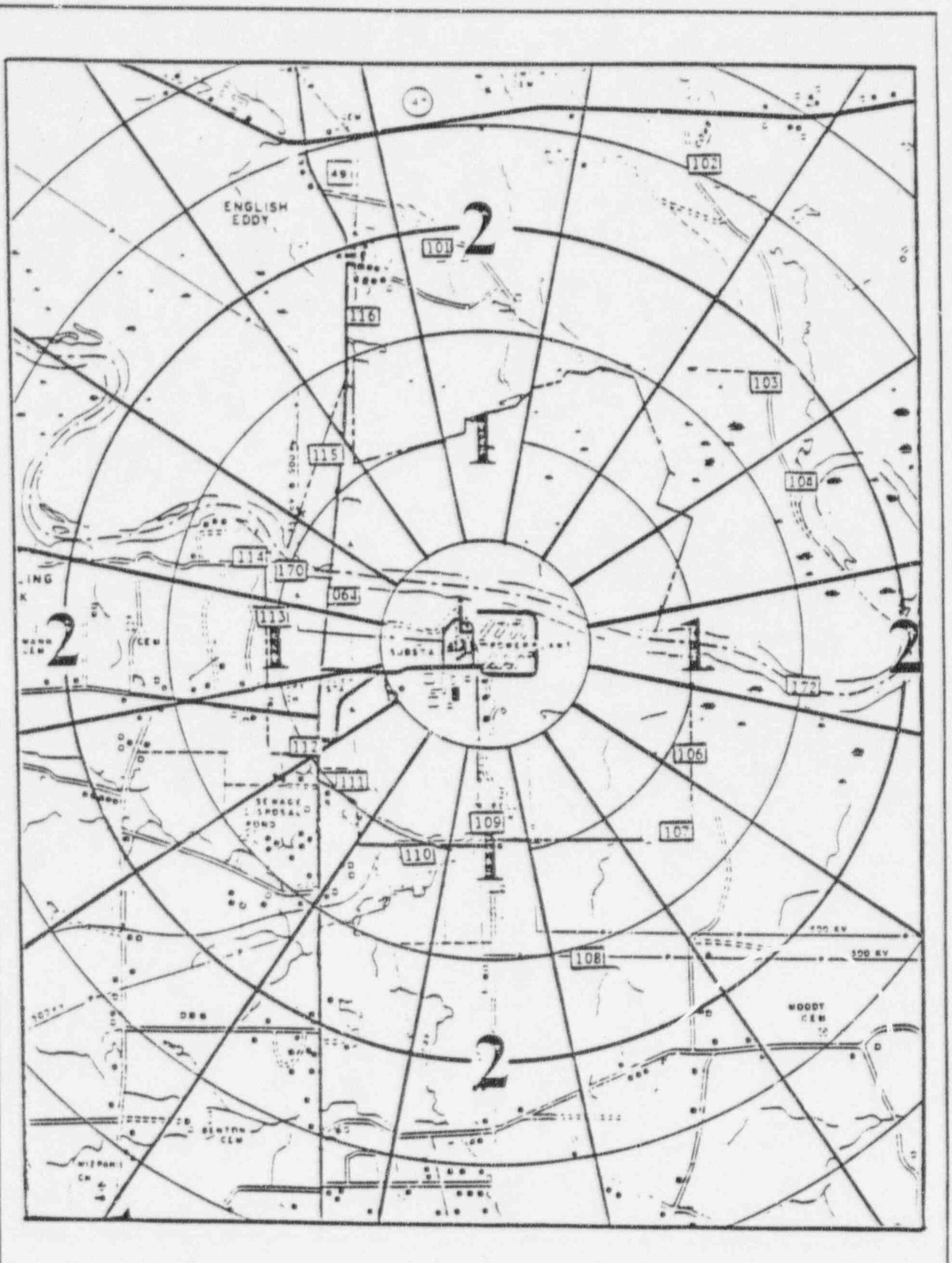


Figure 4-1. Sampling Location Map, Site Periphery

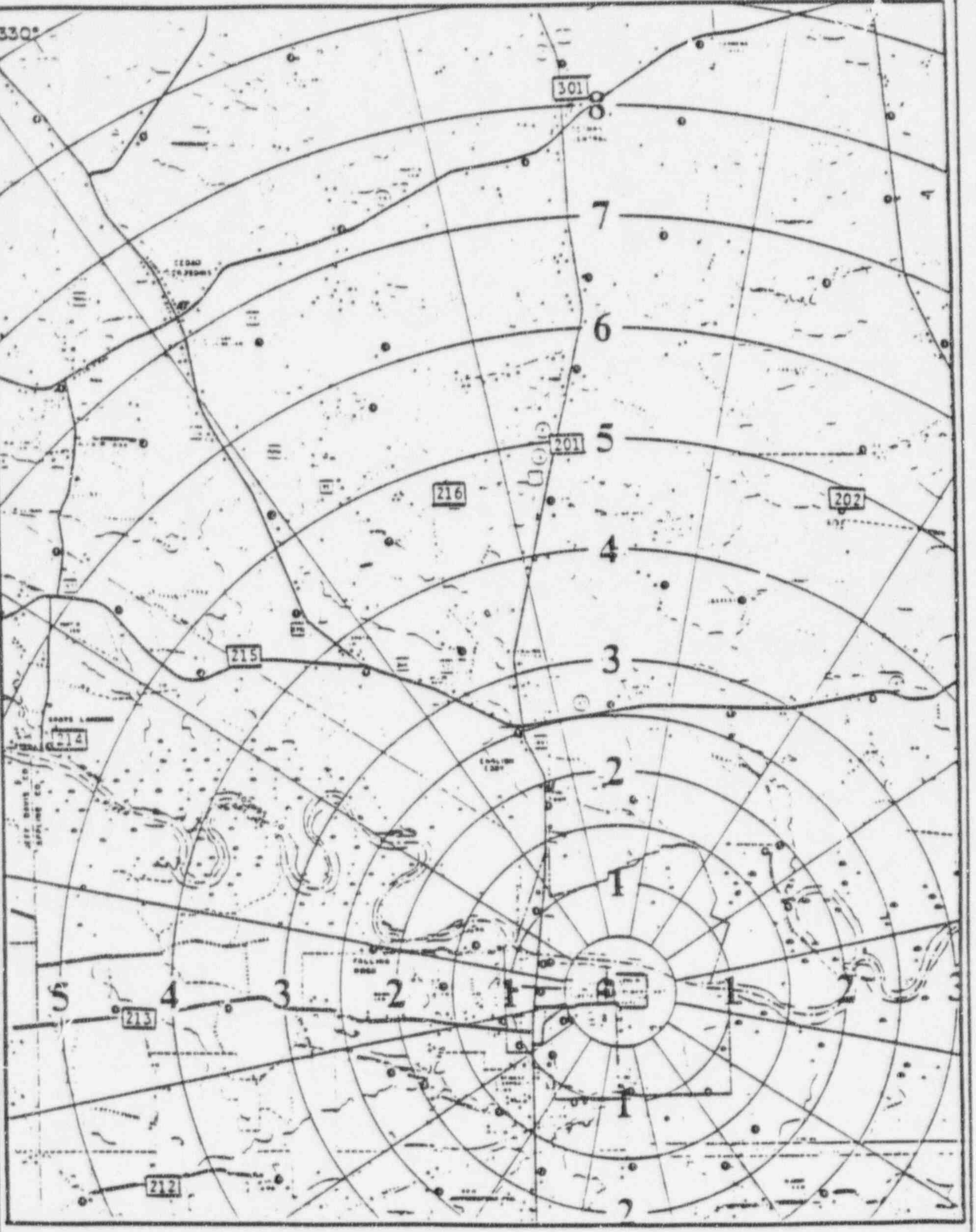


Figure 4-2. Sampling Location Map Beyond Site Periphery, North and West of Site

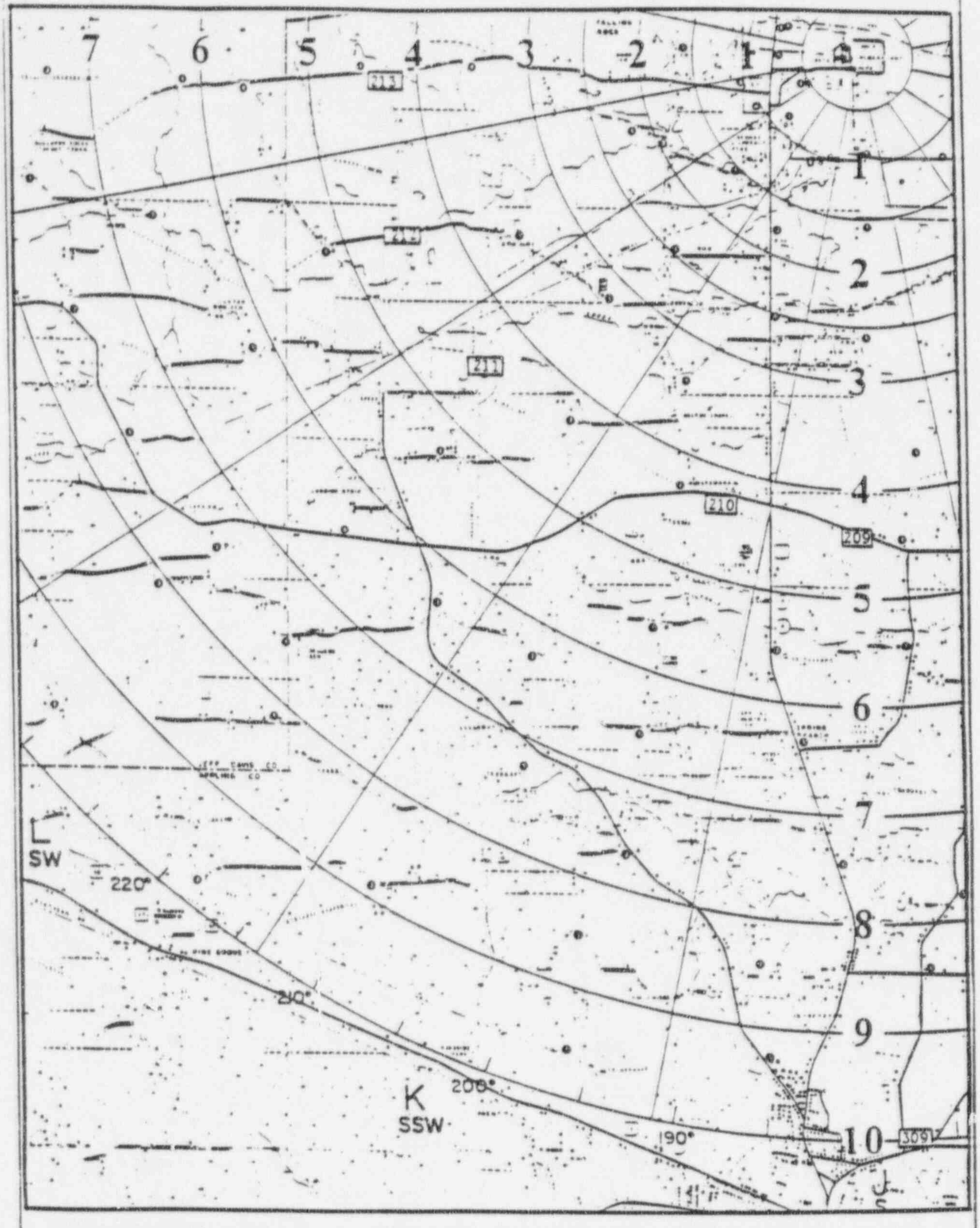


Figure 4-3. Sampling Location Map Beyond Site Periphery, South and West of Site

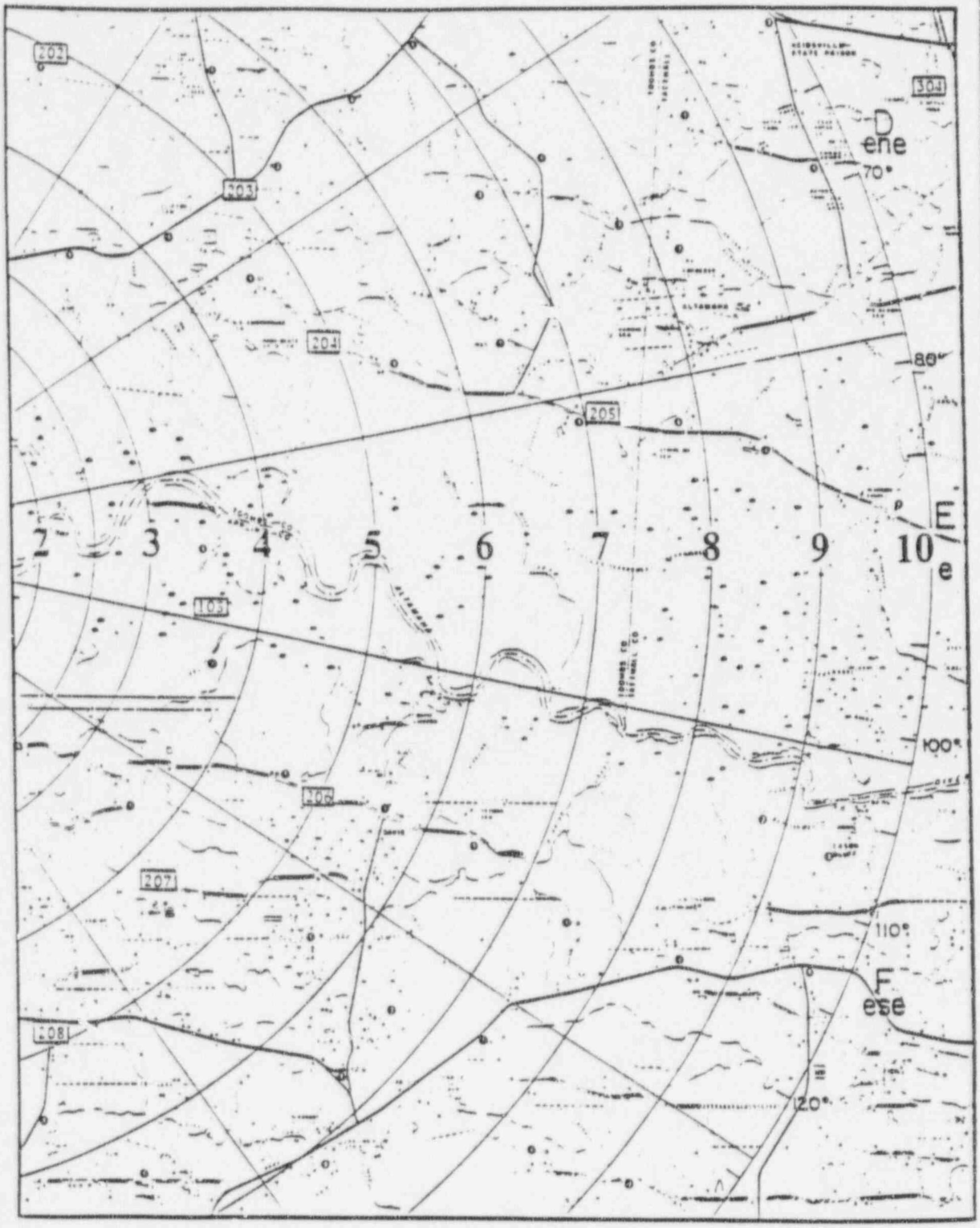


Figure 4-4. Sampling Location Map Beyond Site Periphery, East of Site

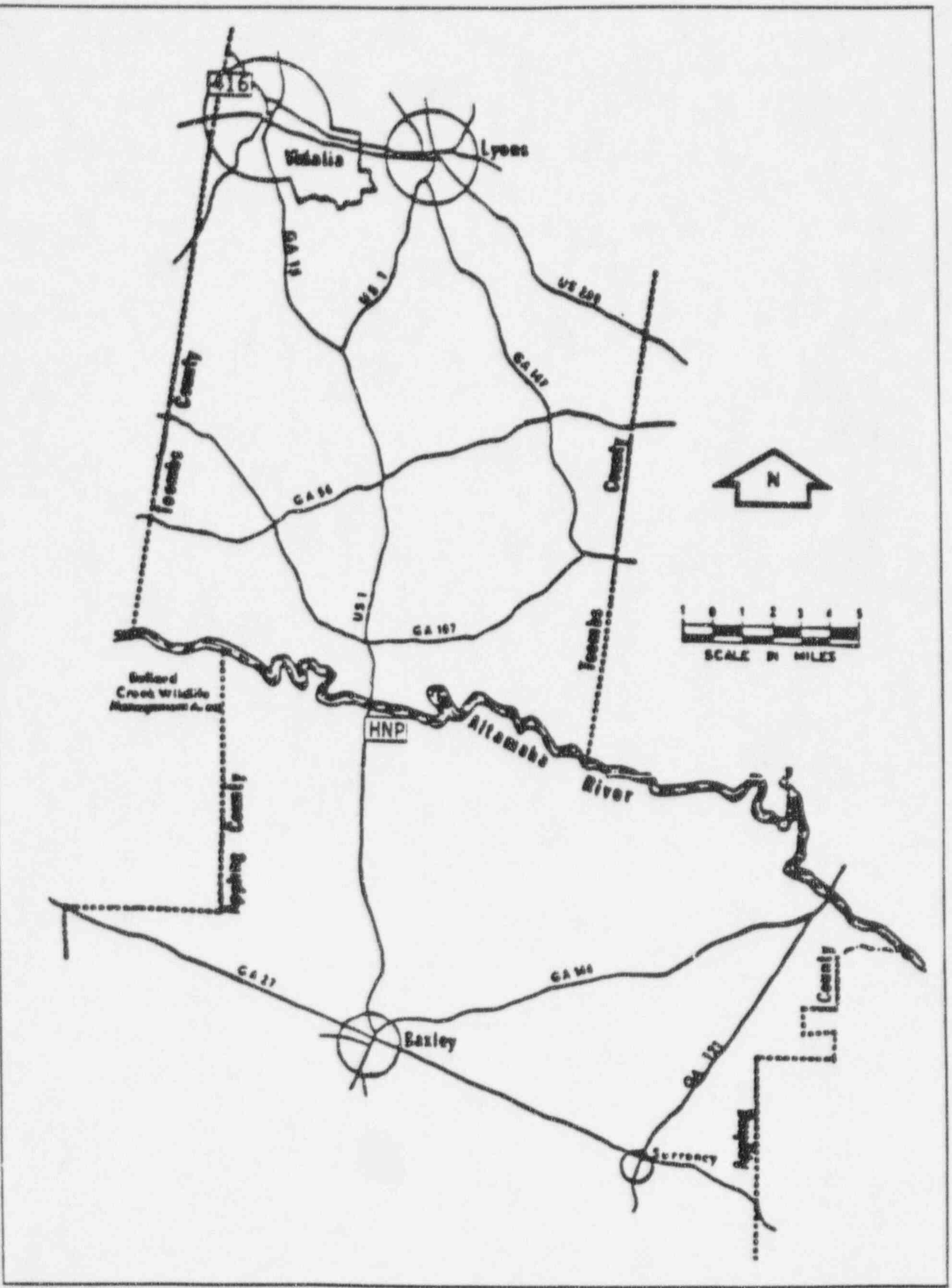


Figure 4-5. Location of Additional Control Station for TLDs and Vegetation

CHAPTER 5
TOTAL DOSE DETERMINATIONS

5.1 LIMIT OF OPERATION

5.5.4.j.)

In accordance with Technical Specification ~~6.10.10,~~ the dose or dose commitment to any MEMBER OF THE PUBLIC over a calendar year, due to releases of radioactivity and to radiation from uranium fuel cycle sources, shall be limited to less than or equal to 25 mrem to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrem.

5.1.1 Applicability

This limit applies at all times.

5.1.2 Actions

With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Section 2.1.3, 3.1.3, or 3.1.4, calculations shall be made according to Section 5.2 methods to determine whether the limits of Section 5.1 have been exceeded. If these limits have been exceeded, ~~prepare~~ and submit a Special Report to the Nuclear Regulatory Commission~~, pursuant to Technical Specification 6.9.2,~~ within 30 days, which defines the corrective actions to be taken to reduce subsequent releases to prevent recurrence of exceeding the limits of Section 5.1 and includes the schedule for achieving conformance with the limits of Section 5.1. This Special Report, as defined in 10 CFR 20.2203, shall also include an analysis which estimates the radiation exposure (dose) to a MEMBER OF THE PUBLIC from uranium fuel cycle sources (including all effluent pathways and direct radiation) for the calendar year that includes the release(s) covered by this report. This Special Report shall also describe the levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the limits of Section 5.1, and if the release condition resulting in violation of the provisions of 40 CFR 190 has not already been corrected, the Special Report shall include a request for variance in accordance with the provisions of 40 CFR 190 and including the specified information of 40 CFR 190.11(b). Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

When the ACTION statement or other requirements of this control cannot be met, steps need not be taken to change the Operational Mode of the unit. Entry into an Operational Mode or other specified CONDITION may be made if, as a minimum, the requirements of the ACTION statement are satisfied.

5.1.3 Surveillance Requirements

Cumulative dose contributions from liquid and gaseous effluents and from direct radiation shall be determined in accordance with Section 5.2. This requirement is applicable only under the conditions set forth above in Section 5.1.2.

5.1.4 Basis

This control is provided to meet the dose limitations and reporting requirements of 40 CFR 190. The control requires the preparation and submittal of a Special Report whenever the calculated doses from plant radioactive effluents exceed the limits of Section 5.1. For sites containing up to 4 reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the the dose limits of 40 CFR 190 if the individual reactors remain within twice the dose design objectives of Appendix I and if direct radiation doses from the units, such as direct exposure from outside storage tanks, are kept small. The Special Report will describe a course of action which should result in the limitation of dose to a MEMBER OF THE PUBLIC for a calendar year to within the 40 CFR 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible with the exception that dose contributions from other uranium fuel cycle facilities at the same site or within a radius of 5 miles must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR 190, the Special Report with a request for variance (provided the release conditions resulting in violation of 40 CFR 190 have not already been corrected), in accordance with the provisions of 40 CFR 190.11 and 10 CFR 20.2203(a)(4), is considered to be a timely request and fulfills the requirements of 40 CFR 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR 190 and does not apply in any way to the requirements for dose limitation addressed in other sections of this ODCM. An individual is not considered a MEMBER OF THE PUBLIC during any period in which he/she is engaged in carrying out any operation which is part of the nuclear fuel cycle.

5.2 DEMONSTRATION OF COMPLIANCE

There are no other uranium fuel cycle facilities within 5 miles of the plant site. Therefore, for the purpose of demonstrating compliance with the limits of Section 5.1, the total dose to a MEMBER OF THE PUBLIC in the vicinity of the plant site due to uranium fuel cycle sources shall be determined as follows:

$$D_{Tk} = D_L + D_G + D_D + D_N \qquad (5.1)$$

where:

D_{Tk} = the total dose or dose commitment to the total body or organ k, in mrem.

D_L = the dose to the same organ due to radioactivity discharged from the plant site in liquid effluents, calculated in accordance with Section 2.4.1, in mrem.

D_G = the dose to the same organ due to non-noble-gas radionuclides discharged from the plant site in gaseous effluents, calculated for the controlling receptor in accordance with Section 3.4.3, in mrem.

D_D = the direct radiation dose to the whole body of an individual at the controlling receptor location, due to radioactive materials retained within the plant site, in mrem. Values of direct radiation dose may be determined by measurement, calculation, or a combination of the two.

D_N = the external whole body dose to an individual at the controlling receptor location, due to gamma ray emissions from noble gas radionuclides discharged from the plant site in gaseous effluents, in mrem. D_N is calculated as follows (equation adapted from Reference 1, page 22, by re-casting in cumulative dose form):

$$D_N = 3.17 \times 10^{-8} \left[\sum_v \left\{ (\overline{X/Q})_{vp} \sum_i \left(K_i \cdot \tilde{Q}_{iv} \right) \right\} + \sum_i \left(V_i \cdot \tilde{Q}_{is} \right) \right] \qquad (5.2)$$

where:

3.17×10^{-8} = a units conversion factor: $1\ y/(3.15 \times 10^7\ s)$.

$\bar{Q}_{iv}$ = the cumulative release of noble gas radionuclide i from non-elevated release pathway v (μCi), during the period of interest.

$\bar{Q}_{is}$ = the value of $\bar{Q}_{iv}$ for the main stack; that is, the cumulative release of noble gas radionuclide i from the main stack (μCi), during the period of interest.

K_i = the total-body dose factor due to gamma emissions from noble gas radionuclide i (mrem/y)/(μCi/m^3), from Table 3-5.

V_i = the elevated finite-plume total-body dose factor at the controlling receptor location, due to gamma emissions from noble gas radionuclide i in effluents released from the main stack (mrem/y)/(μCi/s), from Table 3-7.

$(\bar{X}/\bar{Q})_{vp}$ = annual average relative dispersion factor for release pathway v, at the location of the controlling receptor, from Table 3-7 [s/m^3].

As defined above, D_L and D_G are for different age groups, while D_D and D_N are not age group specific. When a more precise determination of D_{Tk} is desired, values of D_L and D_G may be calculated for all four age groups, and those values used in equation (5.1) to determine age group specific values of D_{Tk}; the largest value of D_{Tk} for any age group may then be compared to the limits of Section 5.1.

CHAPTER 6

POTENTIAL DOSES TO MEMBERS OF THE PUBLIC DUE TO THEIR ACTIVITIES INSIDE THE SITE BOUNDARY

6.1 REQUIREMENT FOR CALCULATION

To support the reporting requirements of Section 7.2.2.3, an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY (Figure 10-1) shall be performed as specified in Section 6.2, at least once per calendar year.

6.2 CALCULATIONAL METHOD

For the purpose of performing the calculations required in Section 6.1, the dose to a member of the public inside the SITE BOUNDARY shall be determined at the locations, and for the receptor age groups, defined in Table 6-1. The dose to such a receptor at any one of the defined locations shall be determined as follows:

$$D_{Ik} = \left[D_A + D_S + D_P \right] \cdot F_O \qquad \textbf{(6.1)}$$

where:

D_{Ik} = the total dose to the total body or organ k, in mrem.

D_A = the dose to the same organ due to <u>inhalation</u> of non-noble-gas radionuclides discharged from the plant site in gaseous effluents, calculated in accordance with Section 3.4.3, in mrem. The $(\overline{X}/\overline{Q})$ value to be used is given for each receptor location in Table 6-1; depleted $(\overline{X}/\overline{Q})$ values may be used in calculations for non-noble-gas radionuclides.

D_S = the dose to the same organ due to <u>ground plane deposition</u> of non-noble-gas radionuclides discharged from the plant site in gaseous effluents, calculated in accordance with Section 3.4.3, in mrem. The $(\overline{D}/\overline{Q})$ value to be used is given for each receptor location in Table 6-1.

D_P = the external whole body dose due to gamma ray emissions from noble gas radionuclides discharged from the plant site in gaseous effluents, calculated using equation (5.2), in mrem. The values of $(\overline{X}/\overline{Q})$ and V_i that are to be used are given for each receptor location in Table 6-1.

F_O = the occupancy factor for the given location, which is the fraction of the year that one individual MEMBER OF THE PUBLIC is assumed to be present at the receptor location [unitless]. Values of F_O for each receptor location are included in Table 6-1.

Table 6-1. Attributes of Member of the Public Receptor Locations Inside the SITE BOUNDARY

Location: Roadside Park, WNW at 1182 meters

Age Group: Child

Occupancy Factor: 2.28×10^{-4} (based on 2 hours per year)

Dispersion and Deposition Parameters:*

Parameter	Ground-Level	Elevated
Undepleted $(\bar{X}/\bar{Q})$, s/m^3	7.83 E-6	2.42 E-8
Depleted $(\bar{X}/\bar{Q})$, s/m^3	7.00 E-6	2.37 E-8
$(\bar{D}/\bar{Q})$, m^{-2}	2.01 E-8	1.29 E-9

Elevated Plume Dose Factors:+

Radionuclide	V_i (mrem/y)/(μCi/s)
Kr-85m	8.39 E-05
Kr-85	1.31 E-06
Kr-87	4.60 E-04
Kr-88	1.14 E-03
Kr-89	9.89 E-04
Kr-90	7.32 E-04
Xe-131m	1.70 E-06

Radionuclide	V_i (mrem/y)/(μCi/s)
Xe-133m	1.32 E-05
Xe-133	1.37 E-05
Xe-135m	2.51 E-04
Xe-135	1.37 E-04
Xe-137	9.91 E-05
Xe-138	6.45 E-04
Ar-41	7.69 E-04

* Values from Reference 16.

\+ See footnotes to Table 3-6.

Table 6-1 (contd). Attributes of Member of the Public Receptor Locations Inside the SITE BOUNDARY

Location: Camping Area, WNW at 1274 meters

Age Group: Child

Occupancy Factor: 5.48×10^{-3} (based on 48 hours per year)

Dispersion and Deposition Parameters:*

Parameter	Ground-Level	Elevated
Undepleted ($\bar{X}/\bar{Q}$), s/m^3	7.03 E-6	2.38 E-6
Depleted ($\bar{X}/\bar{Q}$), s/m^3	6.27 E-6	2.33 E-8
($\bar{D}/\bar{Q}$), m^{-2}	1.80 E-8	1.21 E-9

Elevated Plume Dose Factors:+

Radionuclide	V_i (mrem/y)/(μCi/s)
Kr-85m	7.84 E-05
Kr-85	1.22 E-06
Kr-87	4.28 E-04
Kr-88	1.06 E-03
Kr-89	9.19 E-04
Kr-90	6.80 E-04
Xe-131m	1.59 E-06

Radionuclide	V_i (mrem/y)/(μCi/s)
Xe-133m	1.24 E-05
Xe-133	1.28 E-05
Xe-135m	2.34 E-04
Xe-135	1.27 E-04
Xe-137	9.23 E-05
Xe-138	5.99 E-04
Ar-41	7.14 E-04

* Values from Reference 16.

\+ See footnotes to Table 3-6.

Table 6-1 (contd). Attributes of Member of the Public Receptor Locations Inside the SITE BOUNDARY

Location: Recreation Area, SSE at 1030 meters

Age Group: Child

Occupancy Factor: 2.37×10^{-2} (based on 208 hours per year)

Dispersion and Deposition Parameters:*

Parameter	Ground-Level	Elevated
Undepleted $(\bar{X}/\bar{Q})$, s/m^3	6.42 E-6	3.30 E-8
Depleted $(\bar{X}/\bar{Q})$, s/m^3	5.73 E-6	3.21 E-8
$(\bar{D}/\bar{Q})$, m^{-2}	2.36 E-8	1.56 E-9

Elevated Plume Dose Factors:+

Radionuclide	V_i (mrem/y)/(μCi/s)
Kr-85m	7.21 E-05
Kr-85	1.13 E-06
Kr-87	3.99 E-04
Kr-88	9.90 E-04
Kr-89	8.57 E-04
Kr-90	6.34 E-04
Xe-131m	1.46 E-06

Radionuclide	V_i (mrem/y)/(μCi/s)
Xe-133m	1.14 E-05
Xe-133	1.17 E-05
Xe-135m	2.17 E-04
Xe-135	1.18 E-04
Xe-137	8.57 E-05
Xe-138	5.58 E-04
Ar-41	6.66 E-04

* Values from Reference 16.

\+ See footnotes to Table 3-6.

Table 6-1 (contd). Attributes of Member of the Public Receptor Locations Inside the SITE BOUNDARY

Location: Visitors Center, WSW at 694 meters

Age Group: Child

Occupancy Factor: 4.57×10^{-4} (based on 4 hours per year)

Dispersion and Deposition Parameters:*

Parameter	Ground-Level	Elevated
Undepleted $(\bar{X}/\bar{Q})$, s/m^3	1.87 E-5	5.00 E-8
Depleted $(\bar{X}/\bar{Q})$, s/m^3	1.72 E-5	4.97 E-8
$(\bar{D}/\bar{Q})$, m^{-2}	5.47 E-8	2.26 E-9

Elevated Plume Dose Factors: +

Radionuclide	V_i (mrem/y)/(μCi/s)
Kr-85m	1.47 E-04
Kr-85	2.34 E-06
Kr-87	8.27 E-04
Kr-88	2.06 E-03
Kr-89	1.78 E-03
Kr-90	1.31 E-03
Xe-131m	2.98 E-06

Radionuclide	V_i (mrem/y)/(μCi/s)
Xe-133m	2.34 E-05
Xe-133	2.36 E-05
Xe-135m	4.49 E-04
Xe-135	2.42 E-04
Xe-137	1.77 E-04
Xe-138	1.16 E-03
Ar-41	1.38 E-03

* Values from Reference 16.

\+ See footnotes to Table 3-6.

CHAPTER 7

REPORTS

7.1 ANNUAL RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE REPORT

7.1.1 Requirement for Report

In accordance with Technical Specification ~~6.9.1.6~~ 5.6.2, the Annual Radiological Environmental ~~Surveillance~~ Operating Report covering ~~the REMP~~ activities during the previous calendar year shall be submitted ~~before May 1~~ by May 15 of each year. (A single report fulfills the requirements for both units.) The material provided shall be consistent with the objectives outlined in Section 4.1 and Section 7.1.2 of the ODCM, and in Sections IV.B.2, IV.B.3, and IV.C of Appendix I to 10 CFR Part 50.

7.1.2 Report Contents

The materials specified in the following ~~sub-sections~~ shall be included in each Annual Radiological Environmental ~~Surveillance~~ Operating Report:

7.1.2.1 Data

The report shall include summarized and tabulated results of all REMP samples required by Table 4-1 taken during the report period, in a format similar to that contained in Table 3 of the Radiological Assessment Branch Technical Position (Reference 18); the results for any additional samples shall also be reported. In the event that some results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results; the missing data shall be submitted as soon as possible in a supplementary report. The results for naturally-occurring radionuclides not included in plant effluents need not be reported.

7.1.2.2 Evaluations

Interpretations and analyses of trends of the results shall be included in the report, including the following: (as appropriate) comparisons with pre-operational studies, operational controls, and previous environmental surveillance reports; and an assessment of any observed impacts of the plant operation on the environment. If the measured level of radioactivity in an environmental sampling medium exceeding the reporting levels of Table 4-2 is not the result of plant effluents, the condition shall be described as required by Section 4.1.1.2.2.

7.1.2.3 Programmatic Information

Also to be included in each report are the following: a summary description of the REMP; a map(s) of all sampling locations keyed to a table giving distances and directions from the main stack; the results of land use censuses required by Section 4.1.2; and the results of licensee participation in the Interlaboratory Comparison Program required by Section 4.1.3. [The report shall include either a summary of the results obtained as part of the required Interlaboratory Comparison Program or, for licensees participating in the EPA cross-check program, the EPA program code designations for the plant.]

7.1.2.4 Descriptions of Program Deviations

Discussions of deviations from the established program must be included in each report, as follows:

7.1.2.4.1 If the REMP is not conducted as required in Table 4-1, a description of the reasons for not conducting the program as required, and the plans for preventing a recurrence, must be included in the report.

7.1.2.4.2 If the MDCs required by Table 4-3 are not achieved, the contributing factors must be identified and described in the report.

7.1.2.4.3 If Interlaboratory Comparison Program analyses are not performed as required by Section 4.1.3, the corrective actions taken to prevent a recurrence must be included in the report.

7.2 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

7.2.1 Requirement for Report

In accordance with Technical Specification ~~6.9.1.8,~~ 5.6.3, the ~~Annual~~ Radioactive Effluent Release Report covering the operation of the units during the previous calendar year of operation shall be submitted ~~before May 1 of each year~~ in accordance with 10 CFR 50.36.a. (A single submittal may be made for Units 1 and 2. However, the submittal shall specify the releases of radioactive material in liquid and gaseous effluents from each unit and solid radioactive waste from the site.) The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the units. The material provided shall be consistent with the objectives outlined throughout this ODCM and the Process Control Program (PCP) and in conformance with 10 CFR Part 50.36a and Section IV.B.1 of Appendix I to 10 CFR Part 50.

7.2.2 Report Contents

The materials specified in the following sub-sections shall be included in each ~~Annual~~ Radioactive Effluent Release Report:

7.2.2.1 Quantities of Radioactive Materials Released

The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the units as outlined in NRC Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1, June 1974, with liquid and gaseous effluent data summarized on a quarterly basis and solid radioactive waste data summarized on a semiannual basis following the format of Appendix B thereof. The report shall include documentation of quantities of radioactive materials in unplanned releases of gaseous and liquid effluents from the site to UNRESTRICTED AREAS, tabulated either by quarter or by event, provided that: such liquid releases exceeded 1 Ci, excluding tritium and dissolved or entrained noble gases; or such gaseous releases exceeded 150 Ci of noble gases or 0.02 Ci of radioiodines. For gamma emitters released in liquid and gaseous effluents, in addition to the principal gamma emitters for which MDCs are specifically established in Table 2-3 and Table 3-3, other peaks which are measurable and identifiable also shall be identified and reported.

7.2.2.2 Meteorological Data

The report shall include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing of wind speed, wind direction, and atmospheric stability, and precipitation (if measured) on magnetic tape; or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability. In lieu of submission with the ~~Annual~~ Radioactive Effluent Release Report, the licensee has the option of ~~retaining~~ this summary of required meteorological data on site in a file that shall be provided to the NRC upon request.

7.2.2.3 Dose Assessments

The report shall include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from each unit during the previous calendar year. Historical annual average meteorology or the meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents (as determined by sampling frequency and measurement) shall be used for determining the gaseous pathway dose. This assessment of radiation doses shall be performed in accordance with Sections 2.1.3, 2.4, 3.1.3, 3.1.4, 3.4.2, 3.4.3, 5.1, and 5.2.

If a determination is required by Section 5.1.2, the report shall also include an assessment of radiation doses to the likely most exposed MEMBER OF THE PUBLIC from reactor releases and other nearby uranium fuel cycle sources (including doses from primary effluent pathways and direct radiation) for the previous calendar year to show conformance with 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operation; this dose assessment must be performed in accordance with Chapter 5. The report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY (Figure 10-1) during the report period; this assessment must be performed in accordance with Chapter 6.

7.2.2.4 Solid Radwaste Data

For each type of solid waste shipped offsite during the report period, the following information shall be included:

a. Container volume,
b. Total curie quantity (specify whether determined by measurement or estimate),

c. Principal radionuclides (specify whether determined by measurement or estimate),
d. Type of waste (e.g., spent resin, compacted dry waste, evaporator bottoms),
e. Type of container (e.g., LSA, Type A, Type B, Large Quantity), and
f. Solidification agent (e.g., cement, urea formaldehyde.)

7.2.2.5 Licensee Initiated Document Changes

Licensee initiated changes shall be submitted to the Nuclear Regulatory Commission as a part of or concurrent with the ~~Annual~~ Radioactive Effluent Release Report for the period in which any changes were made. Such changes to the ODCM shall be submitted pursuant to Technical Specification ~~6.13~~ 5.5.1. This requirement includes:

7.2.2.5.1 Any changes to the sampling locations in the radiological environmental monitoring program, including any changes made pursuant to Section 4.1.1.2.3. Documentation of changes made pursuant to Section 4.1.1.2.3 shall include supporting information identifying the cause of the unavailability of samples.

7.2.2.5.2 Any changes to dose calculation locations or pathways, including any changes made pursuant to Section 4.1.2.2.2.

7.2.2.6 Descriptions of Program Deviations

Discussions of deviations from the established program shall be included in each report, as follows:

7.2.2.6.1 The report shall include deviations from Minimum Detectable Concentration (MDC) requirements included in Table 3-3.

7.2.2.6.2 The report shall include deviations from the liquid and gaseous effluent monitoring instrumentation operability requirements included in Sections 2.1.1 and 3.1.1, respectively. The report shall include an explanation as to why the inoperability of the liquid or gaseous effluent monitoring instrumentation was not corrected within the specified time requirement. (This requirement does not include the Service Water System to Closed Cooling Water System Differential Pressure channel.)

~~7.2.2.6.3 The report shall include notification~~ if the contents within any outside temporary tank exceed the limits of Technical Specification ~~3.15.1.4 (Unit 1) or Technical Specification 3.11.1.4 (Unit 2)~~ 5.5.8.b.

7.2.2.7 Major Changes to Radioactive Waste Treatment Systems

As required by Sections 2.1.5 and 3.1.6, licensee initiated MAJOR CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS (liquid and gaseous) shall be reported to the Nuclear Regulatory Commission in the ~~Annual~~ Radioactive Effluents Release Report covering the period in which the change was reviewed and accepted for implementation.[1] The discussion of each change shall contain:

a. A summary of the evaluation that led to the determination that the change could be made in accordance with 10 CFR Part 50.59;

b. Sufficient detailed information to totally support the reason for the change without benefit of additional or supplemental information;

c. A detailed description of the equipment, components and processes involved and the interfaces with other plant systems;

d. An evaluation of the change, which shows the predicted releases of radioactive materials in liquid and gaseous effluents that differ from those previously predicted in the license application and amendments thereto;

e. An evaluation of the change, which shows the expected maximum exposures to a MEMBER OF THE PUBLIC in the UNRESTRICTED AREA and to the general population that differ from those previously estimated in the license application and amendments thereto;

f. A comparison of the predicted releases of radioactive materials, in liquid and gaseous effluents, to the actual releases for the period prior to when the changes are to be made;

g. An estimate of the exposure to plant operating personnel as a result of the change; and

h. Documentation of the fact that the change was reviewed and found acceptable by the Plant Review Board.

1 In lieu of inclusion in the ~~Annual~~ Radioactive Effluents Release Report, this same information may be submitted as part of the annual FSAR update.

7.3 MONTHLY OPERATING REPORT

This ODCM establishes no requirements pertaining to the Monthly Operating Report.

7.4 SPECIAL REPORTS

Special reports shall be submitted to the Nuclear Regulatory Commission ~~in accordance with Technical Specification 6.9.2.~~ as required by Sections 2.1.3.2, 2.1.4.2, 3.1.3.2, 3.1.4.2, 3.1.5.2, 4.1.1.2.2, and 5.1.2.

CHAPTER 8

METEOROLOGICAL MODELS

The models presented in this chapter are those which were used to compute the specific values of meteorology-related parameters that are referenced throughout this ODCM. These models should also be used whenever it is necessary to calculate values of these parameters for new locations of interest.

Note 1: When calculating values of annual average parameters for new locations, use the joint frequency meteorological data presented in Reference 28. Those are the data which were used to compute the specific values of meteorology-related parameters that are referenced throughout this ODCM.

Note 2: Although Plant Hatch has no mixed-mode releases, the sections on mixed-mode calculations (8.1.3 and 8.2.3) are included to preserve section number compatibility with the ODCMs of the other Southern Company nuclear power plants.

8.1 ATMOSPHERIC DISPERSION

Atmospheric dispersion may be calculated using the appropriate form of the sector-averaged Gaussian model. Gaseous release elevations may be considered to be either at ground-level, elevated, or mixed-mode. Facility release elevations for each gaseous release point are as indicated in Table 3-4.

8.1.1 Ground-Level Releases

Relative concentration calculations for ground-level releases, or for the ground-level portion of mixed-mode releases, shall be made as follows:

$$(X/Q)_G = \frac{2.032 \;\; \delta \;\; K_r}{N \;\; r} \sum_{jk} \left[\frac{n_{jk}}{u_j \;\; \Sigma_{zk}} \right] \tag{8.1}$$

where:

$(X/Q)_G$ = the ground-level sector-averaged relative concentration for a given wind direction (sector) and distance (s/m^3).

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

δ = the plume depletion factor for all radionuclides other than noble gases at a distance r shown in Figure 8-3. For noble gases, the depletion factor is unity. If an undepleted relative concentration is desired, the depletion factor is unity. Only depletion by deposition is considered since depletion by radioactive decay would be of little significance at the distances considered.

K_r = the terrain recirculation factor corresponding to a distance r, taken from Figure 8-2.

n_{jk} = the number of hours that wind of wind speed class j is directed into the given sector during the time atmospheric stability category k existed.

N = the total hours of valid meteorological data recorded throughout the period of interest for all sectors, wind speed classes, and stability categories.

u_j = the wind speed (mid-point of wind speed class j) at ground level (m/s).

r = the distance from release point to location of interest (m).

Σ_{zk} = the vertical standard deviation of the plume concentration distribution considering the initial dispersion within the building wake, calculated as follows:

$$\Sigma_{zk} = \text{the lesser of: } \begin{cases} \left(\sigma_{zk}^2 + \dfrac{b^2}{2\pi}\right)^{1/2} \\ OR \\ \sqrt{3}\,(\sigma_{zk}) \end{cases} \qquad (8.2)$$

σ_{zk} = the vertical standard deviation of the plume concentration distribution (m) for a given distance and stability category k as shown in Figure 8-1. The stability category is determined by the vertical temperature gradient $\Delta T/\Delta z$ (°C/100 m).

π = 3.1416

b = the maximum height of adjacent plant structure (47 m).

8.1.2 Elevated Releases

Relative dispersion calculations for elevated releases, or for the elevated portion of mixed-mode releases, shall be made as follows:

$$(X/Q)_E = \frac{2.032\ K_r}{N\ r} \sum_{jk} \left[\frac{\delta_k\ n_{jk}\ \exp\left(\frac{-h^2}{2\ \sigma_{zk}^2}\right)}{u_j\ \sigma_{zk}} \right] \qquad (8.3)$$

where:

$(X/Q)_E$ = the elevated release sector-averaged relative concentration for a given wind direction (sector) and distance (s/m^3).

δ_k = the plume depletion factor for all radionuclides other than noble gases at a distance r for elevated releases, as shown in Figure 8-4, Figure 8-5, and Figure 8-6. For an elevated release, this factor is stability dependent. For noble gases, the depletion factor is unity. If an undepleted relative concentration is desired, the depletion factor is unity. Only depletion by deposition is considered since depletion by radioactive decay would be of little significance at the distances considered.

n_{jk} = the number of hours that wind of wind speed class j is directed into the given sector during the time atmospheric stability category k existed.

u_j = the wind speed (mid-point of wind speed class j) at the effective release height h (m/s).

h = the effective height of the release (m), which is calculated as follows:[1]

$$h = h_v - h_t \qquad (8.4)$$

[1] Effective release height may be further adjusted for plume rise in accordance with Section E.4.3.2 of Appendix E to Reference 7.

h_v = the height of the release point (m), which is the height of the main stack, 120 m.

h_t = the maximum terrain height between the release point and the point of interest (m), from Figure 2.3-12 of Reference 8.

All other symbols are as previously defined in Section 8.1.1.

8.1.3 Mixed-Mode Releases

Relative dispersion calculations for mixed-mode releases shall be made as follows:

$$(X/Q)_M = (1-E) \cdot (X/Q)_E + E \cdot (X/Q)_G \tag{8.5}$$

where:

$(X/Q)_M$ = the mixed-mode release sector-averaged relative concentration for a given wind direction (sector) and distance (s/m^3).

E = the fraction of hours during which releases are considered as ground-level releases, calculated as follows:

$$E = \begin{cases} 1.0 & for\ \frac{W_o}{u_j} \le 1.0 \\ 2.58 - 1.58 \cdot \left(\frac{W_o}{u_j}\right) & for\ 1.0 < \frac{W_o}{u_j} \le 1.5 \\ 0.3 - 0.06 \cdot \left(\frac{W_o}{u_j}\right) & for\ 1.5 < \frac{W_o}{u_j} \le 5.0 \\ 0 & for\ \frac{W_o}{u_j} > 5.0 \end{cases} \tag{8.6}$$

All other symbols are as previously defined.

8.2 RELATIVE DEPOSITION

Plume depletion may be calculated using the appropriate form of the sector-averaged Gaussian model. Gaseous release elevations may be considered to be either at ground-level, elevated, or mixed-mode. Facility release elevations for each gaseous release points are as indicated in Table 3-4.

8.2.1 Ground-Level Releases

Relative deposition calculations for ground-level releases, or for the ground-level portion of mixed-mode releases, shall be made as follow

$$(D/Q)_G = \frac{2.55\ D_g\ K_r}{N\ r} \sum_k n_k \qquad (8.7)$$

where:

$(D/Q)_G$ = the ground-level sector-averaged relative deposition for a given wind direction (sector) and distance (m^{-2}).

2.55 = the inverse of the number of radians in a 22.5° sector [= $(2\ \pi/16)^{-1}$].

D_g = the deposition rate at distance r, taken from Figure 8-7 for ground-level releases (m^{-1}).

n_k = the number of hours in which the wind is directed into the sector of interest, and during which stability category k exists.

All other symbols are as defined previously in Section 8.1.

8.2.2 Elevated Releases

Relative deposition calculations for elevated releases, or for the elevated portion of mixed-mode releases, shall be made as follows:

$$(D/Q)_E = \frac{2.55\ K_r}{N\ r} \sum_k (n_k\ D_{ek}) \qquad (8.8)$$

where:

$(D/Q)_E$ = the elevated-plume sector-averaged relative deposition for a given wind direction (sector) and distance (m^{-2}).

D_{ek} = the elevated plume deposition rate at distance r, taken from Figure 8-8, Figure 8-9, or Figure 8-10, as appropriate to the plume effective release height h defined in Section 8.1.2, for stability class k (m^{-1}).

All other symbols are as defined previously.

8.2.3 Mixed-Mode Releases

Relative deposition calculations for mixed-mode releases shall be made as follows:

$$(D/Q)_M = (1-E)\cdot(D/Q)_E + E\cdot(D/Q)_G \qquad \textbf{(8.9)}$$

where:

$(D/Q)_M$ = the mixed-mode release sector-averaged relative deposition for a given wind direction sector) and distance (m^{-2}).

E = the fraction of hours during which releases are considered as ground-level releases, defined in Section 8.1.3.

All other symbols are as previously defined.

8.3 ELEVATED PLUME DOSE FACTORS

Certain gaseous effluent dose calculations require the use of the elevated-plume noble gas dose parameters B_i or V_i, which are first defined in Section 3.4. These parameters are calculated as follows:

$$B_i = \frac{K}{r\ N} \sum_{j,k,\epsilon} \left[\frac{n_{jk} \cdot A_{\epsilon i} \cdot \mu a_\epsilon \cdot E_\epsilon \cdot I_{k\epsilon}(r)}{u_j} \right] \tag{8.10}$$

$$V_i = \frac{1.1\ K}{r\ N} \sum_{j,k,\epsilon} \left[\frac{n_{jk} \cdot A_{\epsilon i} \cdot \mu a_\epsilon \cdot E_\epsilon \cdot I_{k\epsilon}(r)}{u_j} \cdot e^{-\left(\mu T_\epsilon \cdot d\right)} \right] \tag{8.11}$$

where:

K = a numerical constant representing the aggregated numerical constants and unit conversions, 2.1×10^4.

$A_{\epsilon i}$ = the number of photons in energy group ϵ emitted per transformation of radionuclide i (number/decay).

μa_ϵ = the air energy absorption coefficient for photons in energy group ϵ (m^{-1}).

E_ϵ = the photon energy assigned to energy group ϵ (MeV).

$I_{k\epsilon}(r)$ = the (dimensionless) result of integrating the emission and attenuation of photons of energy group ϵ, over the entire spatial activity distribution of a plume that has spread under atmospheric stability classification k, for a dose receptor at downwind distance r (see below for calculational method).

1.1 = the average ratio of the photon energy absorption coefficient for tissue to that of air over the energy range of interest. This ratio converts air dose (rad) to dose equivalent (rem).

μT_ϵ = the tissue energy absorption coefficient for photons in energy group ϵ (cm^2/g).

d = the tissue density thickness taken to represent the depth at which total body dose is received (5.0 g/cm^2).

All other symbols are as previously defined.

For a sector-averaged plume model like that described in Section 8.1, the dose integral $I_{k\epsilon}(r)$ is calculated as follows:

$$I_{k\epsilon}(r) = \frac{1}{2^{3/2}\,\sigma_z} \int_0^\infty \int_0^\infty B_g(\mu_\epsilon, \mu a_\epsilon, R) \times G(z, k, r) \times A(\mu_\epsilon, R) \times L \, dL \, dz \qquad (8.12)$$

where:

L = the upwind or downwind distance from the differential volume element of the plume to the dose receptor point.

z = the vertical distance from the differential volume element of the plume to the dose receptor point.

R = the total distance from the differential volume element of the plume to the dose receptor point:

$$R = \sqrt{L^2 + z^2}$$

B_g = the air dose buildup factor through a thickness R of air:

$$B_g = 1 + \left[\frac{(\mu_\epsilon - \mu a_\epsilon) \cdot \mu_\epsilon}{\mu a_\epsilon} \right] \times R$$

μ_ϵ = the total photon attenuation coefficient in air, for energy group ϵ (m^{-1}).

G = the function describing the vertical distribution of activity in a plume that has travelled downwind a distance r from the point of emission, at an effective height h, under stability classification k:

$$G = \exp\left[-\frac{(z-h)^2}{2\,\sigma_{zk}^2}\right] + \exp\left[-\frac{(z+h)^2}{2\,\sigma_{zk}^2}\right]$$

A = the attenuation and geometric loss factor for photons in energy group ϵ, for the distance R from the differential plume volume element to the dose receptor point:

$$A = \frac{\exp\left[-\mu_\epsilon R\right]}{R^2}$$

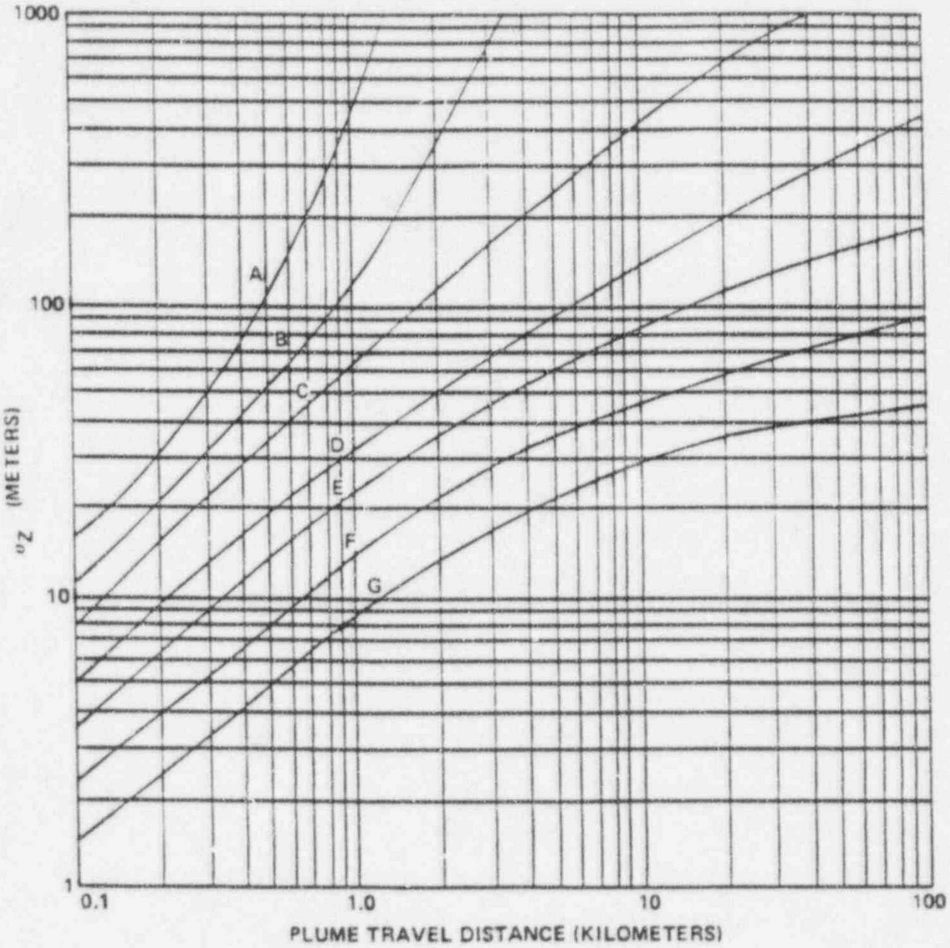
2π L dL dz = the volume of the differential plume element. (When the 2π is factored out into the constants in equations (8.10), (8.11), and (8.12), only L dL dz is left.)

All other symbols are as previously defined.

A derivation of the model describing the gamma dose rate from an elevated finite plume is found in Chapter 7 of Reference 19. Numerical methods for evaluating the dose integral are found in Appendix F of Reference 3. Details of the numerical methods used there may be found in Reference 20.

Table 8-1. Terrain Elevation Above Plant Site Grade

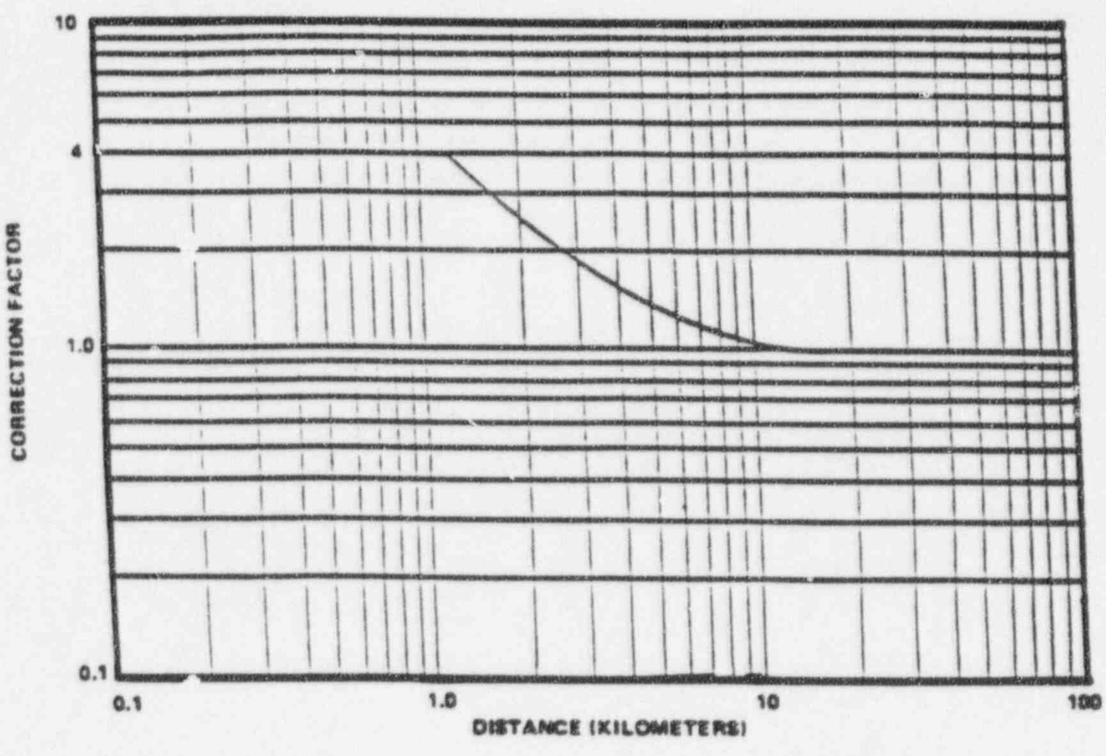
This table intentionally left blank.



Category	Range of Vertical Temperature Gradient (°C/100 m)	Range of Vertical Temperature Gradient (°F/100 ft)
A	$\Delta T/\Delta Z < -1.9$	$\Delta T/\Delta Z < -1.0$
B	$-1.9 \leq \Delta T/\Delta Z < -1.7$	$-1.0 \leq \Delta T/\Delta Z < -0.9$
C	$-1.7 \leq \Delta T/\Delta Z < -1.5$	$-0.9 \leq \Delta T/\Delta Z < -0.8$
D	$-1.5 \leq \Delta T/\Delta Z < -0.5$	$-0.8 \leq \Delta T/\Delta Z < -0.3$
E	$-0.5 \leq \Delta T/\Delta Z < 1.5$	$-0.3 \leq \Delta T/\Delta Z < 0.8$
F	$1.5 \leq \Delta T/\Delta Z < 4.0$	$0.8 \leq \Delta T/\Delta Z < 2.2$
G	$4.0 \leq \Delta T/\Delta Z$	$2.2 \leq \Delta T/\Delta Z$

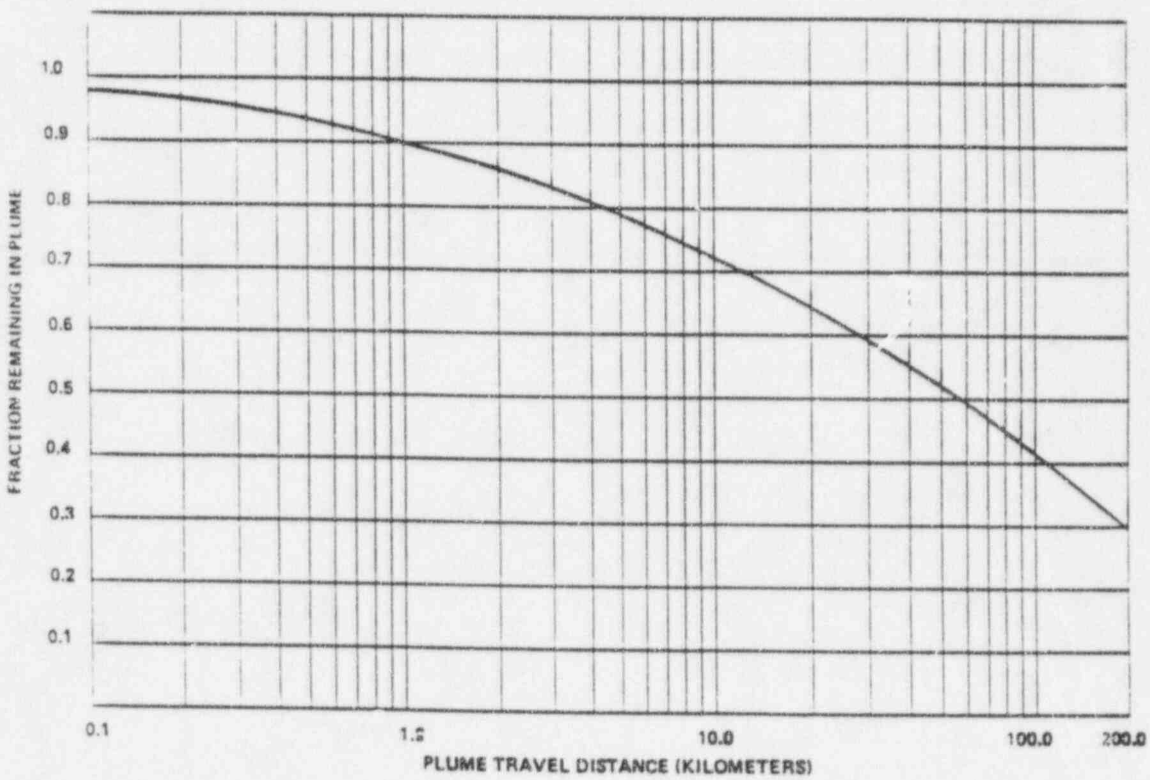
This graph is reproduced from Reference 5 (Figure 1).

Figure 8-1. Vertical Standard Deviation of Material in a Plume (σ_z)



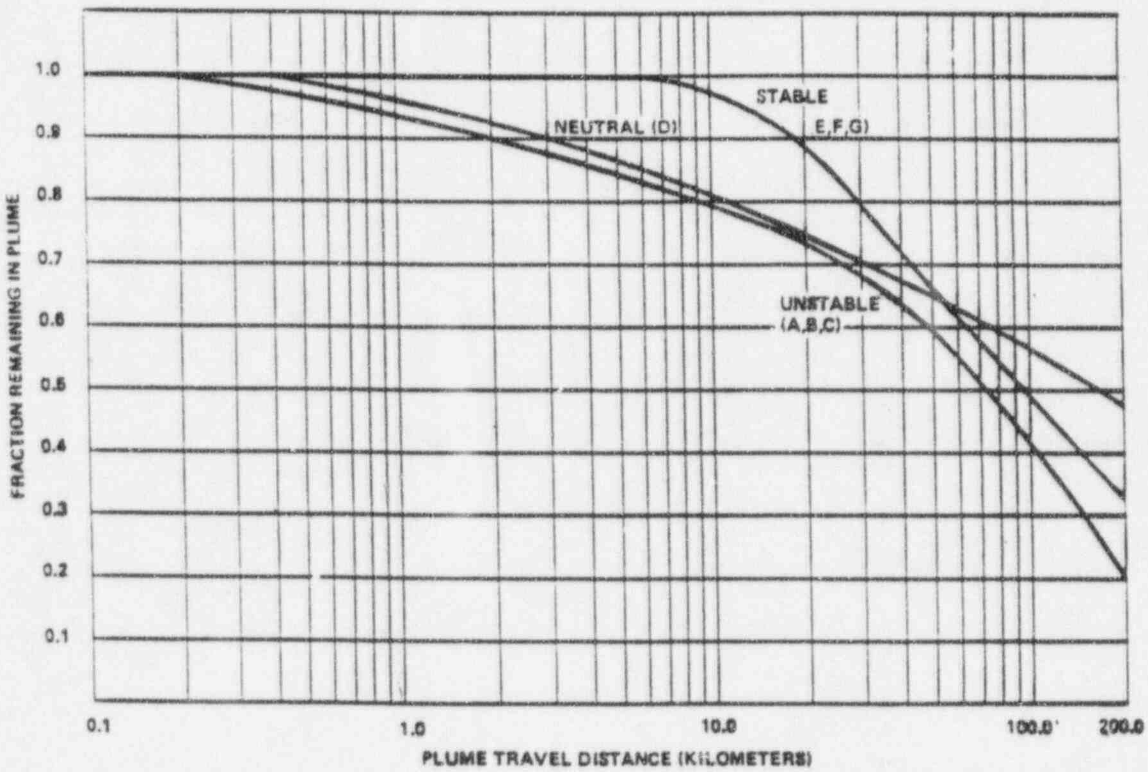
This graph is reproduced from Reference 4.

Figure 8-2. Terrain Recirculation Factor (K_r)



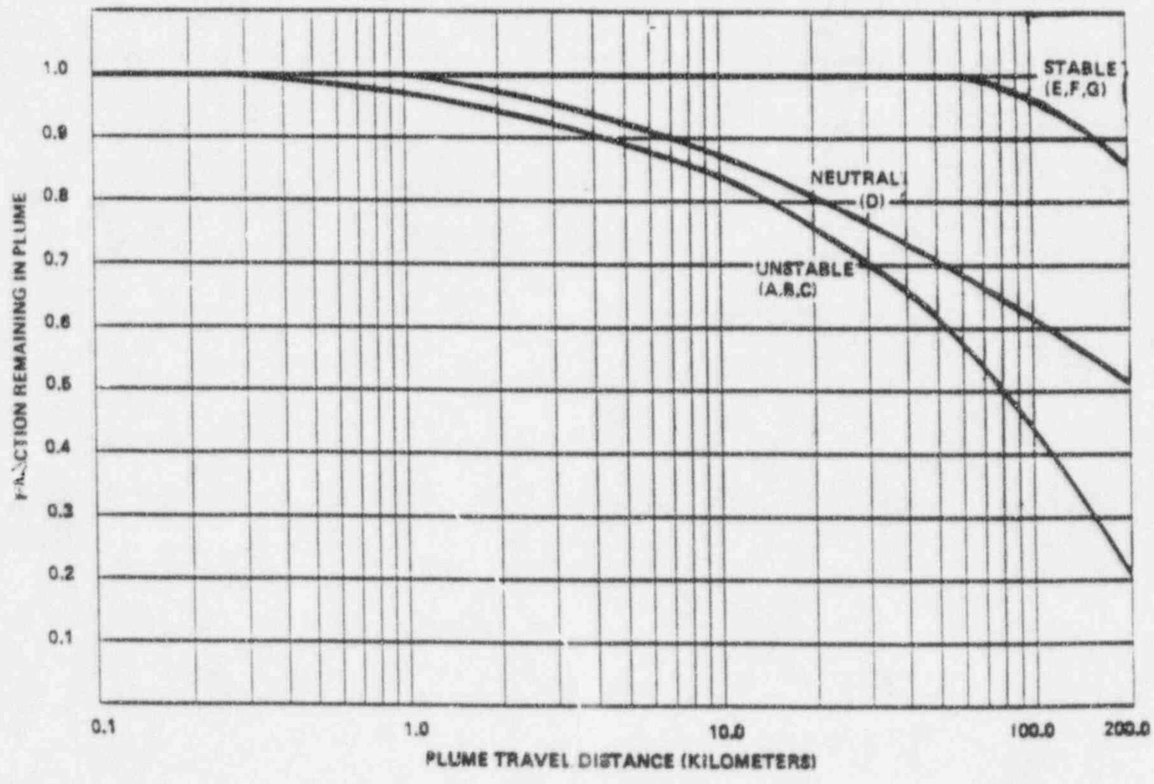
This graph is reproduced from Reference 5 (Figure 2).

Figure 8-3. Plume Depletion Effect for Ground Level Releases



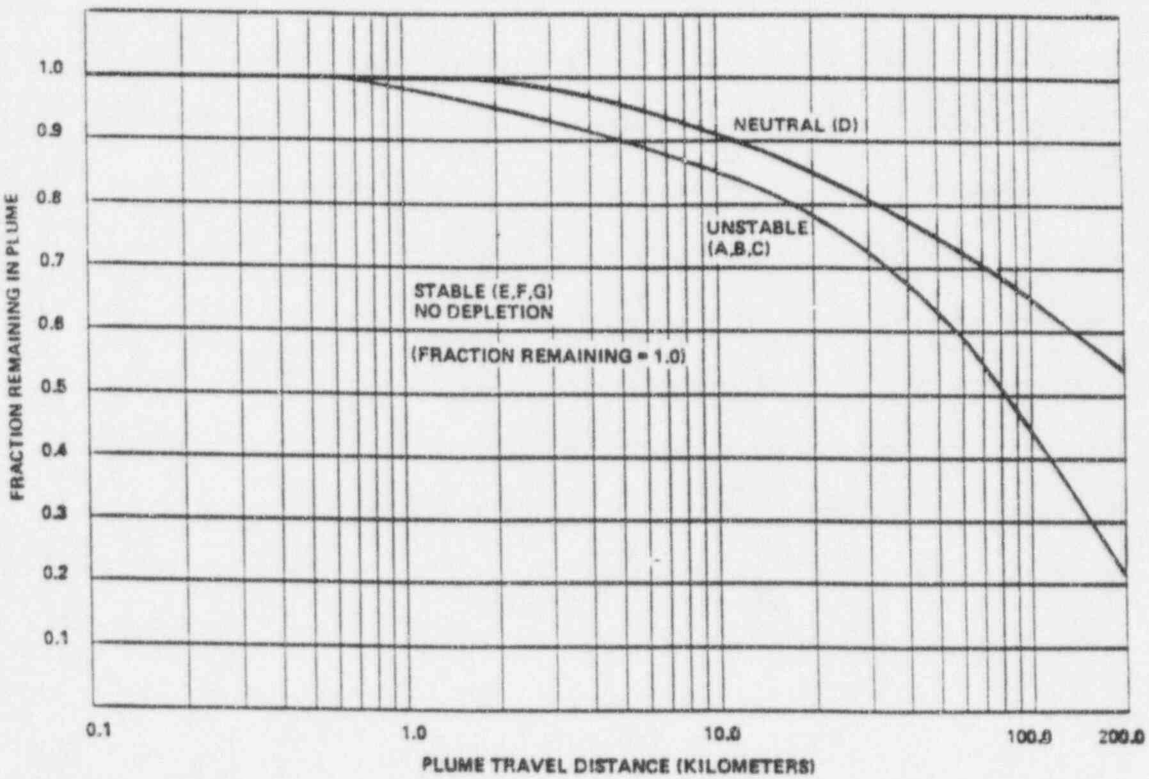
This graph is reproduced from Reference 5 (Figure 3).

Figure 8-4. Plume Depletion Effect for 30-Meter Releases



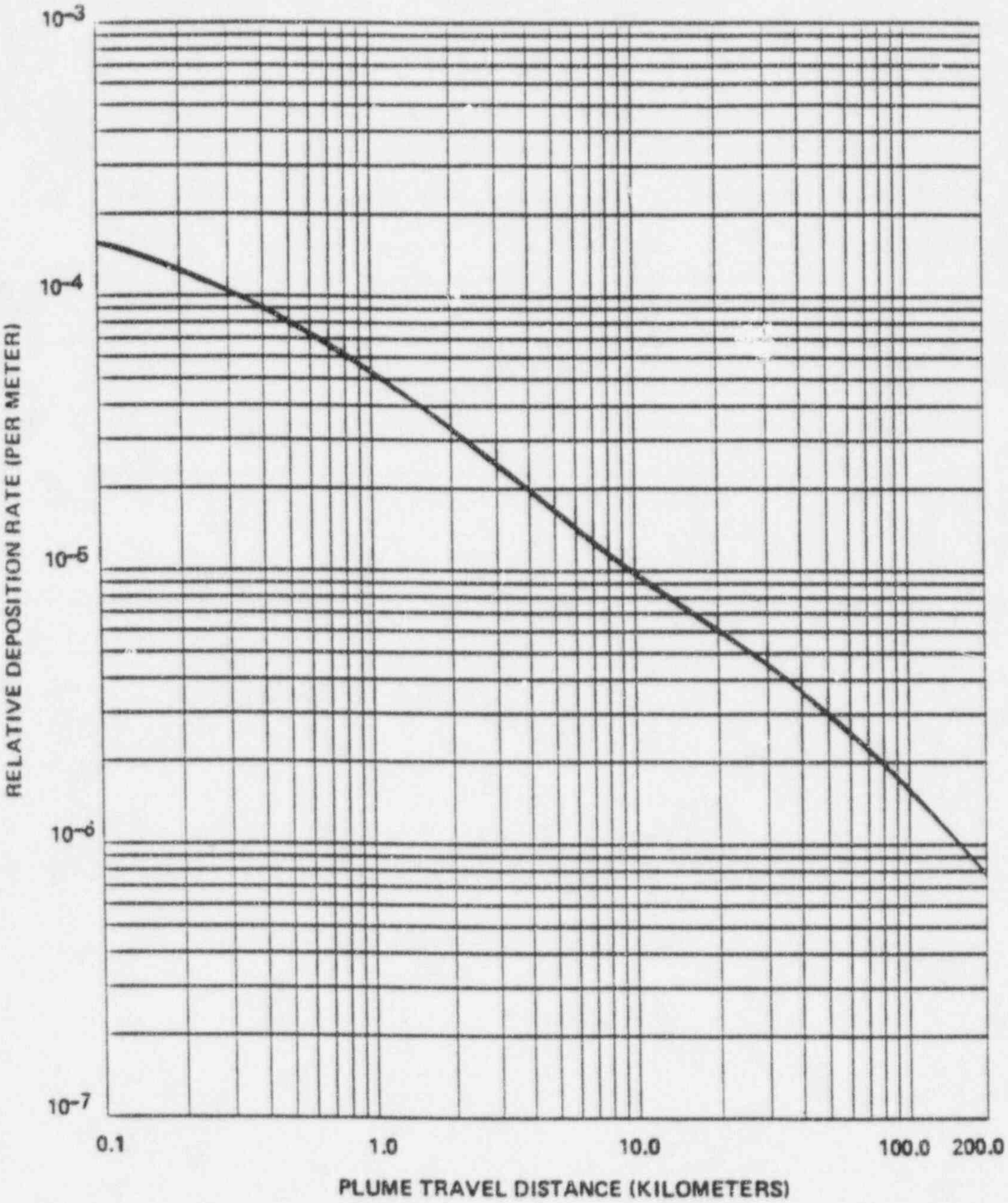
This graph is reproduced from Reference 5 (Figure 4).

Figure 8-5. Plume Depletion Effect for 60-Meter Releases



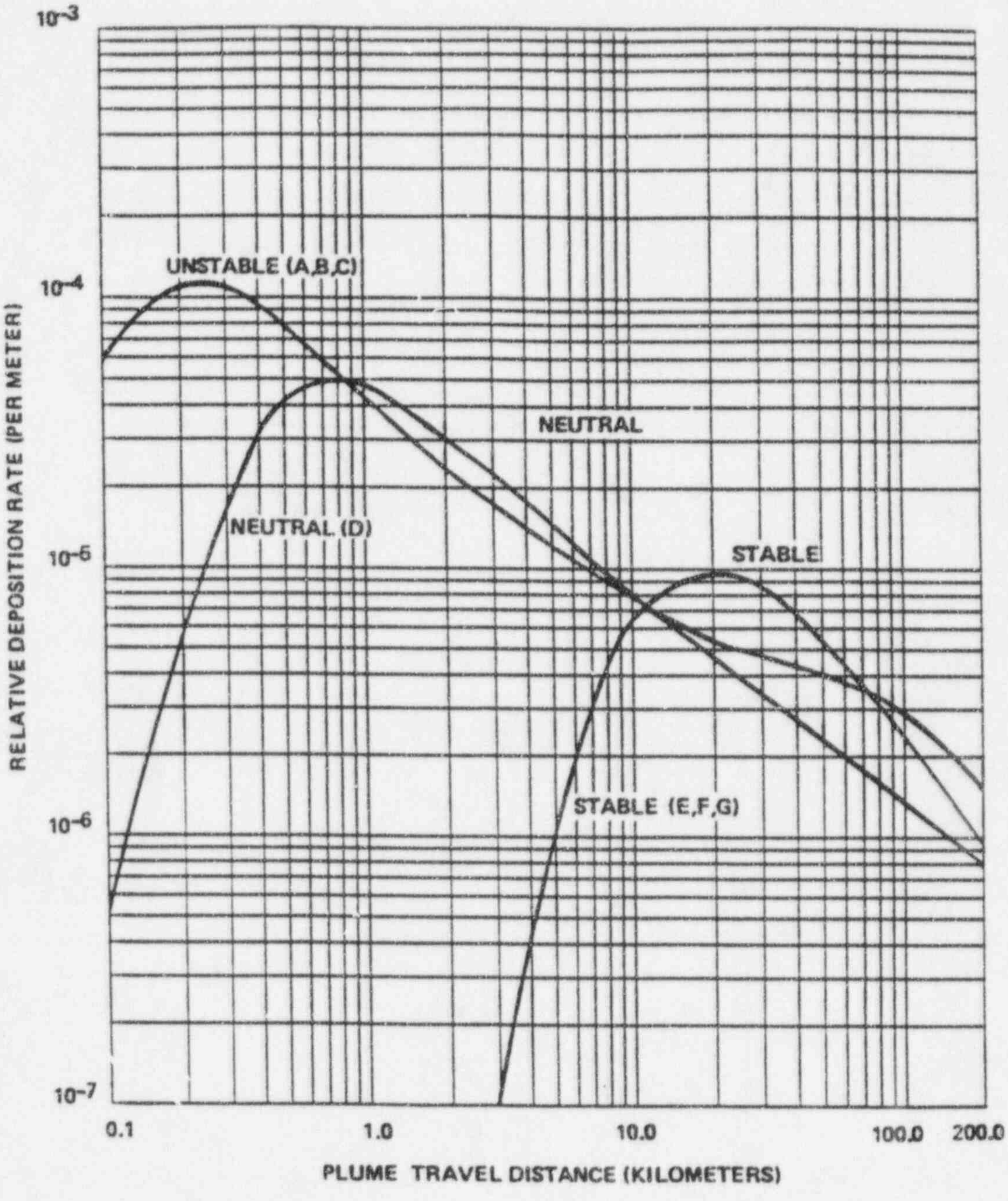
This graph is reproduced from Reference 5 (Figure 5).

Figure 8-6. Plume Depletion Effect for 100-Meter Releases



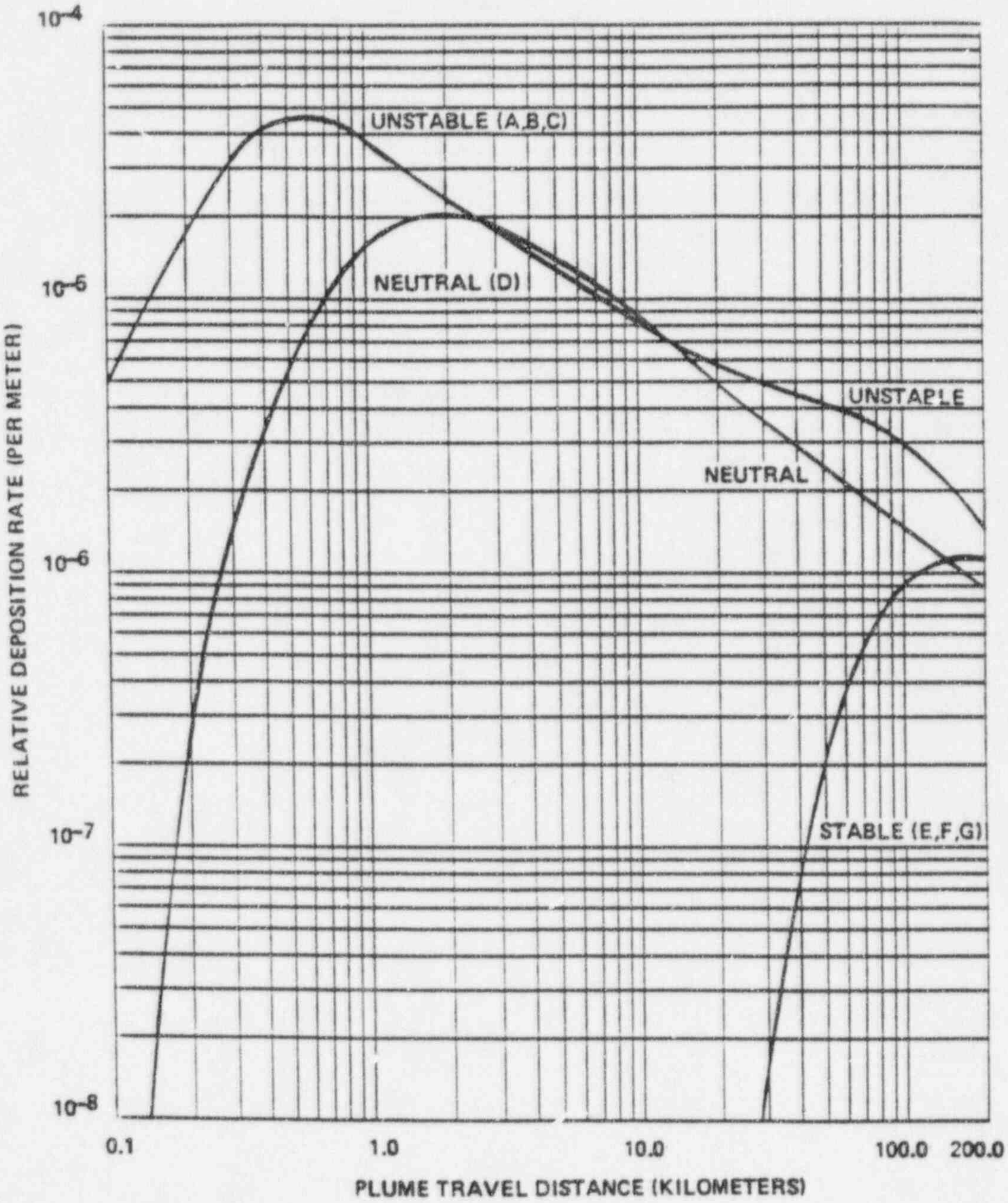
This graph is reproduced from Reference 5 (Figure 6).

Figure 8-7. Relative Deposition for Ground-Level Releases



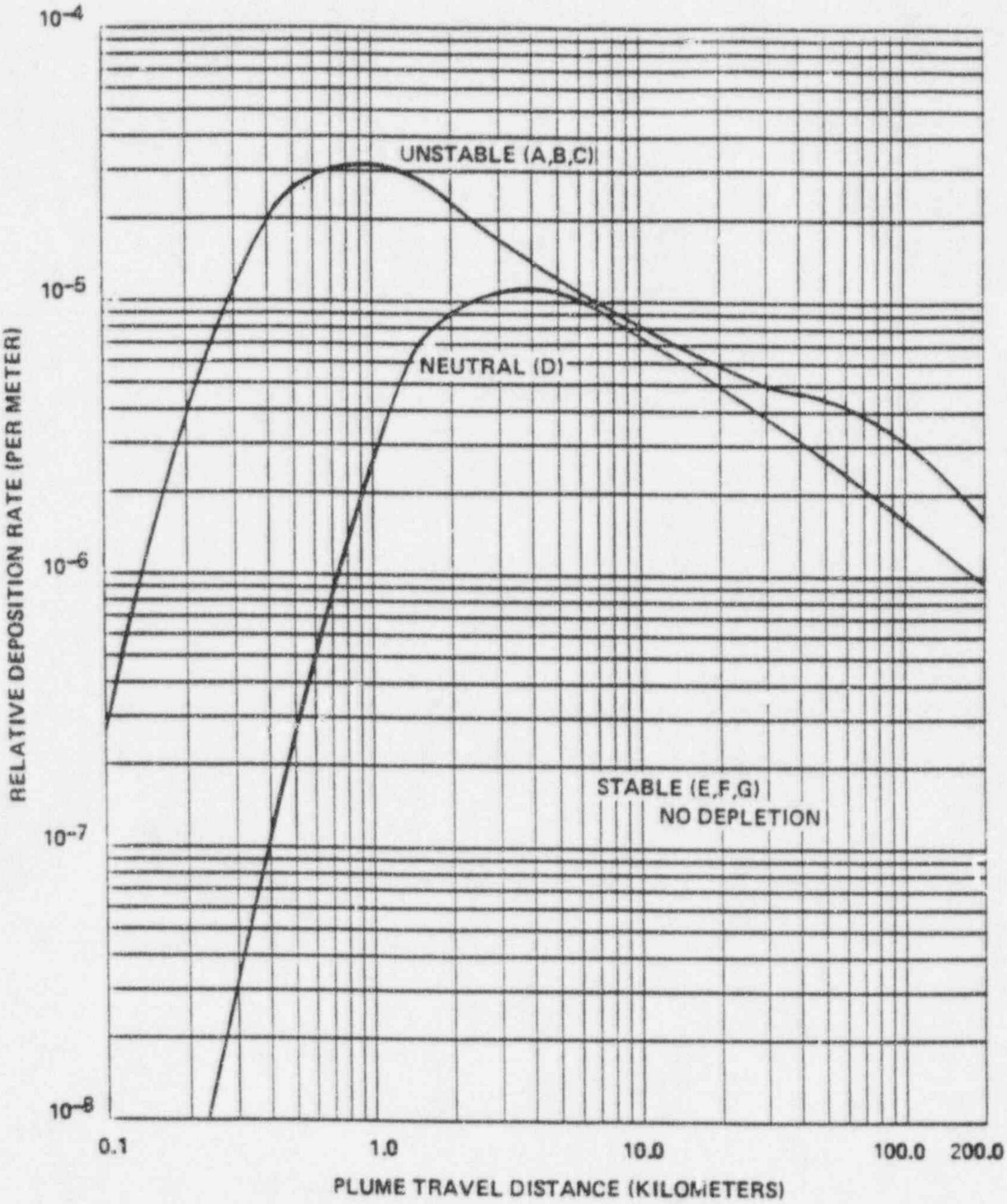
This graph is reproduced from Reference 5 (Figure 7).

Figure 8-8. Relative Deposition for 30-Meter Releases



This graph is reproduced from Reference 5 (Figure 8).

Figure 8-9. Relative Deposition for 60-Meter Releases



This graph is reproduced from Reference 5 (Figure 9).

Figure 8-10. Relative Deposition for 100-Meter (or Greater) Releases

CHAPTER 9
METHODS AND PARAMETERS FOR CALCULATION OF GASEOUS EFFLUENT PATHWAY DOSE FACTORS, R_{aipj}

9.1 INHALATION PATHWAY FACTOR

For the inhalation pathway, R_{aipj} in (mrem/y) per ($\mu Ci/m^3$) is calculated as follows (Reference 1, Section 5.3.1.1):

$$R_{aipj} = K_1 \cdot (BR)_a \cdot (DFA)_{aij} \qquad (9.1)$$

where:

K_1 = the units conversion factor: 10^6 pCi/μCi.

$(BR)_a$ = the breathing rate of receptor age group a, in m^3/y, from Table 9-5.

$(DFA)_{aij}$ = the inhalation dose factor for receptor age group a, radionuclide i, and organ j, in mrem/pCi, from Table 9-7 through Table 9-10.

9.2 GROUND PLANE PATHWAY FACTOR

For the ground plane external exposure pathway, R_{aipj} in ($m^2 \cdot mrem/y$) per ($\mu Ci/s$) is calculated as follows (Reference 1, Section 5.3.1.2):

$$R_{aipj} = K_1 \cdot K_2 \cdot (SHF) \cdot (DFG)_{ij} \cdot \left(\frac{1 - e^{-\lambda_i t}}{\lambda_i} \right) \qquad (9.2)$$

where:

K_1 = the units conversion factor: 10^6 pCi/μCi.

K_2 = the units conversion factor: 8760 h/y.

(SHF) = the shielding factor due to structure (dimensionless). The value used for (SHF) is 0.7, from (Reference 3, Table E-15).

$(DFG)_{ij}$ = the ground plane dose factor for radionuclide i and organ j, in (mrem/h) per (pCi/m^2), from Table 9-15. Dose factors are the same for all age groups, and those for the total body also apply to all organs other than skin.

λ_i = the radioactive decay constant for radionuclide i, in s^{-1}. Values of λ_i used in effluent calculations should be based on decay data from a recognized and current source, such as Reference 26.

t = the exposure time, in s. The value used for t is 4.73×10^8 s (= 15 y), from (Reference 1, Section 5.3.1.2).

9.3 GARDEN VEGETATION PATHWAY FACTOR

For radionuclides other than tritium in the garden vegetation consumption pathway, R_{aipj} in ($m^2 \cdot mrem/y$) per ($\mu Ci/s$) is calculated as follows (Reference 1, Section 5.3.1.5):

$$R_{aipj} = K_1 \cdot \frac{r}{Y_v\ (\lambda_i + \lambda_w)} \cdot (DFL)_{aij} \cdot \left(U_{aL}\, f_L\, e^{-\lambda_i t_L} + U_{aS}\, f_g\, e^{-\lambda_i t_{hv}} \right) \quad (9.3)$$

where:

K_1 = the units conversion factor: 10^6 pCi/μCi.

r = the fraction of deposited activity retained on the edible parts of garden vegetation (dimensionless). The value used for r is 1.0 for radioiodines and 0.2 for particulates, from (Reference 3, Table E-1).

Y_v = the areal density (agricultural productivity) of growing leafy garden vegetation, in kg/m^2, from Table 9-1.

λ_i = the radioactive decay constant for radionuclide i, in s^{-1}. Values of λ_i used in effluent calculations should be based on decay data from a recognized and current source, such as Reference 26.

λ_w = the rate constant for removal of activity on leaf and plant surfaces by weathering, in s^{-1}, from Table 9-1.

$(DFL)_{aij}$ = the ingestion dose factor for receptor age group a, radionuclide i, and organ j, in mrem/pCi, from Table 9-11 through Table 9-14.

U_{aL} = the consumption rate of fresh leafy garden vegetation by a receptor in age group a, in kg/y, from Table 9-5.

U_{aS} = the consumption rate of stored garden vegetation by a receptor in age group a, in kg/y, from Table 9-5.

f_L = the fraction of the annual intake of fresh leafy garden vegetation that is grown locally (dimensionless), from Table 9-1.

f_g = the fraction of the annual intake of stored garden vegetation that is grown locally (dimensionless), from Table 9-1.

t_L = the average time between harvest of fresh leafy garden vegetation and its consumption, in s, from Table 9-1.

t_{hv} = the average time between harvest of stored garden vegetation and its consumption, in s, from Table 9-1.

For tritium in the garden vegetation consumption pathway, R_{aipj} in (mrem/y) per (μCi/m^3) is calculated as follows (Reference 1, Section 5.3.1.5), based on the concentration in air rather than deposition onto the ground:

$$R_{aipj} = K_1 \cdot K_3 \cdot (DFL)_{aij} \cdot (U_{aL} f_L + U_{aS} f_g) \cdot 0.75 \cdot \left(\frac{0.5}{H}\right) \quad \textbf{(9.4)}$$

where:

K_3 = the units conversion factor: 10^3 g/kg.

H = the absolute humidity of atmospheric air, in g/m^3, from Table 9-1.

0.75 = the fraction of the mass of total garden vegetation that is water (dimensionless).

0.5 = the ratio of the specific activity of tritium in garden vegetation water to that in atmospheric water (dimensionless).

and other parameters are as defined above.

Table 9-1. Miscellaneous Parameters for the Garden Vegetation Pathway

The following parameter values are for use in calculating R_{aipj} for the garden vegetation pathway only. The terms themselves are defined in Section 9.3.

Parameter	Value	Reference
Y_v	2.0 kg/m^2	Ref. 3, Table E-15
λ_w	5.73×10^{-7} s^{-1} (14-day half-life)	Ref. 1, page 33
f_L	1.0	Ref. 1, page 36
f_g	0.76	Ref. 1, page 33
t_L	8.6×10^4 s (1 day)	Ref. 3, Table E-15
t_{hv}	5.18×10^6 s (60 days)	Ref. 3, Table E-15
H	8 g/m^3	Ref. 3

9.4 GRASS-COW-MILK PATHWAY FACTOR

For radionuclides other than tritium in the grass-cow-milk pathway, R_{aipj} in ($m^2 \cdot$mrem/y) per (μCi/s) is calculated as follows (Reference 1, Section 5.3.1.3):

$$R_{aipj} = K_1 \cdot \frac{r}{(\lambda_i + \lambda_w)} \cdot Q_F \cdot U_{ap} \cdot F_{mi} \cdot (DFL)_{aij} \cdot \left[\frac{f_p f_s}{Y_p} + \frac{(1 - f_p f_s)\, e^{-\lambda_i t_{hm}}}{Y_s} \right] \cdot e^{-\lambda_i t_f} \qquad (9.5)$$

where:

K_1 = the units conversion factor: 10^6 pCi/μCi.

r = the fraction of deposited activity retained on the edible parts of vegetation (dimensionless). The value used for r is 1.0 for radioiodines and 0.2 for particulates, from (Reference 3, Table E-1).

λ_i = the radioactive decay constant for radionuclide i, in s^{-1}. Values of λ_i used in effluent calculations should be based on decay data from a recognized and current source, such as Reference 26.

λ_w = the rate constant for removal of activity on leaf and plant surfaces by weathering, in s^{-1}, from Table 9-2.

Q_F = the cow's consumption rate of feed, in kg/d, from Table 9-2.

U_{ap} = the consumption rate of cow milk by a receptor in age group a, in L/y, from Table 9-5.

F_{mi} = the stable element transfer coefficient applicable to radionuclide i, for cow's milk, in d/L, from Table 9-6.

$(DFL)_{aij}$ = the ingestion dose factor for receptor age group a, radionuclide i, and organ j, in mrem/pCi, from Table 9-11 through Table 9-14.

f_p = the fraction of the year that the cow is on pasture (dimensionless), from Table 9-2.

f_s = the fraction of the cow's feed that is pasture grass while the cow is on pasture (dimensionless), from Table 9-2.

Y_p = the areal density (agricultural productivity) of growing pasture feed grass, in kg/m^2, from Table 9-2.

Y_s = the areal density (agricultural productivity) of growing stored feed, in kg/m^2, from Table 9-2.

t_{hm} = the transport time from harvest of stored feed to its consumption by the cow, in s, from Table 9-2.

t_f = the transport time from consumption of feed by the cow, to consumption of milk by the receptor, in s, from Table 9-2.

For tritium in the grass-cow-milk pathway, R_{aipj} in (mrem/y) per ($\mu Ci/m^3$) is calculated as follows (Reference 1, Section 5.3.1.5), based on the concentration in air rather than deposition onto the ground:

$$R_{aipj} = K_1 \cdot K_3 \cdot Q_F \cdot U_{ap} \cdot F_{mi} \cdot (DFL)_{aij} \cdot 0.75 \cdot \left(\frac{0.5}{H}\right) \qquad \textbf{(9.6)}$$

where:

K_3 = the units conversion factor: 10^3 g/kg.

H = the absolute humidity of atmospheric air, in g/m^3, from Table 9-2.

0.75 = the fraction of the mass of total vegetation that is water (dimensionless).

0.5 = the ratio of the specific activity of tritium in vegetation water to that in atmospheric water (dimensionless).

and other parameters are as defined above.

Table 9-2. Miscellaneous Parameters for the Grass-Cow-Milk Pathway

The following parameter values are for use in calculating R_{aipj} for the grass-cow-milk pathway only. The terms themselves are defined in Section 9.4.

Parameter	Value	Reference
λ_w	5.73×10^{-7} s^{-1} (14-day half-life)	Ref. 1, page 33
Q_F	50 kg/d	Ref. 3, Table E-3
f_p	1.0	Ref. 1, page 33
f_s	1.0	Ref. 1, page 33
Y_p	0.7 kg/m^2	Ref. 3, Table E-15
Y_s	2.0 kg/m^2	Ref. 3, Table E-15
t_{hm}	7.78×10^6 s (90 days)	Ref. 3, Table E-15
t_f	1.73×10^5 s (2 days)	Ref. 3, Table E-15
H	8 g/m^3	Ref. 3

9.5 GRASS-GOAT-MILK PATHWAY FACTOR

For radionuclides other than tritium in the grass-goat-milk pathway, R_{aipj} in ($m^2\cdot$mrem/y) per (μCi/s) is calculated as follows (Reference 1, Section 5.3.1.3):

$$R_{aipj} = K_1 \cdot \frac{r}{(\lambda_i + \lambda_w)} \cdot Q_F \cdot U_{ap} \cdot F_{mi} \cdot (DFL)_{aij} \cdot \left[\frac{f_p\, f_s}{Y_p} + \frac{(1 - f_p\, f_s)\, e^{-\lambda_i t_{hm}}}{Y_s} \right] \cdot e^{-\lambda_i t_f} \quad (9.7)$$

where:

K_1 = the units conversion factor: 10^6 pCi/μCi.

r = the fraction of deposited activity retained on the edible parts of vegetation (dimensionless). The value used for r is 1.0 for radioiodines and 0.2 for particulates, from (Reference 3, Table E-1).

λ_i = the radioactive decay constant for radionuclide i, in s^{-1}. Values of λ_i used in effluent calculations should be based on decay data from a recognized and current source, such as Reference 26.

λ_w = the rate constant for removal of activity on leaf and plant surfaces by weathering, in s^{-1}, from Table 9-3.

Q_F = the goat's consumption rate of feed, in kg/d, from Table 9-3.

U_{ap} = the consumption rate of goat milk by a receptor in age group a, in L/y, from Table 9-5.

F_{mi} = the stable element transfer coefficient applicable to radionuclide i, for goat's milk, in d/L, from Table 9-6.

$(DFL)_{aij}$ = the ingestion dose factor for receptor age group a, radionuclide i, and organ j, in mrem/pCi, from Table 9-11 through Table 9-14.

f_p = the fraction of the year that the goat is on pasture (dimensionless), from Table 9-3.

f_s = the fraction of the goat's feed that is pasture grass while the goat is on pasture (dimensionless), from Table 9-3.

Y_p = the areal density (agricultural productivity) of growing pasture feed grass, in kg/m^2, from Table 9-3.

Y_s = the areal density (agricultural productivity) of growing stored feed, in kg/m^2, from Table 9-3.

t_{hm} = the transport time from harvest of stored feed to its consumption by the goat, in s, from Table 9-3.

t_f = the transport time from consumption of feed by the goat, to consumption of milk by the receptor, in s, from Table 9-3.

For tritium in the grass-goat-milk pathway, R_{aipj} in (mrem/y) per ($\mu Ci/m^3$) is calculated as follows (Reference 1, Section 5.3.1.5), based on the concentration in air rather than deposition onto the ground:

$$R_{aipj} = K_1 \cdot K_3 \cdot Q_F \cdot U_{ap} \cdot F_{mi} \cdot (DFL)_{aij} \cdot 0.75 \cdot \left(\frac{0.5}{H}\right) \qquad \textbf{(9.8)}$$

where:

K_3 = the units conversion factor: 10^3 g/kg.

H = the absolute humidity of atmospheric air, in g/m^3, from Table 9-3.

0.75 = the fraction of the mass of total vegetation that is water (dimensionless).

0.5 = the ratio of the specific activity of tritium in vegetation water to that in atmospheric water (dimensionless).

and other parameters are as defined above.

Table 9-3. Miscellaneous Parameters for the Grass-Goat-Milk Pathway

The following parameter values are for use in calculating R_{aipj} for the grass-goat-milk pathway only. The terms themselves are defined in Section 9.5.

Parameter	Value	Reference
λ_w	$5.73 \times 10^{-7}\ s^{-1}$ (14-day half-life)	Ref. 1, page 33
Q_F	6 kg/d	Ref. 3, Table E-3
f_p	1.0	Ref. 1, page 33
f_s	1.0	Ref. 1, page 33
Y_p	0.7 kg/m^2	Ref. 3, Table E-15
Y_s	2.0 kg/m^2	Ref. 3, Table E-15
t_{hm}	7.78×10^6 s (90 days)	Ref. 3, Table E-15
t_f	1.73×10^5 s (2 days)	Ref. 3, Table E-15
H	8 g/m^3	Ref. 3

9.6 GRASS-COW-MEAT PATHWAY FACTOR

For radionuclides other than tritium in the grass-cow-meat pathway, R_{aipj} in ($m^2 \cdot$mrem/y) per (μCi/s) is calculated as follows (Reference 1, Section 5.3.1.4):

$$R_{aipj} = K_1 \cdot \frac{r}{(\lambda_i + \lambda_w)} \cdot Q_F \cdot U_{ap} \cdot F_{fi} \cdot (DFL)_{aij} \cdot \left[\frac{f_p\, f_s}{Y_p} + \frac{(1 - f_p\, f_s)\, e^{-\lambda_i t_{hm}}}{Y_s} \right] \cdot e^{-\lambda_i t_f} \quad (9.9)$$

where:

K_1 = the units conversion factor: 10^6 pCi/μCi.

r = the fraction of deposited activity retained on the edible parts of vegetation (dimensionless). The value used for r is 1.0 for radioiodines and 0.2 for particulates, from (Reference 3, Table E-1).

λ_i = the radioactive decay constant for radionuclide i, in s^{-1}. Values of λ_i used in effluent calculations should be based on decay data from a recognized and current source, such as Reference 26.

λ_w = the rate constant for removal of activity on leaf and plant surfaces by weathering, in s^{-1}, from Table 9-4.

Q_F = the cow's consumption rate of feed, in kg/d, from Table 9-4.

U_{ap} = the consumption rate of meat by a receptor in age group a, in kg/y, from Table 9-5.

F_{fi} = the stable element transfer coefficient applicable to radionuclide i, for meat, in d/kg, from Table 9-6.

$(DFL)_{aij}$ = the ingestion dose factor for receptor age group a, radionuclide i, and organ j, in mrem/pCi, from Table 9-11 through Table 9-14.

f_p = the fraction of the year that the cow is on pasture (dimensionless), from Table 9-4.

f_s = the fraction of the cow's feed that is pasture grass while the cow is on pasture (dimensionless), from Table 9-4.

Y_p = the areal density (agricultural productivity) of growing pasture feed grass, in kg/m^2, from Table 9-4.

Y_s = the areal density (agricultural productivity) of growing stored feed, in kg/m^2, from Table 9-4.

t_{hm} = the transport time from harvest of stored feed to its consumption by the cow, in s, from Table 9-4.

t_f = the transport time from consumption of feed by the cow, to consumption of meat by the receptor, in s, from Table 9-4.

For tritium in the grass-cow-meat pathway, R_{aipj} in (mrem/y) per (μCi/m^3) is calculated as follows (Reference 1, Section 5.3.1.4), based on the concentration in air rather than deposition onto the ground:

$$R_{aipj} = K_1 \cdot K_3 \cdot Q_F \cdot U_{ap} \cdot F_{fi} \cdot (DFL)_{aij} \cdot 0.75 \cdot \left(\frac{0.5}{H}\right) \qquad (9.10)$$

where:

K_3 = the units conversion factor: 10^3 g/kg.

H = the absolute humidity of atmospheric air, in g/m^3, from Table 9-4.

0.75 = the fraction of the mass of total vegetation that is water (dimensionless).

0.5 = the ratio of the specific activity of tritium in vegetation water to that in atmospheric water (dimensionless).

and other parameters are as defined above.

Table 9-4. Miscellaneous Parameters for the Grass-Cow-Meat Pathway

The following parameter values are for use in calculating R_{aipj} for the grass-cow-meat pathway only. The terms themselves are defined in Section 9.6.

Parameter	Value	Reference
λ_w	5.73×10^{-7} s^{-1} (14-day half-life)	Ref. 1, page 33
Q_F	50 kg/d	Ref. 3, Table E-3
f_p	1.0	Ref. 1, page 33
f_s	1.0	Ref. 1, page 33
Y_p	0.7 kg/m^2	Ref. 3, Table E-15
Y_s	2.0 kg/m^2	Ref. 3, Table E-15
t_{hm}	7.78×10^6 s (90 days)	Ref. 3, Table E-15
t_f	1.73×10^6 s (20 days)	Ref. 3, Table E-15
H	8 g/m^3	Ref. 3

Table 9-5. Individual Usage Factors

Usage Factor	Receptor Age Group			
	Infant	Child	Teenager	Adult
Milk Consumption Rate, U_{ap} (L/y)	330	330	400	310
Meat Consumption Rate, U_{ap} (kg/y)	0	41	65	110
Fresh Leafy Garden Vegetation Consumption Rate, U_{aL} (kg/y)	0	26	42	64
Stored Garden Vegetation Consumption Rate, U_{aS} (kg/y)	0	520	630	520
Breathing Rate, $(BR)_a$ (m^3/y)	1400	3700	8000	8000

All values are from Reference 3, Table E-5.

Table 9-6. Stable Element Transfer Data

Element	Cow Milk F_m (d/L)*	Goat Milk F_m (d/L)+	Meat F_f (d/kg)*
H	1.0 E-02	1.7 E-01	1.2 E-02
C	1.2 E-02	1.0 E-01	3.1 E-02
Na	4.0 E-02	4.0 E-02	3.0 E-02
P	2.5 E-02	2.5 E-01	4.6 E-02
Cr	2.2 E-03	2.2 E-03	2.4 E-03
Mn	2.5 E-04	2.5 E-04	8.0 E-04
Fe	1.2 E-03	1.3 E-04	4.0 E-02
Co	1.0 E-03	1.0 E-03	1.3 E-02
Ni	6.7 E-03	6.7 E-03	5.3 E-02
Cu	1.4 E-02	1.3 E-02	8.0 E-03
Zn	3.9 E-02	3.9 E-02	3.0 E-02
Br	5.0 E-02	5.0 E-02	2.6 E-02
Rb	3.0 E-02	3.0 E-02	3.1 E-02
Sr	8.0 E-04	1.4 E-02	6.0 E-04
Y	1.0 E-05	1.0 E-05	4.6 E-03
Zr	5.0 E-06	5.0 E-06	3.4 E-02
Nb	2.5 E-03	2.5 E-03	2.8 E-01
Mo	7.5 E-03	7.5 E-03	8.0 E-03
Tc	2.5 E-02	2.5 E-02	4.0 E-01
Ru	1.0 E-06	1.0 E-06	4.0 E-01
Rh	1.0 E-02	1.0 E-02	1.5 E-03
Ag	5.0 E-02	5.0 E-02	1.7 E-02
Sb	1.5 E-03	1.5 E-03	4.0 E-03
Te	1.0 E-03	1.0 E-03	7.7 E-02
I	6.0 E-03	6.0 E-02	2.9 E-03
Cs	1.2 E-02	3.0 E-01	4.0 E-03
Ba	4.0 E-04	4.0 E-04	3.2 E-03
La	5.0 E-06	5.0 E-06	2.0 E-04
Ce	1.0 E-04	1.0 E-04	1.2 E-03
Pr	5.0 E-06	5.0 E-06	4.7 E-03
Nd	5.0 E-06	5.0 E-06	3.3 E-03
W	5.0 E-04	5.0 E-04	1.3 E-03
Np	5.0 E-06	5.0 E-06	2.0 E-04

* - Values from Reference 3 (Table E-1) except as follows: Reference 2 (Table C-5) for Br and Sb.

\+ - Values from Reference 3, Table E-2 for H, C, P, Fe, Cu, Sr, I, and Cs in goat milk, and Table E-1 for all other elements in cow milk, except as follows: Reference 2 (Table C-5) for Br and Sb in cow milk.

Table 9-7. Inhalation Dose Factors for the Infant Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
H-3	No Data	4.62E-07	4.62E-07	4.62E-07	4.62E-07	4.62E-07	4.62E-07
C-14	1.89E-05	3.79E-06	3.79E-06	3.79E-06	3.79E-06	3.79E-06	3.79E-06
Na-24	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06	7.54E-06
P-32	1.45E-03	8.03E-05	5.53E-05	No Data	No Data	No Data	1.15E-05
Cr-51	No Data	No Data	6.39E-08	4.11E-08	9.45E-09	9.17E-06	2.55E-07
Mn-54	No Data	1.81E-05	3.56E-06	No Data	3.56E-06	7.14E-04	5.04E-06
Mn-56	No Data	1.10E-09	1.58E-10	No Data	7.86E-10	8.95E-06	5.12E-05
Fe-55	1.41E-05	8.39E-06	2.38E-06	No Data	No Data	6.21E-05	7.82E-07
Fe-59	9.69E-06	1.68E-05	6.77E-06	No Data	No Data	7.25E-04	1.77E-05
Co-58	No Data	8.71E-07	1.30E-06	No Data	No Data	5.55E-04	7.95E-06
Co-60	No Data	5.73E-06	8.41E-06	No Data	No Data	3.22E-03	2.28E-05
Ni-63	2.42E-04	1.46E-05	8.29E-06	No Data	No Data	1.49E-04	1.73E-06
Ni-65	1.71E-09	2.03E-10	8.79E-11	No Data	No Data	5.80E-06	3.58E-05
Cu-64	No Data	1.34E-09	5.53E-10	No Data	2.84E-09	6.64E-06	1.07E-05
Zn-65	1.38E-05	4.47E-05	2.22E-05	No Data	2.32E-05	4.62E-04	3.67E-05
Zn-69	3.85E-11	6.91E-11	5.13E-12	No Data	2.87E-11	1.05E-06	9.44E-06
Br-83	No Data	No Data	2.72E-07	No Data	No Data	No Data	No Data
Br-84	No Data	No Data	2.86E-07	No Data	No Data	No Data	No Data
Br-85	No Data	No Data	1.46E-08	No Data	No Data	No Data	No Data
Rb-86	No Data	1.36E-04	6.30E-05	No Data	No Data	No Data	2.17E-06
Rb-88	No Data	3.98E-07	2.05E-07	No Data	No Data	No Data	2.42E-07
Rb-89	No Data	2.29E-07	1.47E-07	No Data	No Data	No Data	4.87E-08
Sr-89	2.84E-04	No Data	8.15E-06	No Data	No Data	1.45E-03	4.57E-05
Sr-90	2.92E-02	No Data	1.85E-03	No Data	No Data	8.03E-03	9.36E-05
Sr-91	6.83E-08	No Data	2.47E-09	No Data	No Data	3.76E-05	5.24E-05

All values are in (mrem/pCi inhaled). They are obtained from Reference 3 (Table E-10). Neither Reference 2 nor Reference 3 contains data for Rh-105, Sb-124, or Sb-125.

Table 9-7 (contd). Inhalation Dose Factors for the Infant Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Sr-92	7.50E-09	No Data	2.79E-10	No Data	No Data	1.70E-05	1.00E-04
Y-90	2.35E-06	No Data	6.30E-08	No Data	No Data	1.92E-04	7.43E-05
Y-91m	2.91E-10	No Data	9.90E-12	No Data	No Data	1.99E-06	1.68E-06
Y-91	4.20E-04	No Data	1.12E-05	No Data	No Data	1.75E-03	5.02E-05
Y-92	1.17E-08	No Data	3.29E-10	No Data	No Data	1.75E-05	9.04E-05
Y-93	1.07E-07	No Data	2.91E-09	No Data	No Data	5.46E-05	1.19E-04
Zr-95	8.24E-05	1.99E-05	1.45E-05	No Data	2.22E-05	1.25E-03	1.55E-05
Zr-97	1.07E-07	1.83E-08	8.36E-09	No Data	1.85E-08	7.88E-05	1.00E-04
Nb-95	1.12E-05	4.59E-06	2.70E-06	No Data	3.37E-06	3.42E-04	9.05E-06
Mo-99	No Data	1.18E-07	2.31E-08	No Data	1.89E-07	9.63E-05	3.48E-05
Tc-99m	9.98E-13	2.06E-12	2.66E-11	No Data	2.22E-11	5.79E-07	1.45E-06
Tc-101	4.65E-14	5.88E-14	5.80E-13	No Data	6.99E-13	4.17E-07	6.03E-07
Ru-103	1.44E-06	No Data	4.85E-07	No Data	3.03E-06	3.94E-04	1.15E-05
Ru-105	8.74E-10	No Data	2.93E-10	No Data	6.42E-10	1.12E-05	3.46E-05
Ru-106	6.20E-05	No Data	7.77E-06	No Data	7.61E-05	8.26E-03	1.17E-04
Rh-105	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Ag-110m	7.13E-06	5.16E-06	3.57E-06	No Data	7.80E-06	2.62E-03	2.36E-05
Sb-124	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Sb-125	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Te-125m	3.40E-06	1.42E-06	4.70E-07	1.16E-06	No Data	3.19E-04	9.22E-06
Te-127m	1.19E-05	4.93E-06	1.48E-06	3.48E-06	2.68E-05	9.37E-04	1.95E-05
Te-127	1.59E-09	6.81E-10	3.49E-10	1.32E-09	3.47E-09	7.39E-06	1.74E-05
Te-129m	1.01E-05	4.35E-06	1.59E-06	3.91E-06	2.27E-05	1.20E-03	4.93E-05
Te-129	5.63E-11	2.48E-11	1.34E-11	4.82E-11	1.25E-10	2.14E-06	1.88E-05
Te-131m	7.62E-08	3.93E-08	2.59E-08	6.38E-08	1.89E-07	1.42E-04	8.51E-05
Te-131	1.24E-11	5.87E-12	3.57E-12	1.13E-11	2.85E-11	1.47E-06	5.87E-06

Table 9-7 (contd). Inhalation Dose Factors for the Infant Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Te-132	2.66E-07	1.69E-07	1.26E-07	1.99E-07	7.39E-07	2.43E-04	3.15E-05
I-130	4.54E-06	9.91E-06	3.98E-06	1.14E-03	1.09E-05	No Data	1.42E-06
I-131	2.71E-05	3.17E-05	1.40E-05	1.06E-02	3.70E-05	No Data	7.56E-07
I-132	1.21E-06	2.53E-06	8.99E-07	1.21E-04	2.82E-06	No Data	1.36E-06
I-133	9.46E-06	1.37E-05	4.00E-06	2.54E-03	1.60E-05	No Data	1.54E-06
I-134	6.58E-07	1.34E-06	4.75E-07	3.18E-05	1.49E-06	No Data	9.21E-07
I-135	2.76E-06	5.43E-06	1.98E-06	4.97E-04	6.05E-06	No Data	1.31E-06
Cs-134	2.83E-04	5.02E-04	5.32E-05	No Data	1.36E-04	5.69E-05	9.53E-07
Cs-136	3.45E-05	9.61E-05	3.78E-05	No Data	4.03E-05	8.40E-06	1.02E-06
Cs-137	3.92E-04	4.37E-04	3.25E-05	No Data	1.23E-04	5.09E-05	9.53E-07
Cs-138	3.61E-07	5.58E-07	2.84E-07	No Data	2.93E-07	4.67E-08	6.26E-07
Ba-139	1.06E-09	7.03E-13	3.07E-11	No Data	4.23E-13	4.25E-06	3.64E-05
Ba-140	4.00E-05	4.00E-08	2.07E-06	No Data	9.59E-09	1.14E-03	2.74E-05
Ba-141	1.12E-10	7.70E-14	3.55E-12	No Data	4.64E-14	2.12E-06	3.39E-06
Ba-142	2.84E-11	2.36E-14	1.40E-12	No Data	1.36E-14	1.11E-06	4.95E-07
La-140	3.61E-07	1.43E-07	3.68E-08	No Data	No Data	1.20E-04	6.06E-05
La-142	7.36E-10	2.69E-10	6.46E-11	No Data	No Data	5.87E-06	4.25E-05
Ce-141	1.98E-05	1.19E-05	1.42E-06	No Data	3.75E-06	3.69E-04	1.54E-05
Ce-143	2.09E-07	1.38E-07	1.58E-08	No Data	4.03E-08	8.30E-05	3.55E-05
Ce-144	2.28E-03	8.65E-04	1.26E-04	No Data	3.84E-04	7.03E-03	1.06E-04
Pr-143	1.00E-05	3.74E-06	4.99E-07	No Data	1.41E-06	3.09E-04	2.66E-05
Pr-144	3.42E-11	1.32E-11	1.72E-12	No Data	4.80E-12	1.15E-06	3.06E-06
Nd-147	5.67E-06	5.81E-06	3.57E-07	No Data	2.25E-06	2.30E-04	2.23E-05
W-187	9.26E-09	6.44E-09	2.23E-09	No Data	No Data	2.83E-05	2.54E-05
Np-239	2.65E-07	2.37E-08	1.34E-08	No Data	4.73E-08	4.25E-05	1.78E-05

Table 9-8. Inhalation Dose Factors for the Child Age Group

Nuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
H-3	No Data	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07	3.04E-07
C-14	9.70E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06	1.82E-06
Na-24	4.35E-06	4.35E-06	4.35E-06	4.35E-06	4.35E-06	4.35E-06	4.35E-06
P-32	7.04E-04	3.09E-05	2.67E-05	No Data	No Data	No Data	1.14E-05
Cr-51	No Data	No Data	4.17E-08	2.31E-08	6.57E-09	4.59E-06	2.93E-07
Mn-54	No Data	1.16E-05	2.57E-06	No Data	2.71E-06	4.26E-04	6.19E-06
Mn-56	No Data	4.48E-10	8.43E-11	No Data	4.52E-10	3.55E-06	3.33E-05
Fe-55	1.28E-05	6.80E-06	2.10E-06	No Data	No Data	3.00E-05	7.75E-07
Fe-59	5.59E-06	9.04E-06	4.51E-06	No Data	No Data	3.43E-04	1.91E-05
Co-58	No Data	4.79E-07	8.55E-07	No Data	No Data	2.99E-04	9.29E-06
Co-60	No Data	3.55E-06	6.12E-06	No Data	No Data	1.91E-03	2.60E-05
Ni-63	2.22E-04	1.25E-05	7.56E-06	No Data	No Data	7.43E-05	1.71E-06
Ni-65	8.08E-10	7.99E-11	4.44E-11	No Data	No Data	2.21E-06	2.27E-05
Cu-64	No Data	5.39E-10	2.90E-10	No Data	1.63E-09	2.59E-06	9.92E-06
Zn-65	1.15E-05	3.06E-05	1.90E-05	No Data	1.93E-05	2.69E-04	4.41E-06
Zn-69	1.81E-11	2.61E-11	2.41E-12	No Data	1.58E-11	3.84E-07	2.75E-06
Br-83	No Data	No Data	1.28E-07	No Data	No Data	No Data	No Data
Br-84	No Data	No Data	1.48E-07	No Data	No Data	No Data	No Data
Br-85	No Data	No Data	6.84E-09	No Data	No Data	No Data	No Data
Rb-86	No Data	5.36E-05	3.09E-05	No Data	No Data	No Data	2.16E-06
Rb-88	No Data	1.52E-07	9.90E-08	No Data	No Data	No Data	4.66E-09
Rb-89	No Data	9.33E-08	7.83E-08	No Data	No Data	No Data	5.11E-10
Sr-89	1.62E-04	No Data	4.66E-06	No Data	No Data	5.83E-04	4.52E-05
Sr-90	2.73E-02	No Data	1.74E-03	No Data	No Data	3.99E-03	9.28E-05
Sr-91	3.28E-08	No Data	1.24E-09	No Data	No Data	1.44E-05	4.70E-05

All values are in (mrem/pCi inhaled). They are obtained from Reference 3 (Table E-9). Neither Reference 2 nor Reference 3 contains data for Rh-105, Sb-124, or Sb-125.

Table 9-8 (contd). Inhalation Dose Factors for the Child Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Sr-92	3.54E-09	No Data	1.42E-10	No Data	No Data	6.49E-06	6.55E-05
Y-90	1.11E-06	No Data	2.99E-08	No Data	No Data	7.07E-05	7.24E-05
Y-91m	1.37E-10	No Data	4.98E-12	No Data	No Data	7.60E-07	4.64E-07
Y-91	2.47E-04	No Data	6.59E-06	No Data	No Data	7.10E-04	4.97E-05
Y-92	5.50E-09	No Data	1.57E-10	No Data	No Data	6.46E-06	6.46E-05
Y-93	5.04E-08	No Data	1.38E-09	No Data	No Data	2.01E-05	1.05E-04
Zr-95	5.13E-05	1.13E-05	1.00E-05	No Data	1.61E-05	6.03E-04	1.65E-05
Zr-97	5.07E-08	7.34E-09	4.32E-09	No Data	1.05E-08	3.06E-05	9.49E-05
Nb-95	6.35E-06	2.48E-06	1.77E-06	No Data	2.33E-06	1.66E-04	1.00E-05
Mo-99	No Data	4.66E-08	1.15E-08	No Data	1.06E-07	3.66E-05	3.42E-05
Tc-99m	4.81E-13	9.41E-13	1.56E-11	No Data	1.37E-11	2.57E-07	1.30E-06
Tc-101	2.19E-14	2.30E-14	2.91E-13	No Data	3.92E-13	1.58E-07	4.41E-09
Ru-103	7.55E-07	No Data	2.90E-07	No Data	1.90E-06	1.79E-04	1.21E-05
Ru-105	4.13E-10	No Data	1.50E-10	No Data	3.63E-10	4.30E-06	2.69E-05
Ru-106	3.68E-05	No Data	4.57E-06	No Data	4.97E-05	3.87E-03	1.16E-04
Rh-105	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Ag-110m	4.56E-06	3.08E-06	2.47E-06	No Data	5.74E-06	1.48E-03	2.71E-05
Sb-124	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Sb-125	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Te-125m	1.82E-06	6.29E-07	2.47E-07	5.20E-07	No Data	1.29E-04	9.13E-06
Te-127m	6.72E-06	2.31E-06	8.16E-07	1.64E-06	1.72E-05	4.00E-04	1.93E-05
Te-127	7.49E-10	2.57E-10	1.65E-10	5.30E-10	1.91E-09	2.71E-06	1.52E-05
Te-129m	5.19E-06	1.85E-06	8.22E-07	1.71E-06	1.36E-05	4.76E-04	4.91E-05
Te-129	2.64E-11	9.45E-12	6.44E-12	1.93E-11	6.94E-11	7.93E-07	6.89E-06
Te-131m	3.63E-08	1.60E-08	1.37E-08	2.64E-08	1.08E-07	5.56E-05	8.32E-05
Te-131	5.87E-12	2.28E-12	1.78E-12	4.59E-12	1.59E-11	5.55E-07	3.60E-07

Table 9-8 (contd). Inhalation Dose Factors for the Child Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Te-132	1.30E-07	7.36E-08	7.12E-08	8.58E-08	4.79E-07	1.02E-04	3.72E-05
I-130	2.21E-06	4.43E-06	2.28E-06	4.99E-04	6.61E-06	No Data	1.38E-06
I-131	1.30E-05	1.30E-05	7.37E-06	4.39E-03	2.13E-05	No Data	7.68E-07
I-132	5.72E-07	1.10E-06	5.07E-07	5.23E-05	1.69E-06	No Data	8.65E-07
I-133	4.48E-06	5.49E-06	2.08E-06	1.04E-03	9.13E-06	No Data	1.48E-06
I-134	3.17E-07	5.84E-07	2.69E-07	1.37E-05	8.92E-07	No Data	2.58E-07
I-135	1.33E-06	2.36E-06	1.12E-06	2.14E-04	3.62E-06	No Data	1.20E-06
Cs-134	1.76E-04	2.74E-04	6.07E-05	No Data	8.93E-05	3.27E-05	1.04E-06
Cs-136	1.76E-05	4.62E-05	3.14E-05	No Data	2.58E-05	3.93E-06	1.13E-06
Cs-137	2.45E-04	2.23E-04	3.47E-05	No Data	7.63E-05	2.81E-05	9.78E-07
Cs-138	1.71E-07	2.27E-07	1.50E-07	No Data	1.68E-07	1.84E-08	7.29E-08
Ba-139	4.98E-10	2.66E-13	1.45E-11	No Data	2.33E-13	1.56E-06	1.56E-05
Ba-140	2.00E-05	1.75E-08	1.17E-06	No Data	5.71E-09	4.71E-04	2.75E-05
Ba-141	5.29E-11	2.95E-14	1.72E-12	No Data	2.56E-14	7.89E-07	7.44E-08
Ba-142	1.35E-11	9.73E-15	7.54E-13	No Data	7.87E-15	4.44E-07	7.41E-10
La-140	1.74E-07	6.08E-08	2.04E-08	No Data	No Data	4.94E-05	6.10E-05
La-142	3.50E-10	1.11E-10	3.49E-11	No Data	No Data	2.35E-06	2.05E-05
Ce-141	1.06E-05	5.28E-06	7.83E-07	No Data	2.31E-06	1.47E-04	1.53E-05
Ce-143	9.89E-08	5.37E-08	7.77E-09	No Data	2.26E-08	3.12E-05	3.44E-05
Ce-144	1.83E-03	5.72E-04	9.77E-05	No Data	3.17E-04	3.23E-03	1.05E-04
Pr-143	4.99E-06	1.50E-06	2.47E-07	No Data	8.11E-07	1.17E-04	2.63E-05
Pr-144	1.61E-11	4.99E-12	8.10E-13	No Data	2.64E-12	4.23E-07	5.32E-08
Nd-147	2.92E-06	2.36E-06	1.84E-07	No Data	1.30E-06	8.87E-05	2.22E-05
W-187	4.41E-09	2.61E-09	1.17E-09	No Data	No Data	1.11E-05	2.46E-05
Np-239	1.26E-07	9.04E-09	6.35E-09	No Data	2.63E-08	1.57E-05	1.73E-05

Table 9-9. Inhalation Dose Factors for the Teenager Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
H-3	No Data	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07
C-14	3.2[illegible]E-06	6.09E-07	6.09E-07	6.09E-07	6.09E-07	6.09E-07	6.09E-07
Na-24	1.72E-06	1.72E-06	1.72E-06	1.72E-06	1.72E-06	1.72E-06	1.72E-06
P-32	2.36E-04	1.37E-08	8.95E-06	No Data	No Data	No Data	1.16E-05
Cr-51	No Data	No Data	1.69E-08	9.37E-09	3.84E-09	2.62E-06	3.75E-07
Mn-54	No Data	6.39E-06	1.05E-06	No Data	1.59E-06	2.48E-04	8.35E-06
Mn-56	No Data	2.12E-10	3.15E-11	No Data	2.24E-10	1.90E-06	7.18E-06
Fe-55	4.18E-06	2.98E-06	6.93E-07	No Data	No Data	1.55E-05	7.99E-07
Fe-59	1.99E-06	4.62E-06	1.79E-06	No Data	No Data	1.91E-04	2.23E-05
Co-58	No Data	2.59E-07	3.47E-07	No Data	No Data	1.68E-04	1.19E-05
Co-60	No Data	1.89E-06	2.48E-06	No Data	No Data	1.09E-03	3.24E-05
Ni-63	7.25E-05	5.43E-06	2.47E-06	No Data	No Data	3.84E-05	1.77E-06
Ni-65	2.73E-10	3.66E-11	1.59E-11	No Data	No Data	1.17E-06	4.59E-06
Cu-64	No Data	2.54E-10	1.06E-10	No Data	8.01E-10	1.39E-06	7.68E-06
Zn-65	4.82E-06	1.67E-05	7.80E-06	No Data	1.08E-05	1.55E-04	5.83E-06
Zn-69	6.04E-12	1.15E-11	8.07E-13	No Data	7.53E-12	1.98E-07	3.56E-08
Br-83	No Data	No Data	4.30E-08	No Data	No Data	No Data	No Data
Br-84	No Data	No Data	5.41E-08	No Data	No Data	No Data	No Data
Br-85	No Data	No Data	2.29E-09	No Data	No Data	No Data	No Data
Rb-86	No Data	2.38E-05	1.05E-05	No Data	No Data	No Data	2.21E-06
Rb-88	No Data	6.82E-08	3.40E-08	No Data	No Data	No Data	3.65E-15
Rb-89	No Data	4.40E-08	2.91E-08	No Data	No Data	No Data	4.22E-17
Sr-89	5.43E-05	No Data	1.56E-06	No Data	No Data	3.02E-04	4.64E-05
Sr-90	1.35E-02	No Data	8.35E-04	No Data	No Data	2.06E-03	9.56E-05
Sr-91	1.10E-08	No Data	4.39E-10	No Data	No Data	7.59E-06	3.24E-05

All values are in (mrem/pCi inhaled). They are obtained from Reference 3 (Table E-8). Neither Reference 2 nor Reference 3 contains data for Rh-105, Sb-124, or Sb-125.

Table 9-9 (contd). Inhalation Dose Factors for the Teenager Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Sr-92	1.19E-09	No Data	5.08E-11	No Data	No Data	3.43E-06	1.49E-05
Y-90	3.73E-07	No Data	1.00E-08	No Data	No Data	3.66E-05	6.99E-05
Y-91m	4.63E-11	No Data	1.77E-12	No Data	No Data	4.00E-07	3.77E-09
Y-91	8.26E-05	No Data	2.21E-06	No Data	No Data	3.67E-04	5.11E-05
Y-92	1.84E-09	No Data	5.36E-11	No Data	No Data	3.35E-06	2.06E-05
Y-93	1.69E-08	No Data	4.65E-10	No Data	No Data	1.04E-05	7.24E-05
Zr-95	1.82E-05	5.73E-06	3.94E-06	No Data	8.42E-06	3.36E-04	1.86E-05
Zr-97	1.72E-08	3.40E-09	1.57E-09	No Data	5.15E-09	1.62E-05	7.88E-05
Nb-95	2.32E-06	1.29E-06	7.08E-07	No Data	1.25E-06	9.39E-05	1.21E-05
Mo-99	No Data	2.11E-08	4.03E-09	No Data	5.14E-08	1.92E-05	3.36E-05
Tc-99m	1.73E-13	4.83E-13	6.24E-12	No Data	7.20E-12	1.44E-07	7.66E-07
Tc-101	7.40E-15	1.05E-14	1.03E-13	No Data	1.90E-13	8.34E-08	1.09E-16
Ru-103	2.63E-07	No Data	1.12E-07	No Data	9.29E-07	9.79E-05	1.36E-05
Ru-105	1.40E-10	No Data	5.42E-11	No Data	1.76E-10	2.27E-06	1.13E-05
Ru-106	1.23E-05	No Data	1.55E-06	No Data	2.38E-05	2.01E-03	1.20E-04
Rh-105	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Ag-110m	1.73E-06	1.64E-06	9.99E-07	No Data	3.13E-06	8.44E-04	3.41E-05
Sb-124	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Sb-125	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Te-125m	6.10E-07	2.80E-07	8.34E-08	1.75E-07	No Data	6.70E-05	9.38E-06
Te-127m	2.25E-06	1.02E-06	2.73E-07	5.48E-07	8.17E-06	2.07E-04	1.99E-05
Te-127	2.51E-10	1.14E-10	5.52E-11	1.77E-10	9.10E-10	1.40E-06	1.01E-05
Te-129m	1.74E-06	8.23E-07	2.81E-07	5.72E-07	6.49E-06	2.47E-04	5.06E-05
Te-129	8.87E-12	4.22E-12	2.20E-12	6.48E-12	3.32E-11	4.12E-07	2.02E-07
Te-131m	1.23E-08	7.51E-09	5.03E-09	9.06E-09	5.49E-08	2.97E-05	7.76E-05
Te-131	1.97E-12	1.04E-12	6.30E-13	1.55E-12	7.72E-12	2.92E-07	1.89E-09

Table 9-9 (contd). Inhalation Dose Factors for the Teenager Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Te-132	4.50E-08	3.63E-08	2.74E-08	3.07E-08	2.44E-07	5.61E-05	5.79E-05
I-130	7.80E-07	2.24E-06	8.96E-07	1.86E-04	3.44E-06	No Data	1.14E-06
I-131	4.43E-06	6.14E-06	3.30E-06	1.83E-03	1.05E-05	No Data	8.11E-07
I-132	1.99E-07	5.47E-07	1.97E-07	1.89E-05	8.65E-07	No Data	1.59E-07
I-133	1.52E-06	2.56E-06	7.78E-07	3.65E-04	4.49E-06	No Data	1.29E-06
I-134	1.11E-07	2.90E-07	1.05E-07	4.94E-06	4.58E-07	No Data	2.55E-09
I-135	4.62E-07	1.18E-06	4.36E-07	7.76E-05	1.86E-06	No Data	8.69E-07
Cs-134	6.28E-05	1.41E-04	6.86E-05	No Data	4.69E-05	1.83E-05	1.22E-06
Cs-136	6.44E-06	2.42E-05	1.71E-05	No Data	1.38E-05	2.22E-06	1.36E-06
Cs-137	8.36E-05	1.06E-04	3.89E-05	No Data	3.80E-05	1.51E-05	1.06E-06
Cs-138	5.82E-08	1.07E-07	5.58E-08	No Data	8.28E-08	9.84E-09	3.38E-11
Ba-139	1.67E-10	1.18E-13	4.87E-12	No Data	1.11E-13	8.08E-07	8.06E-07
Ba-140	6.84E-06	8.38E-09	4.40E-07	No Data	2.85E-09	2.54E-04	2.86E-05
Ba-141	1.78E-11	1.32E-14	5.93E-13	No Data	1.23E-14	4.11E-07	9.33E-14
Ba-142	4.62E-12	4.63E-15	2.84E-13	No Data	3.92E-15	2.39E-07	5.99E-20
La-140	5.99E-08	2.95E-08	7.82E-09	No Data	No Data	2.68E-05	6.09E-05
La-142	1.20E-10	5.31E-11	1.32E-11	No Data	No Data	1.27E-06	1.50E-06
Ce-141	3.55E-06	2.37E-06	2.71E-07	No Data	1.11E-06	7.67E-05	1.58E-05
Ce-143	3.32E-08	2.42E-08	2.70E-09	No Data	1.08E-08	1.63E-05	3.19E-05
Ce-144	6.11E-04	2.53E-04	3.28E-05	No Data	1.51E-04	1.67E-03	1.08E-04
Pr-143	1.67E-06	6.64E-07	8.28E-08	No Data	3.86E-07	6.04E-05	2.67E-05
Pr-144	5.37E-12	2.20E-12	2.72E-13	No Data	1.26E-12	2.19E-07	2.94E-14
Nd-147	9.83E-07	1.07E-06	6.41E-08	No Data	6.28E-07	4.65E-05	2.28E-05
W-187	1.50E-09	1.22E-09	4.29E-10	No Data	No Data	5.92E-06	2.21E-05
Np-239	4.23E-08	3.99E-09	2.21E-09	No Data	1.25E-08	8.11E-06	1.65E-05

Table 9-10. Inhalation Dose Factors for the Adult Age Group

Nuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
H-3	No Data	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07	1.58E-07
C-14	2.27E-06	4.26E-07	4.26E-07	4.26E-07	4.26E-07	4.26E-07	4.26E-07
Na-24	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06	1.28E-06
P-32	1.65E-04	9.64E-06	6.26E-06	No Data	No Data	No Data	1.08E-05
Cr-51	No Data	No Data	1.25E-08	7.44E-09	2.85E-09	1.80E-06	4.15E-07
Mn-54	No Data	4.95E-06	7.87E-07	No Data	1.23E-06	1.75E-04	9.67E-06
Mn-56	No Data	1.55E-10	2.29E-11	No Data	1.63E-10	1.18E-06	2.53E-06
Fe-55	3.07E-06	2.12E-06	4.93E-07	No Data	No Data	9.01E-06	7.54E-07
Fe-59	1.47E-06	3.47E-06	1.32E-06	No Data	No Data	1.27E-04	2.35E-05
Co-58	No Data	1.98E-07	2.59E-07	No Data	No Data	1.16E-04	1.33E-05
Co-60	No Data	1.44E-06	1.85E-06	No Data	No Data	7.46E-04	3.56E-05
Ni-63	5.40E-05	3.93E-06	1.81E-06	No Data	No Data	2.23E-05	1.67E-06
Ni-65	1.92E-10	2.62E-11	1.14E-11	No Data	No Data	7.00E-07	1.54E-06
Cu-64	No Data	1.83E-10	7.69E-11	No Data	5.78E-10	8.48E-07	6.12E-06
Zn-65	4.05E-06	1.29E-05	5.82E-06	No Data	8.62E-06	1.08E-04	6.68E-06
Zn-69	4.23E-12	8.14E-12	5.65E-13	No Data	5.27E-12	1.15E-07	2.04E-09
Br-83	No Data	No Data	3.01E-08	No Data	No Data	No Data	2.90E-08
Br-84	No Data	No Data	3.91E-08	No Data	No Data	No Data	2.05E-13
Br-85	No Data	No Data	1.60E-09	No Data	No Data	No Data	No Data
Rb-86	No Data	1.69E-05	7.37E-06	No Data	No Data	No Data	2.08E-06
Rb-88	No Data	4.84E-08	2.41E-08	No Data	No Data	No Data	4.18E-19
Rb-89	No Data	3.20E-08	2.12E-08	No Data	No Data	No Data	1.16E-21
Sr-89	3.80E-05	No Data	1.09E-06	No Data	No Data	1.75E-04	4.37E-05
Sr-90	1.24E-02	No Data	7.62E-04	No Data	No Data	1.20E-03	9.02E-05
Sr-91	7.74E-09	No Data	3.13E-10	No Data	No Data	4.56E-06	2.39E-05

All values are in (mrem/pCi inhaled). They are obtained from Reference 3 (Table E-7), except as follows: Reference 2 (Table C-1) for Rh-105, Sb-124, and Sb-125.

Table 9-10 (contd). Inhalation Dose Factors for the Adult Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Sr-92	8.43E-10	No Data	3.64E-11	No Data	No Data	2.06E-06	5.38E-06
Y-90	2.61E-07	No Data	7.01E-09	No Data	No Data	2.12E-05	6.32E-05
Y-91m	3.26E-11	No Data	1.27E-12	No Data	No Data	2.40E-07	1.66E-10
Y-91	5.78E-05	No Data	1.55E-06	No Data	No Data	2.13E-04	4.81E-05
Y-92	1.29E-09	No Data	3.77E-11	No Data	No Data	1.96E-06	9.19E-06
Y-93	1.18E-08	No Data	3.26E-10	No Data	No Data	6.06E-06	5.27E-05
Zr-95	1.34E-05	4.30E-06	2.91E-06	No Data	6.77E-06	2.21E-04	1.88E-05
Zr-97	1.21E-08	2.45E-09	1.13E-09	No Data	3.71E-09	9.84E-06	6.54E-05
Nb-95	1.76E-06	9.77E-07	5.26E-07	No Data	9.67E-07	6.31E-05	1.30E-05
Mo-99	No Data	1.51E-08	2.87E-09	No Data	3.64E-08	1.14E-05	3.10E-05
Tc-99m	1.29E-13	3.64E-13	4.63E-12	No Data	5.52E-12	9.55E-08	5.20E-07
Tc-101	5.22E-15	7.52E-15	7.38E-14	No Data	1.35E-13	4.99E-08	1.36E-21
Ru-103	1.91E-07	No Data	8.23E-08	No Data	7.29E-07	6.31E-05	1.38E-05
Ru-105	9.88E-11	No Data	3.89E-11	No Data	1.27E-10	1.37E-06	6.02E-06
Ru-106	8.64E-06	No Data	1.09E-06	No Data	1.67E-05	1.17E-03	1.14E-04
Rh-105	9.24E-10	6.73E-10	4.43E-10	No Data	2.86E-09	2.41E-06	1.09E-05
Ag-110m	1.35E-06	1.25E-06	7.43E-07	No Data	2.46E-06	5.79E-04	3.78E-05
Sb-124	3.90E-06	7.36E-08	1.55E-06	9.44E-09	No Data	3.10E-04	5.08E-05
Sb-125	8.26E-06	8.91E-08	1.66E-06	7.34E-09	No Data	2.75E-04	1.26E-05
Te-125m	4.27E-07	1.98E-07	5.84E-08	1.31E-07	1.55E-06	3.92E-05	8.83E-06
Te-127m	1.58E-06	7.21E-07	1.96E-07	4.11E-07	5.72E-06	1.20E-04	1.87E-05
Te-127	1.75E-10	8.03E-11	3.87E-11	1.32E-10	6.37E-10	8.14E-07	7.17E-06
Te-129m	1.22E-06	5.84E-07	1.98E-07	4.30E-07	4.57E-06	1.45E-04	4.79E-05
Te-129	6.22E-12	2.99E-12	1.55E-12	4.87E-12	2.34E-11	2.42E-07	1.96E-08
Te-131m	8.74E-09	5.45E-09	3.63E-09	6.88E-09	3.86E-08	1.82E-05	6.95E-05
Te-131	1.39E-12	7.44E-13	4.49E-13	1.17E-12	5.46E-12	1.74E-07	2.30E-09

Table 9-10 (contd). Inhalation Dose Factors for the Adult Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Te-132	3.25E-08	2.69E-08	2.02E-08	2.37E-08	1.82E-07	3.60E-05	6.37E-05
I-130	5.72E-07	1.68E-06	6.60E-07	1.42E-04	2.61E-06	No Data	9.61E-07
I-131	3.15E-06	4.47E-06	2.56E-06	1.49E-03	7.66E-06	No Data	7.85E-07
I-132	1.45E-07	4.07E-07	1.45E-07	1.43E-05	6.48E-07	No Data	5.08E-08
I-133	1.08E-06	1.85E-06	5.65E-07	2.69E-04	3.23E-06	No Data	1.11E-06
I-134	8.05E-08	2.16E-07	7.69E-08	3.73E-06	3.44E-07	No Data	1.26E-10
I-135	3.35E-07	8.73E-07	3.21E-07	5.60E-05	1.39E-06	No Data	6.56E-07
Cs-134	4.66E-05	1.06E-04	9.10E-05	No Data	3.59E-05	1.22E-05	1.30E-06
Cs-136	4.88E-06	1.83E-05	1.38E-05	No Data	1.07E-05	1.50E-06	1.46E-06
Cs-137	5.98E-05	7.76E-05	5.35E-05	No Data	2.78E-05	9.40E-06	1.05E-06
Cs-138	4.14E-08	7.76E-08	4.05E-08	No Data	6.00E-08	6.07E-09	2.33E-13
Ba-139	1.17E-10	8.32E-14	3.42E-12	No Data	7.78E-14	4.70E-07	1.12E-07
Ba-140	4.88E-06	6.13E-09	3.21E-07	No Data	2.09E-09	1.59E-04	2.73E-05
Ba-141	1.25E-11	9.41E-15	4.20E-13	No Data	8.75E-15	2.42E-07	1.45E-17
Ba-142	3.29E-12	3.38E-15	2.07E-13	No Data	2.86E-15	1.49E-07	1.96E-26
La-140	4.30E-08	2.17E-08	5.73E-09	No Data	No Data	1.70E-05	5.73E-05
La-142	8.54E-11	3.88E-11	9.65E-12	No Data	No Data	7.91E-07	2.64E-07
Ce-141	2.49E-06	1.69E-06	1.91E-07	No Data	7.83E-07	4.52E-05	1.50E-05
Ce-143	2.33E-08	1.72E-08	1.91E-09	No Data	7.60E-09	9.97E-06	2.83E-05
Ce-144	4.29E-04	1.79E-04	2.30E-05	No Data	1.06E-04	9.72E-04	1.02E-04
Pr-143	1.17E-06	4.69E-07	5.80E-08	No Data	2.70E-07	3.51E-05	2.50E-05
Pr-144	3.76E-12	1.56E-12	1.91E-13	No Data	8.81E-13	1.27E-07	2.69E-18
Nd-147	6.59E-07	7.62E-07	4.56E-08	No Data	4.45E-07	2.76E-05	2.16E-05
W-187	1.06E-09	8.85E-10	3.10E-10	No Data	No Data	3.63E-06	1.94E-05
Np-239	2.87E-08	2.82E-09	1.55E-09	No Data	8.75E-09	4.70E-06	1.49E-05

Table 9-11. Ingestion Dose Factors for the Infant Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
H-3	No Data	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07	3.08E-07
C-14	2.37E-05	5.06E-06	5.06E-06	5.06E-06	5.06E-06	5.06E-06	5.06E-06
Na-24	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05	1.01E-05
P-32	1.70E-03	1.00E-04	6.59E-05	No Data	No Data	No Data	2.30E-05
Cr-51	No Data	No Data	1.41E-08	9.20E-09	2.01F-09	1.79E-08	4.11E-07
Mn-54	No Data	1.99E-05	4.51E-06	No Data	4.41E-06	No Data	7.31E-06
Mn-56	No Data	8.18E-07	1.41E-07	No Data	7.03E-07	No Data	7.43E-05
Fe-55	1.39E-05	8.98E-06	2.40E-06	No Data	No Data	4.39E-06	1.14E-06
Fe-59	3.08E-05	5.38E-05	2.12E-05	No Data	No Data	1.59E-05	2.57E-05
Co-58	No Data	3.60E-06	8.98E-06	No Data	No Data	No Data	8.97E-06
Co-60	No Data	1.08E-05	2.55E-05	No Data	No Data	No Data	2.57E-05
Ni-63	6.34E-04	3.92E-05	2.20E-05	No Data	No Data	No Data	1.95E-06
Ni-65	4.70E-06	5.32E-07	2.42E-07	No Data	No Data	No Data	4.05E-05
Cu-64	No Data	6.09E-07	2.82E-07	No Data	1.03E-06	No Data	1.25E-05
Zn-65	1.84E-05	6.31E-05	2.91E-05	No Data	3.06E-05	No Data	5.33E-05
Zn-69	9.33E-08	1.68E-07	1.25E-08	No Data	6.98E-08	No Data	1.37E-05
Br-83	No Data	No Data	3.63E-07	No Data	No Data	No Data	No Data
Br-84	No Data	No Data	3.82E-07	No Data	No Data	No Data	No Data
Br-85	No Data	No Data	1.94E-08	No Data	No Data	No Data	No Data
Rb-86	No Data	1.70E-04	8.40E-05	No Data	No Data	No Data	4.35E-06
Rb-88	No Data	4.98E-07	2.73E-07	No Data	No Data	No Data	4.85E-07
Rb-89	No Data	2.86E-07	1.97E-07	No Data	No Data	No Data	9.74E-08
Sr-89	2.51E-03	No Data	7.20E-05	No Data	No Data	No Data	5.16E-05
Sr-90	1.85E-02	No Data	4.71E-03	No Data	No Data	No Data	2.31E-04
Sr-91	5.00E-05	No Data	1.81E-06	No Data	No Data	No Data	5.92E-05

All values are in (mrem/pCi ingested). They are obtained from Reference 3 (Table E-14). Neither Reference 2 nor Reference 3 contains data for Rh-105, Sb-124, or Sb-125.

Table 9-11 (contd). Ingestion Dose Factors for the Infant Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Sr-92	1.92E-05	No Data	7.13E-07	No Data	No Data	No Data	2.07E-04
Y-90	8.69E-08	No Data	2.33E-09	No Data	No Data	No Data	1.20E-04
Y-91m	8.10E-10	No Data	2.76E-11	No Data	No Data	No Data	2.70E-06
Y-91	1.13E-06	No Data	3.01E-08	No Data	No Data	No Data	8.10E-05
Y-92	7.65E-09	No Data	2.15E-10	No Data	No Data	No Data	1.46E-04
Y-93	2.43E-08	No Data	6.62E-10	No Data	No Data	No Data	1.92E-04
Zr-95	2.06E-07	5.02E-08	3.56E-08	No Data	5.41E-08	No Data	2.50E-05
Zr-97	1.48E-08	2.54E-09	1.16E-09	No Data	2.56E-09	No Data	1.62E-04
Nb-95	4.20E-08	1.73E-08	1.00E-08	No Data	1.24E-08	No Data	1.46E-05
Mo-99	No Data	3.40E-05	6.63E-06	No Data	5.08E-05	No Data	1.12E-05
Tc-99m	1.92E-09	3.96E-09	5.10E-08	No Data	4.26E-08	2.07E-09	1.15E-06
Tc-101	2.27E-09	2.86E-09	2.83E-08	No Data	3.40E-08	1.56E-09	4.86E-07
Ru-103	1.48E-06	No Data	4.95E-07	No Data	3.08E-06	No Data	1.80E-05
Ru-105	1.36E-07	No Data	4.58E-08	No Data	1.00E-06	No Data	5.41E-05
Ru-106	2.41E-05	No Data	3.01E-06	No Data	2.85E-05	No Data	1.83E-04
Rh-105	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Ag-110m	9.96E-07	7.27E-07	4.81E-07	No Data	1.04E-06	No Data	3.77E-05
Sb-124	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Sb-125	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Te-125m	2.33E-05	7.79E-06	3.15E-06	7.84E-06	No Data	No Data	1.11E-05
Te-127m	5.85E-05	1.94E-05	7.08E-06	1.69E-05	1.44E-04	No Data	2.36E-05
Te-127	1.00E-06	3.35E-07	2.15E-07	8.14E-07	2.44E-06	No Data	2.10E-05
Te-129m	1.00E-04	3.43E-05	1.54E-05	3.84E-05	2.50E-04	No Data	5.97E-05
Te-129	2.84E-07	9.79E-08	6.63E-08	2.38E-07	7.07E-07	No Data	2.27E-05
Te-131m	1.52E-05	6.12E-06	5.05E-06	1.24E-05	4.21E-05	No Data	1.03E-04
Te-131	1.76E-07	6.50E-08	4.94E-08	1.57E-07	4.50E-07	No Data	7.11E-06

Table 9-11 (contd). Ingestion Dose Factors for the Infant Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Te-132	2.08E-05	1.03E-05	9.61E-06	1.52E-05	6.44E-05	No Data	3.81E-05
I-130	6.00E-06	1.32E-05	5.30E-06	1.48E-03	1.45E-05	No Data	2.83E-06
I-131	3.59E-05	4.23E-05	1.86E-05	1.39E-02	4.94E-05	No Data	1.51E-06
I-132	1.66E-06	3.37E-06	1.20E-06	1.58E-04	3.76E-06	No Data	2.73E-06
I-133	1.25E-05	1.82E-05	5.33E-06	3.31E-03	2.14E-05	No Data	3.08E-06
I-134	8.69E-07	1.78E-06	6.33E-07	4.15E-05	1.99E-06	No Data	1.84E-06
I-135	3.64E-06	7.24E-06	2.64E-06	6.49E-04	8.07E-06	No Data	2.62E-06
Cs-134	3.77E-04	7.03E-04	7.10E-05	No Data	1.81E-04	7.42E-05	1.91E-06
Cs-136	4.59E-05	1.35E-04	5.04E-05	No Data	5.38E-05	1.10E-05	2.05E-06
Cs-137	5.22E-04	6.11E-04	4.33E-05	No Data	1.64E-04	6.64E-05	1.91E-06
Cs-138	4.81E-07	7.82E-07	3.79E-07	No Data	3.90E-07	6.09E-08	1.25E-06
Ba-139	8.81E-07	5.84E-10	2.55E-08	No Data	3.51E-10	3.54E-10	5.58E-05
Ba-140	1.71E-04	1.71E-07	8.81E-06	No Data	4.06E-08	1.05E-07	4.20E-05
Ba-141	4.25E-07	2.91E-10	1.34E-08	No Data	1.75E-10	1.77E-10	5.19E-06
Ba-142	1.84E-07	1.53E-10	9.06E-09	No Data	8.81E-11	9.26E-11	7.59E-07
La-140	2.11E-08	8.32E-09	2.14E-09	No Data	No Data	No Data	9.77E-05
La-142	1.10E-09	4.04E-10	9.67E-11	No Data	No Data	No Data	6.86E-05
Ce-141	7.87E-08	4.80E-08	5.65E-09	No Data	1.48E-08	No Data	2.48E-05
Ce-143	1.48E-08	9.82E-06	1.12E-09	No Data	2.86E-09	No Data	5.73E-05
Ce-144	2.98E-06	1.22E-06	1.67E-07	No Data	4.93E-07	No Data	1.71E-04
Pr-143	8.13E-08	3.04E-08	4.03E-09	No Data	1.13E-08	No Data	4.29E-05
Pr-144	2.74E-10	1.06E-10	1.38E-11	No Data	3.84E-11	No Data	4.93E-06
Nd-147	5.53E-08	5.68E-08	3.48E-09	No Data	2.19E-08	No Data	3.60E-05
W-187	9.03E-07	6.28E-07	2.17E-07	No Data	No Data	No Data	3.69E-05
Np-239	1.11E-08	9.93E-10	5.61E-10	No Data	1.98E-09	No Data	2.87E-05

Table 9-12. Ingestion Dose Factors for the Child Age Group

Nuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
H-3	No Data	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07	2.03E-07
C-14	1.21E-05	2.42E-06	2.42E-06	2.42E-06	2.42E-06	2.42E-06	2.42E-06
Na-24	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06	5.80E-06
P-32	8.25E-04	3.86E-05	3.18E-05	No Data	No Data	No Data	2.28E-05
Cr-51	No Data	No Data	8.90E-09	4.94E-09	1.35E-09	9.02E-09	4.72E-07
Mn-54	No Data	1.07E-05	2.85E-06	No Data	3.00E-06	No Data	8.98E-06
Mn-56	No Data	3.34E-07	7.54E-08	No Data	4.04E-07	No Data	4.84E-05
Fe-55	1.15E-05	6.10E-06	1.89E-06	No Data	No Data	3.45E-06	1.13E-06
Fe-59	1.65E-05	2.67E-05	1.33E-05	No Data	No Data	7.74E-06	2.78E-05
Co-58	No Data	1.80E-06	5.51E-06	No Data	No Data	No Data	1.05E-05
Co-60	No Data	5.29E-06	1.56E-05	No Data	No Data	No Data	2.93E-05
Ni-63	5.38E-04	2.88E-05	1.83E-05	No Data	No Data	No Data	1.94E-06
Ni-65	2.22E-06	2.09E-07	1.22E-07	No Data	No Data	No Data	2.56E-05
Cu-64	No Data	2.45E-07	1.48E-07	No Data	5.92E-07	No Data	1.15E-05
Zn-65	1.37E-05	3.65E-05	2.27E-05	No Data	2.30E-05	No Data	6.41E-06
Zn-69	4.38E-08	6.33E-08	5.85E-09	No Data	3.84E-08	No Data	3.99E-06
Br-83	No Data	No Data	1.71E-07	No Data	No Data	No Data	No Data
Br-84	No Data	No Data	1.98E-07	No Data	No Data	No Data	No Data
Br-85	No Data	No Data	9.12E-09	No Data	No Data	No Data	No Data
Rb-86	No Data	6.70E-05	4.12E-05	No Data	No Data	No Data	4.31E-06
Rb-88	No Data	1.90E-07	1.32E-07	No Data	No Data	No Data	9.32E-09
Rb-89	No Data	1.17E-07	1.04E-07	No Data	No Data	No Data	1.02E-09
Sr-89	1.32E-03	No Data	3.77E-05	No Data	No Data	No Data	5.11E-05
Sr-90	1.70E-02	No Data	4.31E-03	No Data	No Data	No Data	2.29E-04
Sr-91	2.40E-05	No Data	9.06E-07	No Data	No Data	No Data	5.30E-05

All values are in (mrem/pCi ingested). They are obtained from Reference 3 (Table E-13). Neither Reference 2 nor Reference 3 contains data for Rh-105, Sb-124, or Sb-125.

Table 9-12 (contd). Ingestion Dose Factors for the Child Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Sr-92	9.03E-06	No Data	3.62E-07	No Data	No Data	No Data	1.71E-04
Y-90	4.11E-08	No Data	1.10E-09	No Data	No Data	No Data	1.17E-04
Y-91m	3.82E-10	No Data	1.39E-11	No Data	No Data	No Data	7.48E-07
Y-91	6.02E-07	No Data	1.61E-08	No Data	No Data	No Data	8.02E-05
Y-92	3.60E-09	No Data	1.03E-10	No Data	No Data	No Data	1.04E-04
Y-93	1.14E-08	No Data	3.13E-10	No Data	No Data	No Data	1.70E-04
Zr-95	1.16E-07	2.55E-08	2.27E-08	No Data	3.65E-08	No Data	2.66E-05
Zr-97	6.99E-09	1.01E-09	5.96E-10	No Data	1.45E-09	No Data	1.53E-04
Nb-95	2.25E-08	8.76E-09	6.26E-09	No Data	8.23E-09	No Data	1.62E-05
Mo-99	No Data	1.33E-05	3.29E-06	No Data	2.84E-05	No Data	1.10E-05
Tc-99m	9.23E-10	1.81E-09	3.00E-08	No Data	2.63E-08	9.19E-10	1.03E-06
Tc-101	1.07E-09	1.12E-09	1.42E-08	No Data	1.91E-08	5.92E-10	3.56E-09
Ru-103	7.31E-07	No Data	2.81E-07	No Data	1.84E-06	No Data	1.89E-05
Ru-105	6.45E-08	No Data	2.34E-08	No Data	5.67E-07	No Data	4.21E-05
Ru-106	1.17E-05	No Data	1.46E-06	No Data	1.58E-05	No Data	1.82E-04
Rh-105	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Ag-110m	5.39E-07	3.64E-07	2.91E-07	No Data	6.78E-07	No Data	4.33E-05
Sb-124	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Sb-125	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Te-125m	1.14E-05	3.09E-06	1.52E-06	3.20E-06	No Data	No Data	1.10E-05
Te-127m	2.89E-05	7.78E-06	3.43E-06	6.91E-06	8.24E-05	No Data	2.34E-05
Te-127	4.71E-07	1.27E-07	1.01E-07	3.26E-07	1.34E-06	No Data	1.84E-05
Te-129m	4.87E-05	1.36E-05	7.56E-06	1.57E-05	1.43E-04	No Data	5.94E-05
Te-129	1.34E-07	3.74E-08	3.18E-08	9.56E-08	3.92E-07	No Data	8.34E-06
Te-131m	7.20E-06	2.49E-06	2.65E-06	5.12E-06	2.41E-05	No Data	1.01E-04
Te-131	8.30E-08	2.53E-08	2.47E-08	6.35E-08	2.51E-07	No Data	4.36E-07

Table 9-12 (contd). Ingestion Dose Factors for the Child Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Te-132	1.01E-05	4.47E-06	5.40E-06	6.51E-06	4.15E-05	No Data	4.50E-05
I-130	2.92E-06	5.90E-06	3.04E-06	6.50E-04	8.82E-06	No Data	2.76E-06
I-131	1.72E-05	1.73E-05	9.83E-06	5.72E-03	2.84E-05	No Data	1.54E-06
I-132	8.00E-07	1.47E-06	6.76E-07	6.82E-05	2.25E-06	No Data	1.73E-06
I-133	5.92E-06	7.32E-06	2.77E-06	1.36E-03	1.22E-05	No Data	2.95E-06
I-134	4.19E-07	7.78E-07	3.58E-07	1.79E-05	1.19E-06	No Data	5.16E-07
I-135	1.75E-06	3.15E-06	1.49E-06	2.79E-04	4.83E-06	No Data	2.40E-06
Cs-134	2.34E-04	3.84E-04	8.10E-05	No Data	1.19E-04	4.27E-05	2.07E-06
Cs-136	2.35E-05	6.46E-05	4.18E-05	No Data	3.44E-05	5.13E-06	2.27E-06
Cs-137	3.27E-04	3.13E-04	4.62E-05	No Data	1.02E-04	3.67E-05	1.96E-06
Cs-138	2.28E-07	3.17E-07	2.01E-07	No Data	2.23E-07	2.40E-08	1.46E-07
Ba-139	4.14E-07	2.21E-10	1.20E-08	No Data	1.93E-10	1.30E-10	2.39E-05
Ba-140	8.31E-05	7.28E-08	4.85E-06	No Data	2.37E-08	4.34E-08	4.21E-05
Ba-141	2.00E-07	1.12E-10	6.51E-09	No Data	9.69E-11	6.58E-10	1.14E-07
Ba-142	8.74E-08	6.29E-11	4.88E-09	No Data	5.09E-11	3.70E-11	1.14E-09
La-140	1.01E-08	3.53E-09	1.19E-09	No Data	No Data	No Data	9.84E-05
La-142	5.24E-10	1.67E-10	5.23E-11	No Data	No Data	No Data	3.31E-05
Ce-141	3.97E-08	1.98E-08	2.94E-09	No Data	8.68E-09	No Data	2.47E-05
Ce-143	6.99E-09	3.79E-06	5.49E-10	No Data	1.59E-09	No Data	5.55E-05
Ce-144	2.08E-06	6.52E-07	1.11E-07	No Data	3.61E-07	No Data	1.70E-04
Pr-143	3.93E-08	1.18E-08	1.95E-09	No Data	6.39E-09	No Data	4.24E-05
Pr-144	1.29E-10	3.99E-11	6.49E-12	No Data	2.11E-11	No Data	8.59E-08
Nd-147	2.79E-08	2.26E-08	1.75E-09	No Data	1.24E-08	No Data	3.58E-05
W-187	4.29E-07	2.54E-07	1.14E-07	No Data	No Data	No Data	3.57E-05
Np-239	5.25E-09	3.77E-10	2.65E-10	No Data	1.09E-09	No Data	2.79E-05

Table 9-13. Ingestion Dose Factors for the Teenager Age Group

Nuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
H-3	No Data	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07	1.06E-07
C-14	4.06E-06	8.12E-07	8.12E-07	8.12E-07	8.12E-07	8.12E-07	8.12E-07
Na-24	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06	2.30E-06
P-32	2.76E-04	1.71E-05	1.07E-05	No Data	No Data	No Data	2.32E-05
Cr-51	No Data	No Data	3.60E-09	2.00E-09	7.89E-10	5.14E-09	6.05E-07
Mn-54	No Data	5.90E-06	1.17E-06	No Data	1.76E-06	No Data	1.21E-05
Mn-56	No Data	1.58E-07	2.81E-08	No Data	2.00E-07	No Data	1.04E-05
Fe-55	3.78E-06	2.68E-06	6.25E-07	No Data	No Data	1.70E-06	1.16E-06
Fe-59	5.87E-06	1.37E-05	5.29E-06	No Data	No Data	4.32E-06	3.24E-05
Co-58	No Data	9.72E-07	2.24E-06	No Data	No Data	No Data	1.34E-05
Co-60	No Data	2.81E-06	6.33E-06	No Data	No Data	No Data	3.66E-05
Ni-63	1.77E-04	1.25E-05	6.00E-06	No Data	No Data	No Data	1.99E-06
Ni-65	7.49E-07	9.57E-08	4.36E-08	No Data	No Data	No Data	5.19E-06
Cu-64	No Data	1.15E-07	5.41E-08	No Data	2.91E-07	No Data	8.92E-06
Zn-65	5.76E-06	2.00E-05	9.33E-06	No Data	1.28E-05	No Data	8.47E-06
Zn-69	1.47E-08	2.80E-08	1.96E-09	No Data	1.83E-08	No Data	5.16E-08
Br-83	No Data	No Data	5.74E-08	No Data	No Data	No Data	No Data
Br-84	No Data	No Data	7.22E-08	No Data	No Data	No Data	No Data
Br-85	No Data	No Data	3.05E-09	No Data	No Data	No Data	No Data
Rb-86	No Data	2.98E-05	1.40E-05	No Data	No Data	No Data	4.41E-06
Rb-88	No Data	8.52E-08	4.54E-08	No Data	No Data	No Data	7.30E-15
Rb-89	No Data	5.50E-08	3.89E-08	No Data	No Data	No Data	8.43E-17
Sr-89	4.40E-04	No Data	1.26E-05	No Data	No Data	No Data	5.24E-05
Sr-90	8.30E-03	No Data	2.05E-03	No Data	No Data	No Data	2.33E-04
Sr-91	8.07E-06	No Data	3.21E-07	No Data	No Data	No Data	3.66E-05

All values are in (mrem/pCi ingested). They are obtained from Reference 3 (Table E-12). Neither Reference 2 nor Reference 3 contains data for Rh-105, Sb-124, or Sb-125.

Table 9-13 (contd). Ingestion Dose Factors for the Teenager Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Sr-92	3.05E-06	No Data	1.30E-07	No Data	No Data	No Data	7.77E-05
Y-90	1.37E-08	No Data	3.69E-10	No Data	No Data	No Data	1.13E-04
Y-91m	1.29E-10	No Data	4.93E-12	No Data	No Data	No Data	6.09E-09
Y-91	2.01E-07	No Data	5.39E-09	No Data	No Data	No Data	8.24E-05
Y-92	1.21E-09	No Data	3.50E-11	No Data	No Data	No Data	3.32E-05
Y-93	3.83E-09	No Data	1.05E-10	No Data	No Data	No Data	1.17E-04
Zr-95	4.12E-08	1.30E-08	8.94E-09	No Data	1.91E-08	No Data	3.00E-05
Zr-97	2.37E-09	4.69E-10	2.16E-10	No Data	7.11E-10	No Data	1.27E-04
Nb-95	8.22E-09	4.56E-09	2.51E-09	No Data	4.42E-09	No Data	1.95E-05
Mo-99	No Data	6.03E-06	1.15E-06	No Data	1.38E-05	No Data	1.08E-05
Tc-99m	3.32E-10	9.26E-10	1.20E-08	No Data	1.38E-08	5.14E-10	6.08E-07
Tc-101	3.60E-10	5.12E-10	5.03E-09	No Data	9.26E-09	3.12E-10	8.75E-17
Ru-103	2.55E-07	No Data	1.09E-07	No Data	8.99E-07	No Data	2.13E-05
Ru-105	2.18E-08	No Data	8.46E-09	No Data	2.75E-07	No Data	1.76E-05
Ru-106	3.92E-06	No Data	4.94E-07	No Data	7.56E-06	No Data	1.88E-04
Rh-105	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Ag-110m	2.05E-07	1.94E-07	1.18E-07	No Data	3.70E-07	No Data	5.45E-05
Sb-124	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Sb-125	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Te-125m	3.83E-06	1.38E-06	5.12E-07	1.07E-06	No Data	No Data	1.13E-05
Te-127m	9.67E-06	3.43E-06	1.15E-06	2.30E-06	3.92E-05	No Data	2.41E-05
Te-127	1.58E-07	5.60E-08	3.40E-08	1.09E-07	6.40E-07	No Data	1.22E-05
Te-129m	1.63E-05	6.05E-06	2.58E-06	5.26E-06	6.82E-05	No Data	6.12E-05
Te-129	4.48E-08	1.67E-08	1.09E-08	3.20E-08	1.88E-07	No Data	2.45E-07
Te-131m	2.44E-06	1.17E-06	9.76E-07	1.76E-06	1.22E-05	No Data	9.39E-05
Te-131	2.79E-08	1.15E-08	8.72E-09	2.15E-08	1.22E-07	No Data	2.29E-09

Table 9-13 (contd). Ingestion Dose Factors for the Teenager Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Te-132	3.49E-06	2.21E-06	2.08E-06	2.33E-06	2.12E-05	No Data	7.00E-05
I-130	1.03E-06	2.98E-06	1.19E-06	2.43E-04	4.59E-06	No Data	2.29E-06
I-131	5.85E-06	8.19E-06	4.40E-06	2.39E-03	1.41E-05	No Data	1.62E-06
I-132	2.79E-07	7.30E-07	2.62E-07	2.46E-05	1.15E-06	No Data	3.18E-07
I-133	2.01E-06	3.41E-06	1.04E-06	4.76E-04	5.98E-06	No Data	2.58E-06
I-134	1.46E-07	3.87E-07	1.39E-07	6.45E-06	6.10E-07	No Data	5.10E-09
I-135	6.10E-07	1.57E-06	5.82E-07	1.01E-04	2.48E-06	No Data	1.74E-06
Cs-134	8.37E-05	1.97E-04	9.14E-05	No Data	6.26E-05	2.39E-05	2.45E-06
Cs-136	8.59E-06	3.38E-05	2.27E-05	No Data	1.84E-05	2.90E-06	2.72E-06
Cs-137	1.12E-04	1.49E-04	5.19E-05	No Data	5.07E-05	1.97E-05	2.12E-06
Cs-138	7.76E-08	1.49E-07	7.45E-08	No Data	1.10E-07	1.28E-08	6.76E-11
Ba-139	1.39E-07	9.78E-11	4.05E-09	No Data	9.22E-11	6.74E-11	1.24E-06
Ba-140	2.84E-05	3.48E-08	1.83E-06	No Data	1.18E-08	2.34E-08	4.38E-05
Ba-141	6.71E-08	5.01E-11	2.24E-09	No Data	4.65E-11	3.43E-11	1.43E-13
Ba-142	2.99E-08	2.99E-11	1.84E-09	No Data	2.53E-11	1.99E-11	9.18E-20
La-140	3.48E-09	1.71E-09	4.55E-10	No Data	No Data	No Data	9.82E-05
La-142	1.79E-10	7.95E-11	1.98E-11	No Data	No Data	No Data	2.42E-06
Ce-141	1.33E-08	8.88E-09	1.02E-09	No Data	4.18E-09	No Data	2.54E-05
Ce-143	2.35E-09	1.71E-06	1.91E-10	No Data	7.67E-10	No Data	5.14E-05
Ce-144	6.96E-07	2.88E-07	3.74E-08	No Data	1.72E-07	No Data	1.75E-04
Pr-143	1.31E-08	5.23E-09	6.52E-10	No Data	3.04E-09	No Data	4.31E-05
Pr-144	4.30E-11	1.76E-11	2.18E-12	No Data	1.01E-11	No Data	4.74E-14
Nd-147	9.38E-09	1.02E-08	6.11E-10	No Data	5.99E-09	No Data	3.68E-05
W-187	1.46E-07	1.19E-07	4.17E-08	No Data	No Data	No Data	3.22E-05
Np-239	1.76E-09	1.66E-10	9.22E-11	No Data	5.21E-10	No Data	2.67E-05

Table 9-14. Ingestion Dose Factors for the Adult Age Group

Nuclide	Bone	Liver	T. Body	Thyroid	Kidney	Lung	GI-LLI
H-3	No Data	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07	1.05E-07
C-14	2.84E-06	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07	5.68E-07
Na-24	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06	1.70E-06
P-32	1.93E-04	1.20E-05	7.46E-06	No Data	No Data	No Data	2.17E-05
Cr-51	No Data	No Data	2.66E-09	1.59E-09	5.86E-10	3.53E-09	6.69E-07
Mn-54	No Data	4.57E-06	8.72E-07	No Data	1.36E-06	No Data	1.40E-05
Mn-56	No Data	1.15E-07	2.04E-08	No Data	1.46E-07	No Data	3.67E-06
Fe-55	2.75E-06	1.90E-06	4.43E-07	No Data	No Data	1.06E-06	1.09E-06
Fe-59	4.34E-06	1.02E-05	3.91E-06	No Data	No Data	2.85E-06	3.40E-05
Co-58	No Data	7.45E-07	1.67E-06	No Data	No Data	No Data	1.51E-05
Co-60	No Data	2.14E-06	4.72E-06	No Data	No Data	No Data	4.02E-05
Ni-63	1.30E-04	9.01E-06	4.36E-06	No Data	No Data	No Data	1.88E-06
Ni-65	5.28E-07	6.86E-08	3.13E-08	No Data	No Data	No Data	1.74E-06
Cu-64	No Data	8.33E-08	3.91E-08	No Data	2.10E-07	No Data	7.10E-06
Zn-65	4.84E-06	1.54E-05	6.96E-06	No Data	1.03E-05	No Data	9.70E-06
Zn-69	1.03E-08	1.97E-08	1.37E-09	No Data	1.28E-08	No Data	2.96E-09
Br-83	No Data	No Data	4.02E-08	No Data	No Data	No Data	5.79E-08
Br-84	No Data	No Data	5.21E-08	No Data	No Data	No Data	4.09E-13
Br-85	No Data	No Data	2.14E-09	No Data	No Data	No Data	No Data
Rb-86	No Data	2.11E-05	9.83E-06	No Data	No Data	No Data	4.16E-06
Rb-88	No Data	6.05E-08	3.21E-08	No Data	No Data	No Data	8.36E-19
Rb-89	No Data	4.01E-08	2.82E-08	No Data	No Data	No Data	2.33E-21
Sr-89	3.08E-04	No Data	8.84E-06	No Data	No Data	No Data	4.94E-05
Sr-90	7.58E-03	No Data	1.86E-03	No Data	No Data	No Data	2.19E-04
Sr-91	5.67E-06	No Data	2.29E-07	No Data	No Data	No Data	2.70E-05

All values are in (mrem/pCi ingested). They are obtained from Reference 3 (Table E-11), except as follows: Reference 2 (Table A-3) for Rh-105, Sb-124, and Sb-125.

Table 9-14 (contd). Ingestion Dose Factors for the Adult Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Sr-92	2.15E-06	No Data	9.30E-08	No Data	No Data	No Data	4.26E-05
Y-90	9.62E-09	No Data	2.58E-10	No Data	No Data	No Data	1.02E-04
Y-91m	9.09E-11	No Data	3.52E-12	No Data	No Data	No Data	2.67E-10
Y-91	1.41E-07	No Data	3.77E-09	No Data	No Data	No Data	7.76E-05
Y-92	8.45E-10	No Data	2.47E-11	No Data	No Data	No Data	1.48E-05
Y-93	2.68E-09	No Data	7.40E-11	No Data	No Data	No Data	8.50E-05
Zr-95	3.04E-08	9.75E-09	6.60E-09	No Data	1.53E-08	No Data	3.09E-05
Zr-97	1.68E-09	3.39E-10	1.55E-10	No Data	5.12E-10	No Data	1.05E-04
Nb-95	6.22E-09	3.46E-09	1.86E-09	No Data	3.42E-09	No Data	2.10E-05
Mo-99	No Data	4.31E-06	8.20E-07	No Data	9.76E-06	No Data	9.99E-06
Tc-99m	2.47E-10	6.98E-10	8.89E-09	No Data	1.06E-08	3.42E-10	4.13E-07
Tc-101	2.54E-10	3.66E-10	3.59E-09	No Data	6.59E-09	1.87E-10	1.10E-21
Ru-103	1.85E-07	No Data	7.97E-08	No Data	7.06E-07	No Data	2.16E-05
Ru-105	1.54E-08	No Data	6.08E-09	No Data	1.99E-07	No Data	9.42E-06
Ru-106	2.75E-06	No Data	3.48E-07	No Data	5.31E-06	No Data	1.78E-04
Rh-105	1.22E-07	8.86E-08	5.83E-08	No Data	3.76E-07	No Data	1.41E-05
Ag-110m	1.60E-07	1.48E-07	8.79E-08	No Data	2.91E-07	No Data	6.04E-05
Sb-124	2.81E-06	5.30E-08	1.11E-06	6.79E-09	No Data	2.18E-06	7.95E-05
Sb-125	2.23E-06	2.40E-08	4.48E-07	1.98E-09	No Data	2.33E-04	1.97E-05
Te-125m	2.68E-06	9.71E-07	3.59E-07	8.06E-07	1.09E-05	No Data	1.07E-05
Te-127m	6.77E-06	2.42E-06	8.25E-07	1.73E-06	2.75E-05	No Data	2.27E-05
Te-127	1.10E-07	3.95E-08	2.38E-08	8.15E-08	4.48E-07	No Data	8.68E-06
Te-129m	1.15E-05	4.29E-06	1.82E-06	3.95E-06	4.80E-05	No Data	5.79E-05
Te-129	3.14E-08	1.18E-08	7.65E-09	2.41E-08	1.32E-07	No Data	2.37E-08
Te-131m	1.73E-06	8.46E-07	7.05E-07	1.34E-06	8.57E-06	No Data	8.40E-05
Te-131	1.97E-08	8.23E-09	6.22E-09	1.62E-08	8.63E-08	No Data	2.79E-09

Table 9-14 (contd). Ingestion Dose Factors for the Adult Age Group

Nuclide	Bone	Liver	T.Body	Thyroid	Kidney	Lung	GI-LLI
Te-132	2.52E-06	1.63E-06	1.53E-06	1.80E-06	1.57E-05	No Data	7.71E-05
I-130	7.56E-07	2.23E-06	8.80E-07	1.89E-04	3.48E-06	No Data	1.92E-06
I-131	4.16E-06	5.95E-06	3.41E-06	1.95E-03	1.02E-05	No Data	1.57E-06
I-132	2.03E-07	5.43E-07	1.90E-07	1.90E-05	8.65E-07	No Data	1.02E-07
I-133	1.42E-06	2.47E-06	7.53E-07	3.63E-04	4.31E-06	No Data	2.22E-06
I-134	1.06E-07	2.88E-07	1.03E-07	4.99E-06	4.58E-07	No Data	2.51E-10
I-135	4.43E-07	1.16E-06	4.28E-07	7.65E-05	1.86E-06	No Data	1.31E-06
Cs-134	6.22E-05	1.48E-04	1.21E-04	No Data	4.79E-05	1.59E-05	2.59E-06
Cs-136	6.51E-06	2.57E-05	1.85E-05	No Data	1.43E-05	1.96E-06	2.92E-06
Cs-137	7.97E-05	1.09E-04	7.14E-05	No Data	3.70E-05	1.23E-05	2.11E-06
Cs-138	5.52E-08	1.09E-07	5.40E-08	No Data	8.01E-08	7.91E-09	4.65E-13
Ba-139	9.70E-08	6.91E-11	2.84E-09	No Data	6.46E-11	3.92E-11	1.72E-07
Ba-140	2.03E-05	2.55E-08	1.33E-06	No Data	8.67E-09	1.46E-08	4.18E-05
Ba-141	4.71E-08	3.56E-11	1.59E-09	No Data	3.31E-11	2.02E-11	2.22E-17
Ba-142	2.13E-08	2.19E-11	1.34E-09	No Data	1.85E-11	1.24E-11	3.00E-26
La-140	2.50E-09	1.26E-09	3.33E-10	No Data	No Data	No Data	9.25E-05
La-142	1.28E-10	5.82E-11	1.45E-11	No Data	No Data	No Data	4.25E-07
Ce-141	9.36E-09	6.33E-09	7.18E-10	No Data	2.94E-09	No Data	2.42E-05
Ce-143	1.65E-09	1.22E-06	1.35E-10	No Data	5.37E-10	No Data	4.56E-05
Ce-144	4.88E-07	2.04E-07	2.62E-08	No Data	1.21E-07	No Data	1.65E-04
Pr-143	9.20E-09	3.69E-09	4.56E-10	No Data	2.13E-09	No Data	4.03E-05
Pr-144	3.01E-11	1.25E-11	1.53E-12	No Data	7.05E-12	No Data	4.33E-18
Nd-147	6.29E-09	7.27E-09	4.35E-10	No Data	4.25E-09	No Data	3.49E-05
W-187	1.03E-07	8.61E-08	3.01E-08	No Data	No Data	No Data	2.82E-05
Np-239	1.19E-09	1.17E-10	6.45E-11	No Data	3.65E-10	No Data	2.40E-05

Table 9-15. External Dose Factors for Standing on Contaminated Ground

Nuclide	T. Body	Skin
H-3	0.00	0.00
C-14	0.00	0.00
Na-24	2.50E-08	2.90E-08
P-32	0.00	0.00
Cr-51	2.20E-10	2.60E-10
Mn-54	5.80E-09	6.80E-09
Mn-56	1.10E-08	1.30E-08
Fe-55	0.00	0.00
Fe-59	8.00E-09	9.40E-09
Co-58	7.00E-09	8.20E-09
Co-60	1.70E-08	2.00E-08
Ni-63	0.00	0.00
Ni-65	3.70E-09	4.30E-09
Cu-64	1.50E-09	1.70E-09
Zn-65	4.00E-09	4.60E-09
Zn-69	0.00	0.00
Br-83	6.40E-11	9.30E-11
Br-84	1.20E-08	1.40E-08
Br-85	0.00	0.00
Rb-86	6.30E-10	7.20E-10
Rb-88	3.50E-09	4.00E-09
Rb-89	1.50E-08	1.80E-08
Sr-89	5.60E-13	6.50E-13
Sr-90	0.00	0.00

Nuclide	T. Body	Skin
Sr-91	7.10E-09	8.30E-09
Sr-92	9.00E-09	1.00E-08
Y-90	2.20E-12	2.60E-12
Y-91m	3.80E-09	4.40E-09
Y-91	2.40E-11	2.70E-11
Y-92	1.60E-09	1.90E-09
Y-93	5.70E-10	7.80E-10
Zr-95	5.00E-09	5.80E-09
Zr-97	5.50E-09	6.40E-09
Nb-95	5.10E-09	6.00E-09
Mo-99	1.90E-09	2.20E-09
Tc-99m	9.60E-10	1.10E-09
Tc-101	2.70E-09	3.00E-09
Ru-103	3.60E-09	4.20E-09
Ru-105	4.50E-09	5.10E-09
Ru-106	1.50E-09	1.80E-09
Rh-105	6.60E-10	7.70E-10
Ag-110m	1.80E-08	2.10E-08
Sb-124	1.30E-08	1.50E-08
Sb-125	3.10E-09	3.50E-09
Te-125m	3.50E-11	4.80E-11
Te-127m	1.10E-12	1.30E-12
Te-127	1.00E-11	1.10E-11
Te-129m	7.70E-10	9.00E-10

All values are in (mrem/h) per (pCi/m^2). They are obtained from **Reference** 3 (Table E-6), except as follows: Reference 2 (Table A-7) for Rh-105, Sb-124, and Sb-125.

Table 9-15 (contd). External Dose Factors for Standing on Contaminated Ground

Nuclide	T.Body	Skin
Te-129	7.10E-10	8.40E-10
Te-131m	8.40E-09	9.90E-09
Te-131	2.20E-09	2.60E-06
Te-132	1.70E-09	2.00E-09
I-130	1.40E-08	1.70E-08
I-131	2.80E-09	3.40E-09
I-132	1.70E-08	2.00E-08
I-133	3.70E-09	4.50E-09
I-134	1.60E-08	1.90E-08
I-135	1.20E-08	1.40E-08
Cs-134	1.20E-08	1.40E-08
Cs-136	1.50E-08	1.70E-08
Cs-137	4.20E-09	4.90E-09
Cs-138	2.10E-08	2.40E-08
Ba-139	2.40E-09	2.70E-09
Ba-140	2.10E-09	2.40E-09
Ba-141	4.30E-09	4.90E-09
Ba-142	7.90E-09	9.00E-09
La-140	1.50E-08	1.70E-08
La-142	1.50E-08	1.80E-08
Ce-141	5.50E-10	6.20E-10
Ce-143	2.20E-09	2.50E-09
Ce-144	3.20E-10	3.70E-10
Pr-143	0.00	0.00
Pr-144	2.00E-10	2.30E-10
Nd-147	1.00E-09	1.20E-09
W-187	3.10E-09	3.60E-09
Np-239	9.50E-10	1.10E-09

CHAPTER 10

DEFINITIONS OF EFFLUENT CONTROL TERMS

The terms defined in this chapter are used in the presentation of the above chapters. These terms are shown in all capital letters to indicate that they are specifically defined.

10.1 TERMS SPECIFIC TO THE ODCM

The following terms are used in the ODCM, but are not found in the Technical Specifications:

BATCH RELEASE

A BATCH RELEASE is the discharge of wastes of a discrete volume. Prior to sampling for analyses, each liquid batch shall be isolated and then thoroughly mixed by a method described in the ODCM to assure representative sampling.

COMPOSITE SAMPLE

A COMPOSITE SAMPLE is one which contains material from multiple waste releases, in which the quantity of sample is proportional to the quantity of waste discharged, and in which the method of sampling employed results in a specimen that is representative of the wastes released. Prior to analyses, all liquid samples that are to be aliquotted for a COMPOSITE SAMPLE shall be mixed thoroughly, in order for the COMPOSITE SAMPLE to be representative of the effluent release.

When assessing the consequences of a waste release at the pre-release or post-release stage, the most recent available COMPOSITE SAMPLE results for the applicable release pathway may be used.

CONTINUOUS RELEASE

A CONTINUOUS RELEASE is the discharge of wastes of a non-discrete volume, e.g., from a volume within a system that has an input flow during the CONTINUOUS RELEASE.

FREQUENCY NOTATION

The FREQUENCY NOTATION specified for the performance of surveillance requirements shall correspond to the intervals defined below, with a maximum allowable extension not to exceed 25% of the surveillance interval.

NOTATION	FREQUENCY
S (Once per shift)	At least once per 12 hours.
D (Daily)	At least once per 24 hours.
W (Weekly)	At least once per 7 days.
M (Monthly)	At least once per 31 days.
Q (Quarterly)	At least once per 92 days.
SA (Semi-annually)	At least once per 184 days.
R (Refueling)	At least once per 18 months.
S/U (Startup)	Prior to each reactor startup.
NA	Not applicable.
P (Prior)	Completed prior to each release.

GASEOUS RADWASTE TREATMENT SYSTEM

The GASEOUS RADWASTE TREATMENT SYSTEM is the offgas holdup system designed and installed to reduce radioactive gaseous effluents by collecting primary coolant system offgases from the primary system and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

LIQUID RADWASTE TREATMENT SYSTEM

A LIQUID RADWASTE TREATMENT SYSTEM is any system designed and installed to reduce radioactive materials in liquid effluents by systematic collection, retention, and processing through filtration, evaporation, separation and/or ion exchange treatment. This system consists of at least one collection tank, one evaporator or demineralizer system, one post-treatment tank and associated components providing for treatment flow and functional control.

MAJOR CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS

For the purposes of the ODCM, MAJOR CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS include the following changes to such systems:

(1) Major changes in process equipment, components, structures, or effluent monitoring instrumentation as described in the Final Safety Analysis Report (FSAR) or as evaluated in the Nuclear Regulatory Commission staff's Safety Evaluation Report (SER) (e.g., deletion of evaporators and installation of demineralizers);

(2) Changes in the design of radwaste treatment systems that could significantly increase quantities of effluents released from those previously considered in the FSAR and SER;

(3) Changes in system design which may invalidate the accident analysis as described in the SER (e.g., changes in tank capacity that would alter the curies released); or

(4) Changes in system design that could potentially result in a significant increase in occupational exposure of operating personnel (e.g., use of temporary equipment without adequate shielding provisions).

MEMBER(S) OF THE PUBLIC[1]

A MEMBER OF THE PUBLIC shall be an individual in a *controlled area* or an UNRESTRICTED AREA. However, an individual is not a MEMBER OF THE PUBLIC during any period in which the individual receives an *occupational dose*. This category may include persons who use portions of the site for recreational, occupational, or other purposes not associated with the plant.

MILK ANIMAL

A MILK ANIMAL is a cow or goat that is producing milk for human consumption.

MINIMUM DETECTABLE CONCENTRATION

The MINIMUM DETECTABLE CONCENTRATION (MDC) is defined, for purposes of the controls in this ODCM, as the smallest concentration of radioactive material in a sample that will yield a net count above system background and that will be detected with 95-percent probability, with only 5-percent probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation, the MDC for a given radionuclide is determined as follows (Reference 17):

$$MDC = \frac{\frac{2.71}{t_r} + 3.29\sqrt{R_b\left(\frac{1}{t_r} + \frac{1}{t_b}\right)}}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot e^{-\lambda \Delta t}} \qquad (10.1)$$

[1] The italicized terms in this definition, which are not otherwise used in this ODCM, shall have the definitions assigned to them by 10 CFR 20.1003.

- For gaseous radioactive effluents: In noble gas releases, Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, Xe-138; and in particulate releases, Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144.

- For environmental media: The gamma emitters specifically listed in Table 4-3.

These lists do not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the ~~Annual~~ Radioactive ~~Effluent~~ Release Report, the Annual Radiological Environmental ~~Surveillance~~ Operating Report, or other applicable report(s).

10.2 TERMS DEFINED IN THE TECHNICAL SPECIFICATIONS

The following terms are defined in the Technical Specifications, Section 1.~~0~~1. Because they are used throughout the Limits of Operation sections of the ODCM, they are presented here for convenience. In the event of discrepancies between the definitions below and those in the Technical Specifications, the Technical Specification definitions shall take precedence.

Refer to following Insert

ACTION~~(S)~~S

~~For Unit 1: An ACTION shall be that part of a control that prescribes remedial measures required under designated conditions.~~

~~For Unit 2: ACTIONS shall be those additional requirements specified as corollary statements to each control, and shall be part of the control.~~

CHANNEL CALIBRATION

~~A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel output, such that it responds within the required range and accuracy to known values of the parameter which the channel monitors. The CHANNEL CALIBRATION shall encompass the entire channel including the sensor and alarm and/or trip functions, and shall include the CHANNEL FUNCTIONAL TEST. The CHANNEL CALIBRATION may be performed by any series of sequential, overlapping, or total channel steps, such that the entire channel is calibrated.~~

CHANNEL CHECK

~~A CHANNEL CHECK shall be the qualitative assessment of channel behavior during operation by observation. This determination shall include, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrument channels measuring the same parameter.~~

CHANNEL FUNCTIONAL TEST

~~A CHANNEL FUNCTIONAL TEST shall be:~~

- ~~Analog Channels - the injection of a simulated signal into the channel as close to the primary sensor as practicable to verify OPERABILITY including: for both units, alarm and/or trip functions; and for Unit 2 only, channel failure trips.~~

- ~~Bistable Channels - the injection of a simulated signal into the sensor to verify OPERABILITY including alarm and/or trip functions.~~

~~DOSE EQUIVALENT I-131~~

~~DOSE EQUIVALENT I-131 shall be that concentration of I-131 (μCi/g) which alone would produce the same thyroid dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table III of TID-14844 or those in Table E-7 of NRC Regulatory Guide 1.109, Revision 1, 1977.~~

Enter following Insert

FREQUENCY NOTATION

The FREQUENCY NOTATION specified for the performance of surveillance requirements shall correspond to the intervals defined below, with a maximum allowable extension not to exceed 25% of the surveillance interval.

NOTATION	FREQUENCY
S (Once per shift)	At least once per 12 hours.
D (Daily)	At least once per 24 hours.
W (Weekly)	At least once per 7 days.
M (Monthly)	At least once per 31 days.
Q (Quarterly)	At least once per 92 days.
SA (Semi-annually)	At least once per 184 days.
R (Refueling)	At least once per 18 months.
S/U (Startup)	Prior to each reactor startup.
NA	Not applicable.
P (Prior)	Completed prior to each release.

Move to Section).1

MEMBER(S) OF THE PUBLIC[1]

A MEMBER OF THE PUBLIC shall be an individual in a *controlled area* or an UNRESTRICTED AREA. However, an individual is not a MEMBER OF THE PUBLIC during any period in which the individual receives an *occupational dose*. This category may include persons who use portions of the site for recreational, occupational, or other purposes not associated with the plant.

MILK ANIMAL

A MILK ANIMAL is a cow or goat that is producing milk for human consumption.

1 The italicized terms in this definition, which are not otherwise used in this ODCM, shall have the definitions assigned to them by 10 CFR 20.1003.

Insert following

OPERABLE (or OPERABILITY)

~~OPERABILITY exists when a system, subsystem, train, component or device is capable of performing its specified function(s), and when all necessary attendant instrumentation, controls, electrical power, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component or device to perform its function(s) are also capable of performing their related support function(s).~~

Move to section 10.1

OPERATIONAL CONDITION

~~For Unit 1: This term is not defined. See definition of REACTOR MODE.~~

~~For Unit 2:~~ An OPERATIONAL CONDITION shall be any one inclusive combination of Mode Switch position and average reactor coolant temperature, as defined in ~~Section 1.0~~ Table 1.1-1 of the ~~Unit 2~~ Technical Specifications.

REACTOR MODE

~~For Unit 1:~~ The REACTOR MODE is established by the Mode Switch position. The four Mode Switch positions are REFUEL, SHUTDOWN, START & HOT STANDBY, and RUN; thus the four possible REACTOR MODES are: Refuel Mode, Shutdown Mode, Start & Hot Standby Mode, and Run Mode. (See ~~Unit 1~~ Technical Specifications ~~Section 1.0~~ Table 1.1-1 for definitions of these terms.)

~~For Unit 2: This term is not defined. See definition of OPERATIONAL CONDITION.~~

RATED THERMAL POWER

~~For Unit 1:~~ RATED THERMAL POWER ~~is operation at a steady state power~~ shall be a total reactor core heat transfer rate to the reactor coolant of 2436 MWt. ~~This is also referred to as 100 percent THERMAL POWER.~~

~~For Unit 2: RATED THERMAL POWER shall be a total reactor core heat transfer rate to the reactor coolant of 2436 MWt.~~

Move to section 10.1

SITE BOUNDARY

The SITE BOUNDARY shall be that line beyond which the land is not owned leased or otherwise controlled by Georgia Power Company as shown in Figure 10-1.

SOURCE CHECK

A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a source of increased radioactivity.

INSERT

ACTIONS

ACTIONS shall be that part of a specification that prescribes reqired actions to be taken under designated Conditions within specified Completion Times.

CHANNEL CALIBRATION

CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to known values of the parameter that the channel monitors. The CHANNEL CALIBRATION shall encompass the entire channel, including the required sensor, alarm, display, and trip functions, and shall include the CHANNEL FUNCTIONAL TEST. Calibration of instrument channels with resistance temperature detector (RTD) or thermocouple sensors may consist of an inplace qualitative assessment of sensor behavior and normal calibration of the remaining adjustable devices in the channel. The CHANNEL CALIBRATION may be performed by means of any series of sequential, overlapping, or total channel steps so that the entire channel is calibrated.

CHANNEL CHECK

CHANNEL CHECK shall be the qualitative assessment, by observation, of channel behavior during operation. This determination shall include, where possible, comparison of the channel indication and status to other indications or status derived from independent instrument channels measuring the same parameter.

CHANNEL FUNCTIONAL TEST

CHANNEL FUNCTIONAL TEST shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify operability, including required alarm, interlock, display, and trip functions, and channel failure trips. The CHANNEL FUNCTIONAL TEST may be performed by means of any series of sequential, overlapping, or total channel steps so that the entire channel is tested.

DOSE EQUIVALENT I-131

DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries/gram) that alone would produce the same thyroid dose as the quantity and isotopic of I-131, I-132, I-133, I-134, and I-135 actually present. The thyroid dose conversion factors used for this calculation shall be those listed in Table III of TID-14844, AEC, 1962, "Calculation of Distance Factors for Power and Test Reactor Sites;" Table E-7 of Regulatory Guide 1.109, Rev. 1, NRC, 1977; or ICRP 30, Supplement to Part 1, page 192-212, Table titled, "Committed Dose Equivalent in Target Organs or Tissue per Intake of Unit Activity."

INSERT (continued)

OPERABLE (or OPERABILITY)

A system, subsystem, division, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified safety function(s) and when all necessary attendant instrumentation, controls, normal or emergency electrical power, cooling and seal water, lubrication, and other auxiliary equipment that are required for the system, subsystem, division, component, or device to perform its specified safety function(s) are also capable of performing their related support function(s).

THERMAL POWER

~~For Unit 1: This term is not defined. For the purposes of effluent controls in the ODCM requiring special sampling in the event of specified changes in THERMAL POWER, the definition shall be taken to be the same as that for Unit 2.~~

~~For Unit 2:~~ THERMAL POWER shall be the total reactor core heat transfer rate to the reactor coolant.

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UNRESTRICTED AREA

The UNRESTRICTED AREA shall be any area access to which is neither limited nor controlled by the licensee, or any area within the SITE BOUNDARY used for residential quarters or for industrial, commercial, institutional, and/or recreational purposes.

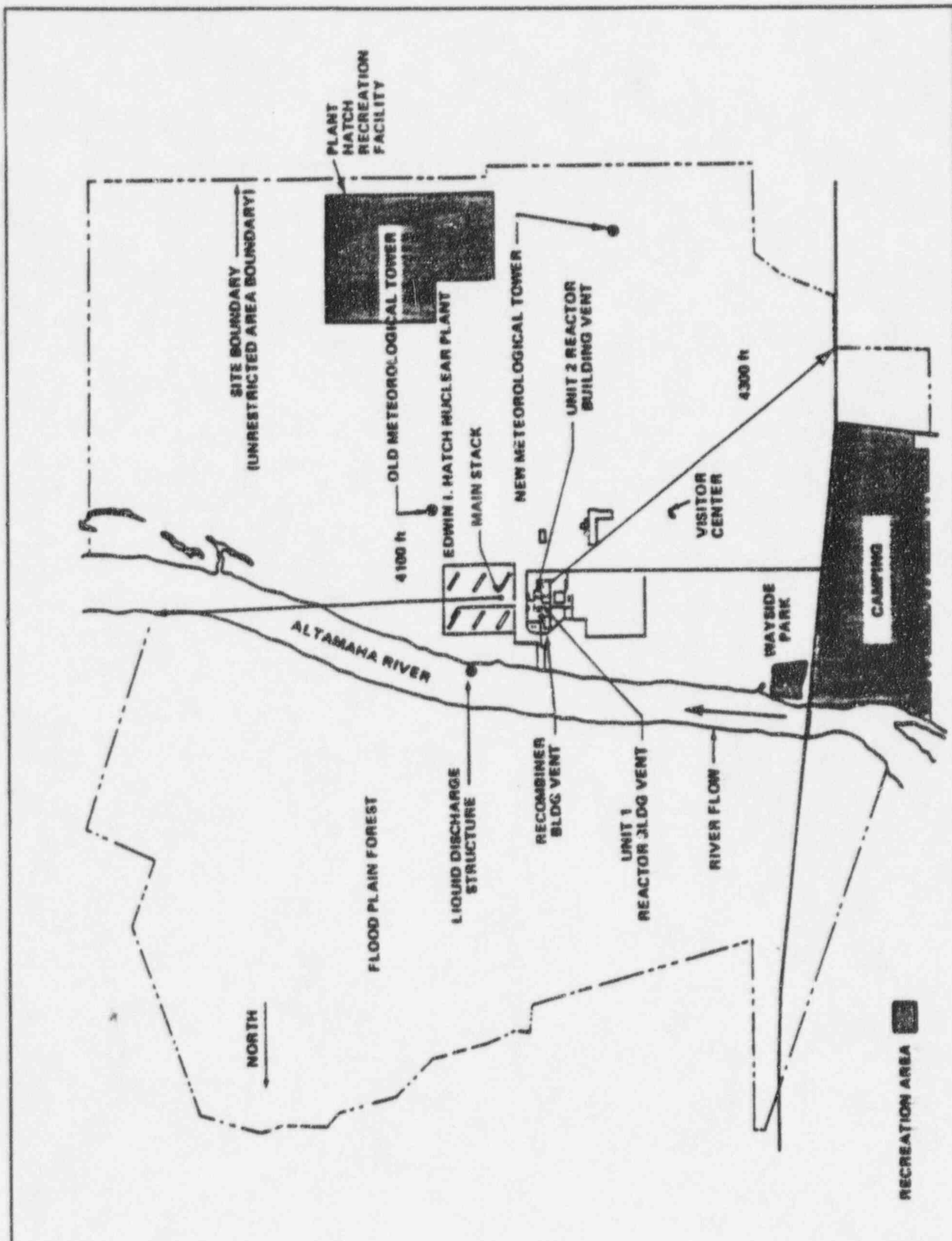

Figure 10-1. Site Map for Effluent Controls