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

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 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. 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 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:

$$\frac{\textit{concentration}\ (1)}{\textit{reporting level}\ (1)} + \frac{\textit{concentration}\ (2)}{\textit{reporting level}\ (2)} + \cdots \geq 1.0$$

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

[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.

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 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 5.5.1, documentation shall be submitted in the next 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).

4.1.1.2.4 This control does not affect shutdown requirements or MODE changes.

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 Radiological Environmental 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	Number of Representative Samples and Sample Locations(1)	Sampling and Collection Frequency	Type and Frequency of Analysis
1. DIRECT RADIATION			
Direct Radiation(2)	Thirty-six or more routine monitoring stations, either with two or more dosimeters, or with one instrument for measuring and recording dose rate continuously, placed as follows: An inner ring of stations, one in each meteorological sector in the general area of the site boundary. An outer ring of stations, one in each meteorological sector at approximately 5 miles from the site. The balance of the stations to be placed in special interest areas such as population centers, nearby residences, schools, and in one or more areas to serve as control stations.	Quarterly.	Gamma dose quarterly.
2. AIRBORNE			
Radioiodine and Particulates	Samples from 5 or more locations as follows: Three or more samples from close to the three site boundary locations, in different sectors. One sample from the vicinity of a community having the highest calculated annual average ground-level D/Q. One sample from a control location, as, for example, a population center 10 to 20 miles distant and in the least prevalent wind direction.	Continuous sampler operation with sample collection weekly, or more frequently if required by dust loading.	Radioiodine Canister: I-131 analysis weekly. Particulate Sampler: Gross beta radioactivity analysis following filter change, and gamma isotopic analysis of composite (by location) quarterly.(3)(4)

Table 4-1.(cont.) Radiological Environmental Monitoring Program (continued)

Exposure Pathway and/or Sample	Number of Representative Samples and Sample Locations(1)	Sampling and Collection Frequency	Type and Frequency of Analysis
3. WATERBORNE			
Surface(5)	One sample upstream. One sample downstream.	Composite sample over 1-month period.(6)	Gamma isotopic analysis monthly; composite for tritium analysis quarterly.(4)
Drinking	Two samples at each of the one to three nearest water treatment plants that could be affected by discharges from the facility. Two samples at a control location.	Composite sample of river water near intake at each water treatment plant over 2-week period when I-131 analysis is performed, monthly composite otherwise; and grab sample of finished water at each water treatment plant every 2 weeks or monthly, as appropriate.(6)	I-131 analysis on each sample when the dose calculated for the consumption of the water is greater than 1 mrem per year. Composite for gross beta and gamma isotopic analyses monthly. Composite for tritium analysis quarterly.(4)(7)
Sediment from Shoreline	One sample from downstream area with existing or potential recreational value.	Semiannually.	Gamma isotopic analysis semiannually.(4)

Table 4-1.(cont.) Radiological Environmental Monitoring Program (continued)

Exposure Pathway and/or Sample	Number of Representative Samples and Sample Locations(1)	Sampling and Collection Frequency	Type and Frequency of Analysis
	4. INGESTION		
Milk	Samples from milking animals in three locations within 3 miles distance having the highest dose potential; if there are none, then one sample from milking animals in each of three areas between 3 and 5 miles distance where doses are calculated to be greater than 1 mrem per year.(7) One sample from milking animals at a control location about 10 miles distant or beyond, and preferably in a wind direction of low prevalence.	Semimonthly.	Gamma isotopic analysis semi-monthly.(4)(8)
Fish	At least one sample of any commercially and recreationally important species in vicinity of plant discharge area. At least one sample of any species in areas not influenced by plant discharge.	Semiannually.	Gamma isotopic analyses on edible portions.(4)
	At least one sample of any anadromous species in vicinity of plant discharge.	During spring spawning season.	Gamma isotopic analyses on edible portion.(4)
Grass or Leafy Vegetation	One sample from two onsite locations near the site boundary in different sectors.	Monthly during growing season.	Gamma isotopic.(4)(8)
	One sample from a control location about 15 miles distant.	Monthly during growing season.	Gamma isotopic.(4)(8)

TABLE NOTATIONS

(1) For each sample location in this table, specific parameters of distance and direction sector from a point midway betw the center of the two reactors, and additional description where pertinent, are provided in Table 4-4, and in Figure 4-1 through Figure 4-4 of this ODCM.

(2) One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously, m be used in place of or in addition to integrating dosimeters. For the purpose of this table, a thermoluminescent dosim (TLD) is considered to be one phosphor; two or more phosphors in a packet are considered as two or more dosimete Film badges shall not be used as dosimeters for measuring direct radiation.

(3) Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to all for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than 10 times the yea mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

(4) Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

(5) The upstream sample shall be taken at a distance beyond significant influence of the discharge. The downstream sample shall be taken in an area beyond but near the mixing zone.

(6) Composite sample aliquots shall be collected at time intervals that are very short (e.g., hourly) relative to the composi period (e.g., monthly) in order to assure obtaining a representative sample.

(7) The dose shall be calculated for the maximum organ and age group, using the methodology and parameters in the ODCM.

(8) If gamma isotopic analysis is not sensitive enough to meet the required MDC for I-131, a separate analysis for I-131 be performed.

Table 4-2. Reporting Levels for Radioactivity Concentrations in Environmental Samples

Analysis	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 (MDC)

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

A land use census shall be conducted and shall identify the following within a distance of 5 miles in each of the 16 meteorological sectors: the location of the nearest milk animal,[1] the nearest permanent residence, and the nearest garden of greater than 500 square feet producing broad leafy vegetation. Land within the Savannah River Site is excluded from this census.

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 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 5.5.1 submit in the next 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).

4.1.2.2.3 This control does not affect shutdown requirements or MODE changes.

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 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. Restricting the census to gardens of greater than 500 ft^2 provides assurance that significant exposure pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/y) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the

[1] Defined as a cow or goat that is producing milk for human consumption.

following assumptions were made: (1) 20 percent of the garden was used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage) and (2) a vegetation yield of 2 kg/m^2 was obtained.

4.1.3 Interlaboratory Comparison Program

Analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program which satisfies the requirements of Regulatory Guide 4.15, Revision 1, February, 1979.

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 Operating Report.

This control does not affect shutdown requirements or MODE changes.

4.1.3.3 Surveillance Requirements

A summary of the results obtained as part of the required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report.

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 4-4 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[1]
1	River Bank	N	1.1	D
2	River Bank	NNE	0.8	D
3	Discharge Area	NE	0.6	A
3	River Bank	NE	0.7	D
4	River Bank	ENE	0.8	D
5	River Bank	E	1.0	D
6	Plant Wilson	ESE	1.1	D
7	Simulator Building	SE	1.7	D,V,A
8	River Road	SSE	1.1	D
9	River Road	S	1.1	D
10	Met Tower	SSW	0.9	A
10	River Road	SSW	1.1	D
11	River Road	SW	1.2	D
12	River Road	WSW	1.2	D,A
13	River Road	W	1.3	D
14	River Road	WNW	1.8	D
15	Hancock Landing Road	NW	1.5	D,V
16	Hancock Landing Road	NNW	1.4	D,A
17	Savannah River Site, River Road	N	5.4	D
18	Savannah River Site, D Area	NNE	5.0	D
19	Savannah River Site, Road A.13	NE	4.6	D
20	Savannah River Site, Road A.13.1	ENE	4.8	D
21	Savannah River Site, Road A.17	E	5.3	D
22	River Bank Downstream of Buxton Landing	ESE	5.2	D
23	River Road	SE	4.6	D
24	Chance Road	SSE	4.9	D
25	Chance Road near Highway 23	S	5.2	D
26	Highway 23 and Ebenezer Church Rd.	SSW	4.6	D

Table 4-4 (contd). Radiological Environmental Monitoring Locations

Location Number	Descriptive Location	Direction	Distance (miles)	Sample Type(1)
27	Highway 23, opposite Boll Weevil Road	SW	4.7	D
28	Thomas Road	WSW	5.0	D
29	Claxton-Lively Road	W	5.1	D
30	Nathaniel Howard Road	WNW	5.0	D
31	River Road at Allen's Chapel Fork	NW	5.0	D
32	River Bank	NNW	4.7	D
35	Girard	SSE	6.6	D,A
36	GPC Waynesboro Operating Headquarters	WSW	13.9	D,A
37	Substation; Waynesboro, GA	WSW	16.7	D,V
43	Employees Recreation Area	SW	2.2	D
47	Oak Grove Church	SE	10.4	D
48	McBean Cemetery	NW	10.2	D
51	SGA School; Sardis, GA	S	11.0	D
52	Oglethorp Substation; Alexander, GA	SW	10.7	D
80	Augusta Water Treatment Plant	NNW	29.0	W(2)
81	Savannah River	N	2.5	F(3),S(4)
82	Savannah River (RM 151.2)	NNE	0.8	R
83	Savannah River (RM 150.4)	ENE	0.8	R,S(4)
84	Savannah River (RM 149.5)	ESE	1.6	R
85	Savannah River	ESE	4.3	F(3)
87	Beaufort - Jasper Water Treatment Plant; Beaufort, SC	SE	76.0	W(5)
88	Cherokee Hill Water Treatment Plant; Port Wentworth, GA	SSE	72.0	W(6)
98	W.C. Dixon Dairy	SE	9.8	M
99	Boyceland Dairy	W	20.9	M

Table 4-4 (cont.) Radiological Environmental Monitoring Locations

TABLE NOTATIONS

(1) Sample Types:

A - Airborne Radioactivity
D - Direct Radiation
F - Fish
M - Milk
R - River Water
S - River Shoreline Sediment
W - Drinking Water (at water treatment plant)
V - Vegetation

(2) The intake for the Augusta Water Treatment Plant is located on the Augusta Canal. The entrance to this canal is at river mile (RM) 207 on the Savannah River. The canal effectively parallels the river. The intake to the pumping station is about 4 miles down the canal and only 0.1 mile from the river (across land).

(3) About a 5-mile stretch of the river is generally needed to obtain adequate fish samples. Samples are normally gathered between RM 153 and 158 for upriver collections and between RMs 144 and 149.4 for downriver collections.

(4) Sediment is collected at locations with existing or potential recreational value. High water shifting of the river bottom or other reasons could cause a suitable location for sediment collection to become unavailable or unsuitable. Thus, a stretch of river between RM 148.5 and 150.5 is designated for downriver sediment collections, while a stretch between RM 153 and 154 is designated for upriver collections. In practice, collections are normally made at RM 150.2 for downriver collections and at RM 153.3 for upriver collections.

(5) The intake for the Beaufort-Jasper Water Treatment Plant is located at the end of a canal which begins at RM 39.3 on the Savannah River. This intake is about 16 miles by line of sight down the canal from its beginning on the Savannah River.

(6) The intake for the Cherokee Hill Water Treatment Plant is located on Abercorn Creek, which is about one and a quarter creek miles from its mouth on the Savannah River at RM 29.

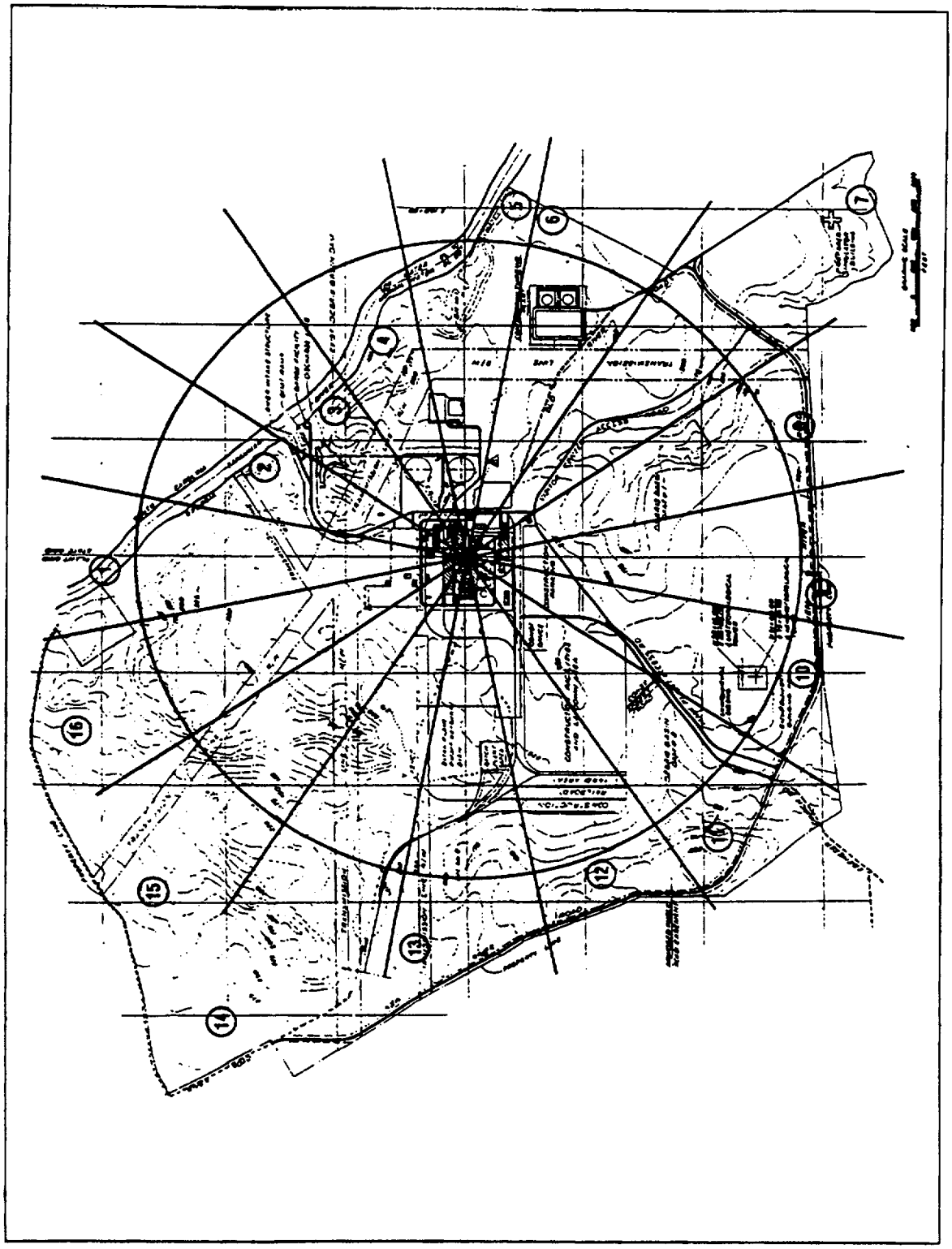

Figure 4-1. Terrestrial Stations Near Site Boundary

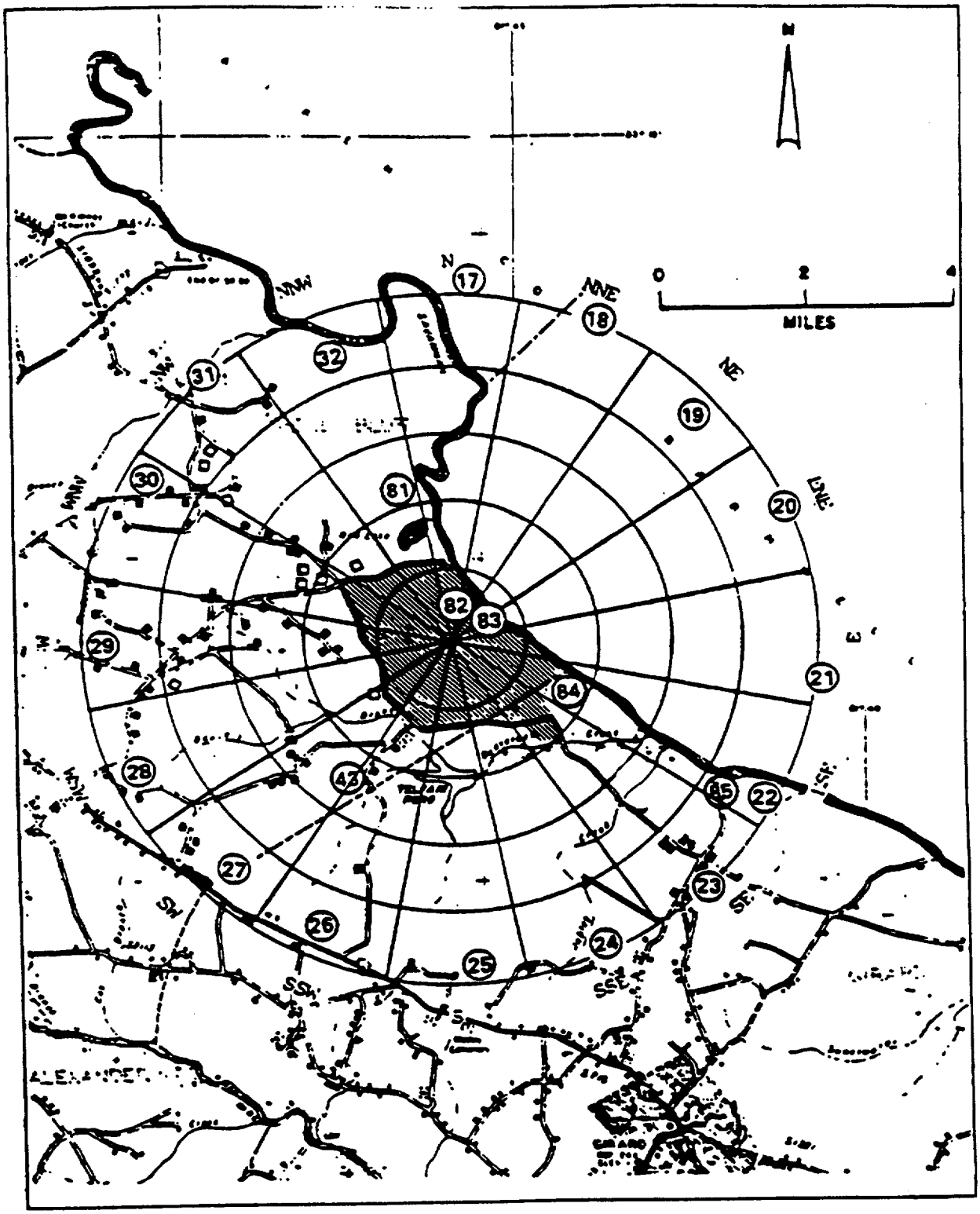

Figure 4-2. Terrestrial Stations and Aquatic Stations, 0-5 Miles

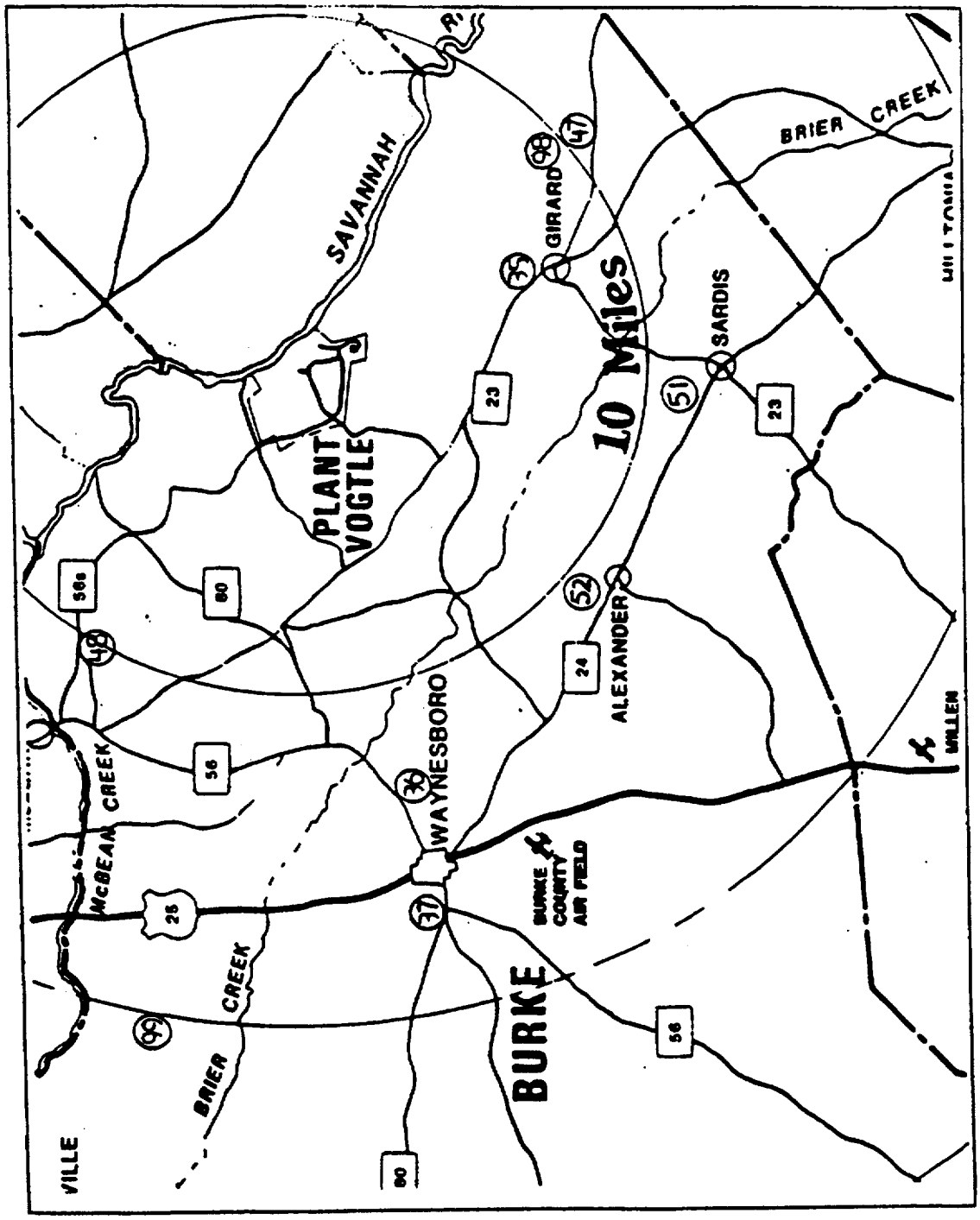

Figure 4-3. Terrestrial Stations Beyond 5 Miles

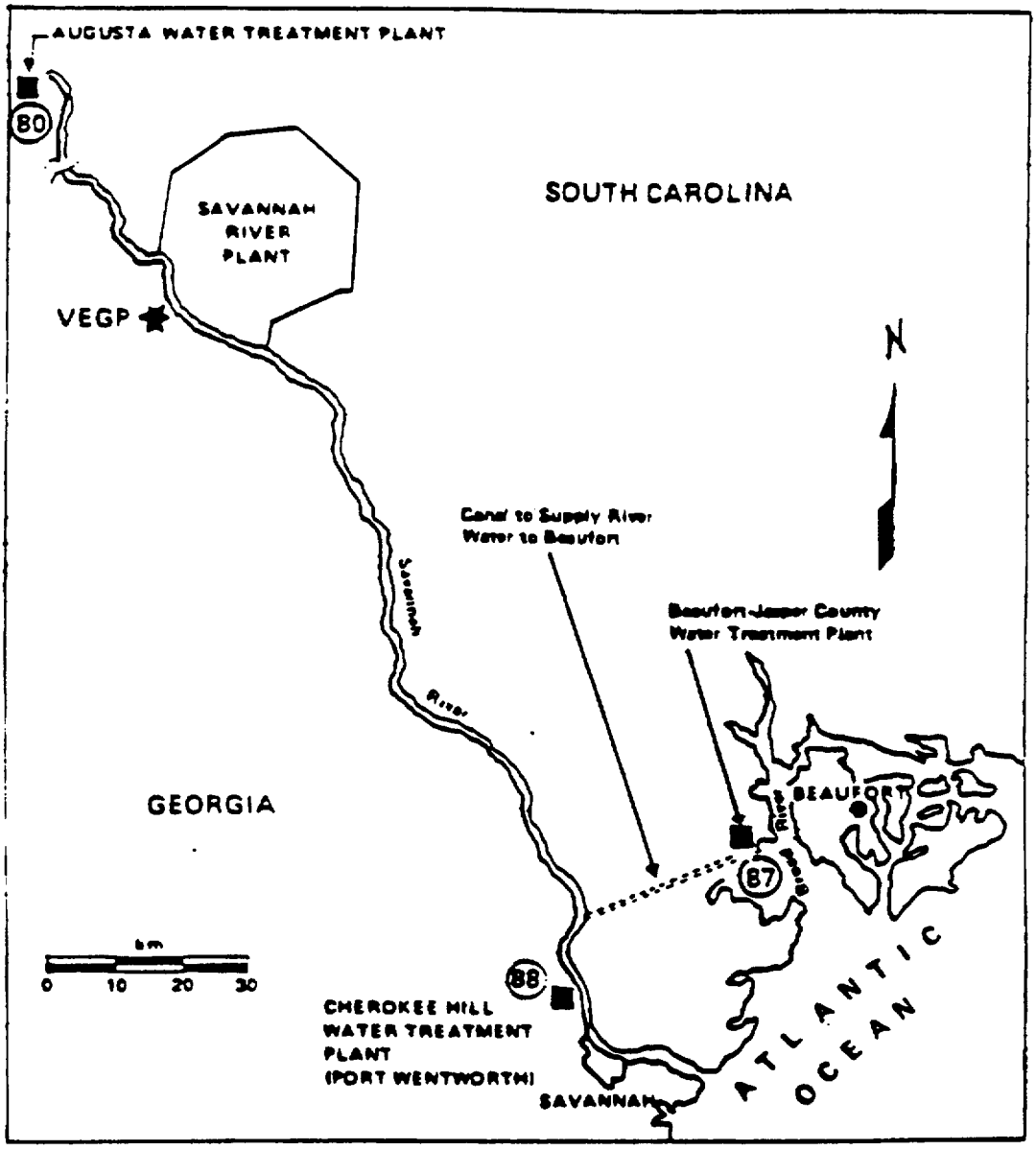

Figure 4-4. Drinking Water Stations

CHAPTER 5
TOTAL DOSE DETERMINATIONS

5.1 LIMIT OF OPERATION

In accordance with Technical Specification 5.5.4.j, 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 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.

This control does not affect shutdown requirements or MODE changes.

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 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 as 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:

$$D_{Tk} = D_L + D_G + D_D + D_N \tag{5.1}$$

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):

$$D_N = 3.17 \times 10^{-8} \sum_v \left\{ \left(\overline{X/Q} \right)_{vp} \sum_i \left[K_i \cdot \tilde{Q}_{iv} \right] \right\} \tag{5.2}$$

where:

3.17×10^{-8} = a units conversion factor: 1 y/(3.15×10^7 s).

$\tilde{Q}_{iv}$ = the cumulative release of noble gas radionuclide i from release pathway v (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.

$\overline{(X/Q)}_{vp}$ = 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 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:

$$D_{Ik} = [D_A + D_S + D_P] \cdot F_o \qquad \textbf{(6.1)}$$

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 inhalation of non-noble-gas radionuclides discharged from the plant site in gaseous effluents, calculated in accordance with Section 3.4.3, in mrem. The $\overline{(X/Q)}$ value to be used is given for each receptor location in Table 6-1; depleted (X/Q) values may be used in calculations for non-noble-gas radionuclides.

D_S = the dose to the same organ due to ground plane deposition of non-noble-gas radionuclides discharged from the plant site in gaseous effluents, calculated in accordance with Section 3.4.3, in mrem. The (D/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 $\overline{(X/Q)}$ values 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: Visitors Center, SE at 447 meters

Age Group: Child

Occupancy Factor: 4.57×10^{-4} (based on 4 hours per year)

Dispersion and Deposition Parameters:

Parameter	Ground-Level	Mixed-Mode
Undepleted $(\overline{X/Q})$, s/m^3	5.93 E-6	7.12 E-7
Depleted $(\overline{X/Q})$, s/m^3	5.58 E-6	6.74 E-7
$(\overline{D/Q})$, m^{-2}	2.28 E-8	5.77 E-9

CHAPTER 7
REPORTS

7.1 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

7.1.1 Requirement for Report

In accordance with Technical Specification 5.6.2, the Annual Radiological Environmental Operating Report covering the REMP activities during the previous calendar year shall be submitted before 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 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 19); 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 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 a point midway between the centers of the two reactors; 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.

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 RADIOACTIVE EFFLUENT RELEASE REPORT

7.2.1 Requirement for Report

In accordance with Technical Specification 5.6.3, the Radioactive Effluent Release Report covering the operation of the units during the previous calendar year of operation shall be submitted in accordance with 10 CFR Part 50.36a. (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 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. Unplanned releases of radioactive materials in gaseous and liquid effluents from the site to UNRESTRICTED AREAS shall be included in the report, tabulated either by quarter or by event. 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 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 doses. 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 during the report period; this assessment must be performed in accordance with Chapter 6. All assumptions used in making these assessments (i.e., specific activity, exposure time, and location) shall be included in the report.

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. Waste 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 (e.g., spent resin, compacted dry waste, evaporator bottoms),
e. Type of container (e.g., LSA, Type A, Type B, Large Quantity),
f. Solidification agent (e.g., cement, urea formaldehyde) and
g. Class of solid wastes (as defined by 10 CFR Part 61.)

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 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 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 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.

7.2.2.6.2 The report shall include a description of the events leading to liquid holdup tanks or gas storage tanks exceeding the limits of Technical Specification 5.5.12.

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 Radioactive Effluent 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 50.59;

b. Sufficient detailed information to totally support the reason for the change without benefit of additional 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 applications and amendments thereto;

e. An evaluation of the change which shows the expected maximum exposures to individuals in the UNRESTRICTED AREA and to the general population that differ from those previously estimated in the license applications 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 PRB.

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1 In lieu of inclusion in the 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 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: Although Plant Vogtle has no pure elevated releases, the sections on elevated-mode calculations (8.1.2 and 8.2.2) are included for convenience in calculating mixed-mode values, and 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:

$$(X/Q)_G = \frac{2.032\,\delta\,K_r}{N\,r}\sum_{jk}\left[\frac{n_{jk}}{u_j\sum_{zk}}\right] \qquad \textbf{(8.1)}$$

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 Appendix A of Reference 15.

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:

$$\sum_{zk} = the \quad lesser \quad of \begin{cases} \left(\sigma_{zk}^2 + \dfrac{b^2}{2\pi}\right)^{1/2} \\ OR \\ \sqrt{3}(\sigma_{zk}) \end{cases} \tag{8.2}$$

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 (55 m).

8.1.2 <u>Elevated Releases</u>

Relative dispersion calculations for elevated releases, or for the elevated portion of mixed-mode releases, shall be made as follows:

$$(X/Q)_E = \frac{2.032K_r}{N\,r}\sum_{jk}\left[\frac{\delta_k n_{jk} exp\left(\dfrac{-h^2}{2\sigma_{zk}^2}\right)}{u_j\sigma_{zk}}\right] \tag{8.3}$$

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:

$$h = h_v + h_{pr} - h_t - c_v \tag{8.4}$$

h_v = the height of the release point (m).

h_t = the maximum terrain height between the release point and the point of interest (m), from Table 8-1.

h_{pr} = the additional height due to plume rise (m) which is calculated as follows and limited by $h_{pr(max)}$:

$$h_{pr} = 1.44\, d \left(\frac{W_o}{u}\right)^{2/3} \cdot \left(\frac{x}{d}\right)^{1/3} \tag{8.5}$$

$$h_{pr}(max) = the \quad lesser \quad of: \begin{cases} 3\left(\frac{W_o}{u}\right) \cdot d \\ OR \\ 1.5\left(\frac{F_m}{u}\right)^{1/3} \cdot s^{-1/6} \end{cases} \tag{8.6}$$

d = the inside diameter of the vent (m).

c_v = the correction for low vent exit velocity (m), which is calculated as follows:

$$c_v = \begin{cases} 3\left(1.5 - \frac{W_o}{u}\right) \cdot d & for \frac{W_o}{u} < 1.5 \\ OR & \\ 0 & for \frac{W_o}{u} \geq 1.5 \end{cases} \tag{8.7}$$

F_m = the momentum flux parameter (m^4/s^2), which is calculated as follows:

$$F_m = \left(W_o \cdot \frac{d}{2}\right)^2 \tag{8.8}$$

S = the stability parameter:

= $8.75 \times 10^{-4}\ s^{-2}$ for $-0.5 < \Delta T \leq 1.5$
= $1.75 \times 10^{-3}\ s^{-2}$ for $1.5 < \Delta T \leq 4.0$
= $2.45 \times 10^{-3}\ s^{-2}$ for $\Delta T > 4.0$

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:

$$(X/Q)_M = (1 - E) \cdot (X/Q)_E + E \cdot (X/Q)_G \qquad \textbf{(8.9)}$$

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:

$$E = \begin{cases} 1.0 & \text{for } \dfrac{W_o}{u_j} \leq 1.0 \\ 2.58 - 1.58 \cdot \left(\dfrac{W_o}{u_j}\right) & \text{for } 1.0 < \dfrac{W_o}{u_j} \leq 1.5 \\ 0.3 - 0.06 \cdot \left(\dfrac{W_o}{u_j}\right) & \text{for } 1.5 < \dfrac{W_o}{u_j} \leq 5.0 \\ 0 & \text{for } \dfrac{W_o}{u_j} > 5.0 \end{cases} \qquad \textbf{(8.10)}$$

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 follows:

$$(D/Q)_G = \frac{2.55 D_g K_r}{N r} \sum_k n_k \qquad \textbf{(8.11)}$$

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 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:

$$(D/Q)_E = \frac{2.55 K_r}{N r} \sum_k (n_k D_{ek}) \qquad \textbf{(8.12)}$$

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:

$$(D/Q)_M = (1 - E) \cdot (D/Q)_E + E \cdot (D/Q)_G \qquad \textbf{(8.13)}$$

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.

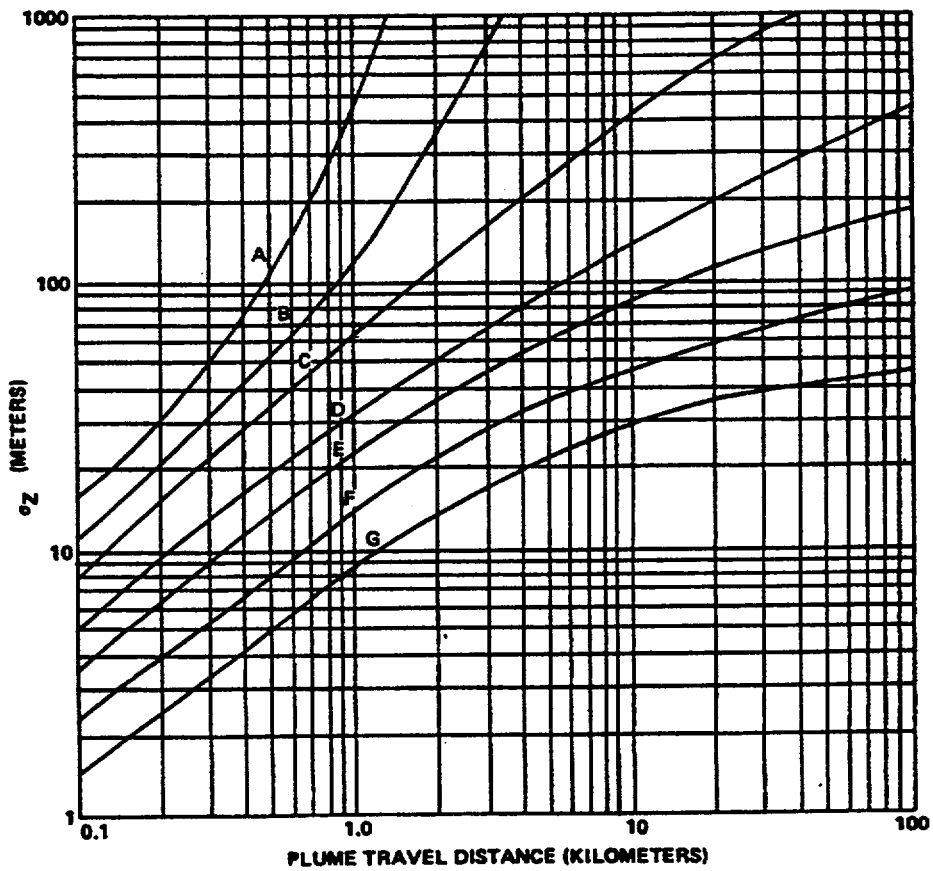
8.3 ELEVATED PLUME DOSE FACTORS

These factors are not required in effluent dose calculations for VEGP.

Table 8-1. Terrain Elevation Above Plant Site Grade

Dist. (m)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	8.7	5.7	1.4	5.8	5.7	3.5
1,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	16.7	13.4	3.3	10.4	11.8	6.8
1,500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	21.7	18.6	7.3	12.2	14.3	7.3
2,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	21.7	18.6	7.3	12.2	14.3	7.3
2,500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	21.7	18.6	7.3	12.2	14.3	7.3
3,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	23.7	18.6	7.3	12.2	14.3	7.3
3,500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	24.4	18.6	7.3	12.2	16.9	7.3
4,000	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0	4.7	24.4	18.6	7.3	12.2	16.9	7.3
5,000	0.0	0.0	0.0	0.0	0.0	0.0	11.1	0.0	0.0	4.7	24.7	18.6	7.3	12.2	16.9	7.3
6,000	0.0	0.0	0.0	0.0	0.0	0.0	11.1	0.0	0.0	4.7	26.8	18.6	7.3	12.2	16.9	7.3
7,000	0.0	0.0	0.0	7.8	0.0	0.0	11.1	0.0	3.6	4.7	26.8	18.6	7.3	12.2	16.9	7.3
8,000	0.0	0.0	21.1	13.9	0.0	0.0	11.8	0.0	14.6	4.7	26.8	18.6	7.3	12.2	16.9	7.3
9,000	0.0	0.0	24.4	14.6	0.0	0.0	12.7	7.1	14.6	5.1	26.8	18.6	7.3	12.2	16.9	7.3
10,000	0.0	10.2	24.4	20.2	0.0	0.0	17.1	17.0	14.6	6.8	26.8	18.6	7.3	12.2	16.9	7.3
12,000	0.0	15.9	26.8	20.2	0.0	0.0	17.1	19.5	14.6	6.8	34.1	28.9	13.4	12.2	16.9	7.3
14,000	0.0	15.9	26.8	20.2	0.0	0.0	17.1	19.5	14.6	6.8	34.1	28.9	13.4	16.5	19.7	7.3
16,000	0.0	15.9	26.8	21.7	13.2	0.0	17.1	19.5	14.6	6.8	34.1	28.9	13.4	16.5	25.7	7.3

Data in this table are obtained from Reference 11.



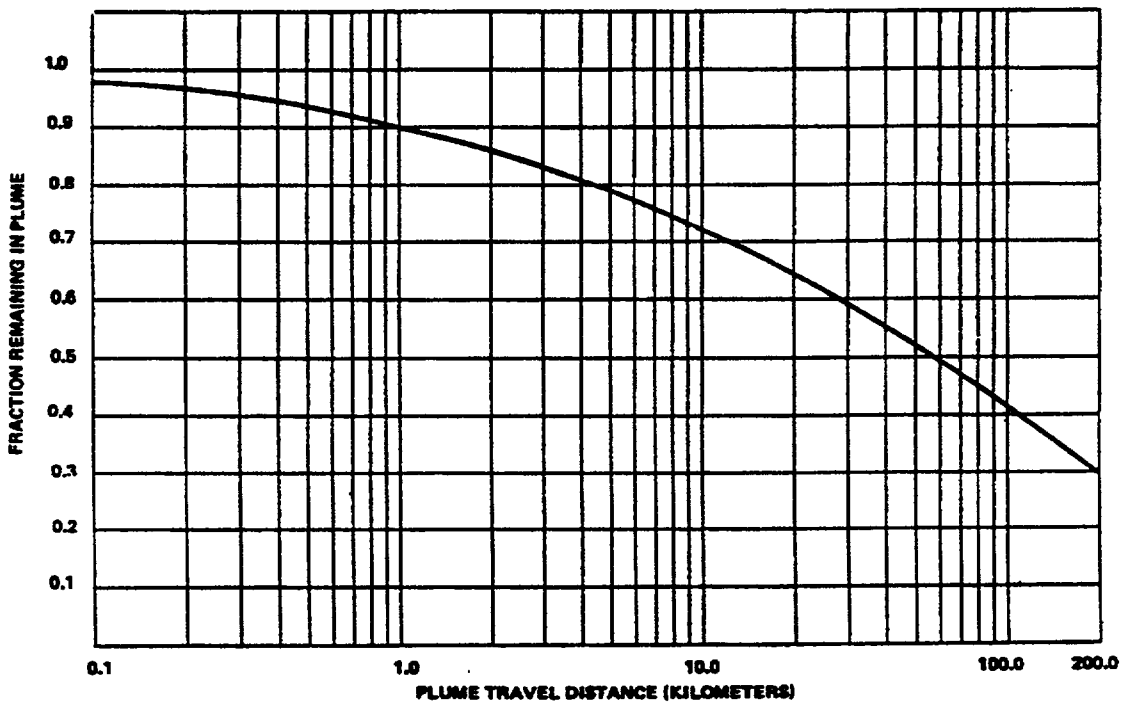
Category	Range of Vertical Temperature Gradient (°C/100 m)	Range of Vertical Temperature Gradient (°F/100 ft)
A	$\Delta T/\Delta Z < -1.9$	$\Delta T/\Delta Z < -1.0$
B	$-1.9 \leq \Delta T/\Delta Z < -1.7$	$-1.0 \leq \Delta T/\Delta Z < -0.9$
C	$-1.7 \leq \Delta T/\Delta Z < -1.5$	$-0.9 \leq \Delta T/\Delta Z < -0.8$
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)

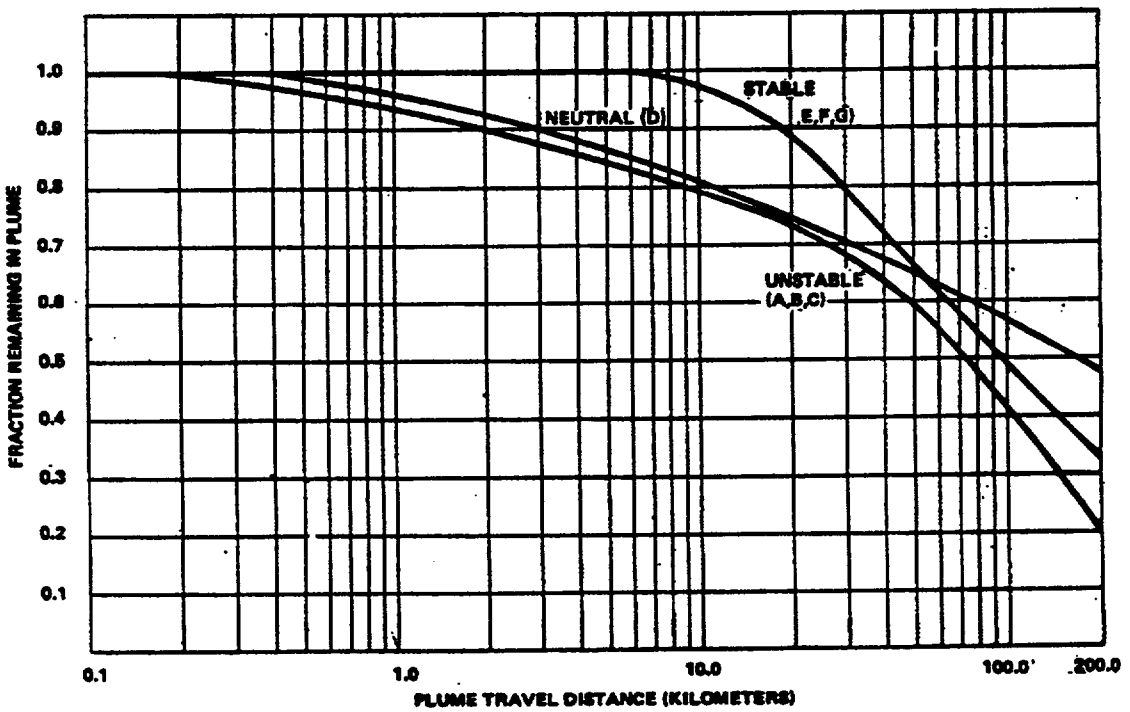
This figure intentionally left blank.
Refer to the definition for K_r (terrain recirculation factor) in section 8.1.1 for applicable plant data.

Figure 8-2. Terrain Recirculation Factor (K_r)



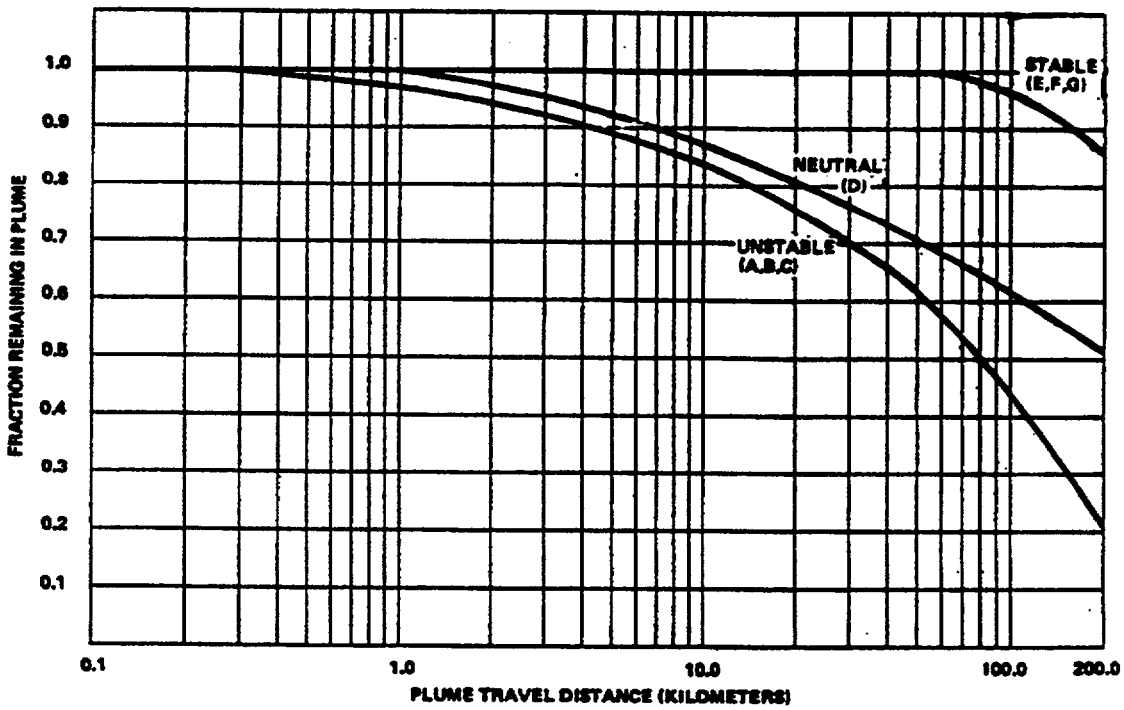
This graph is reproduced from Reference 5 (Figure 2).

Figure 8-3. Plume Depletion Effect for Ground Level Releases



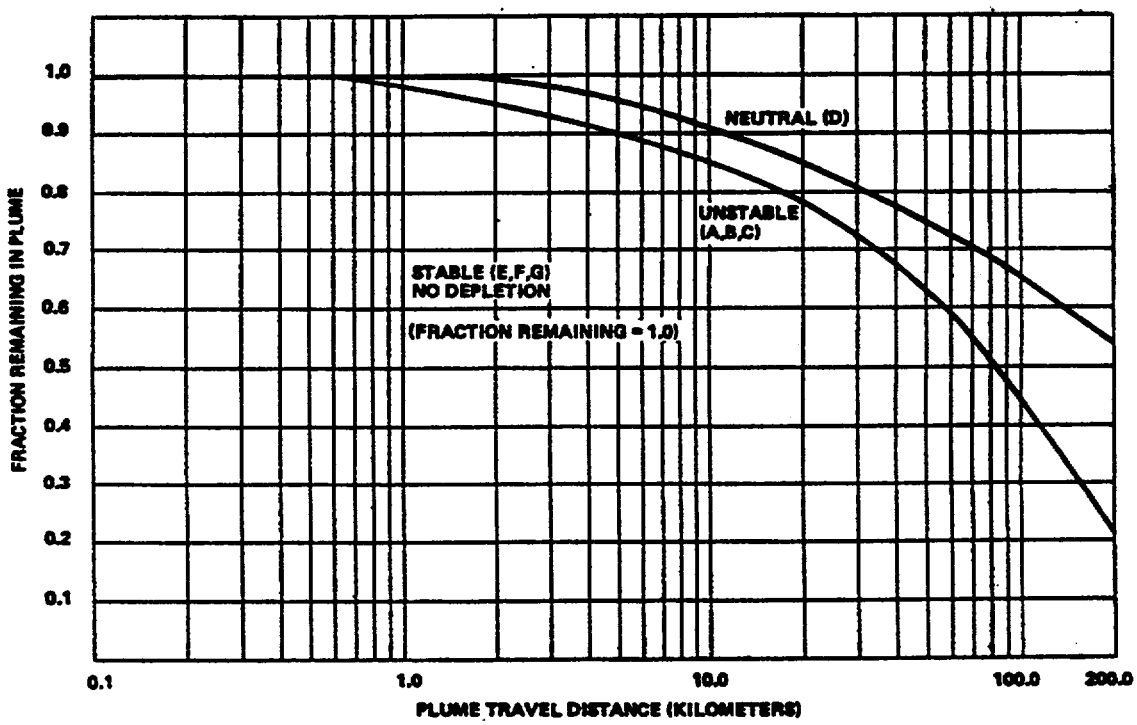
This graph is reproduced from Reference 5 (Figure 3).

Figure 8-4. Plume Depletion Effect for 30-Meter Releases



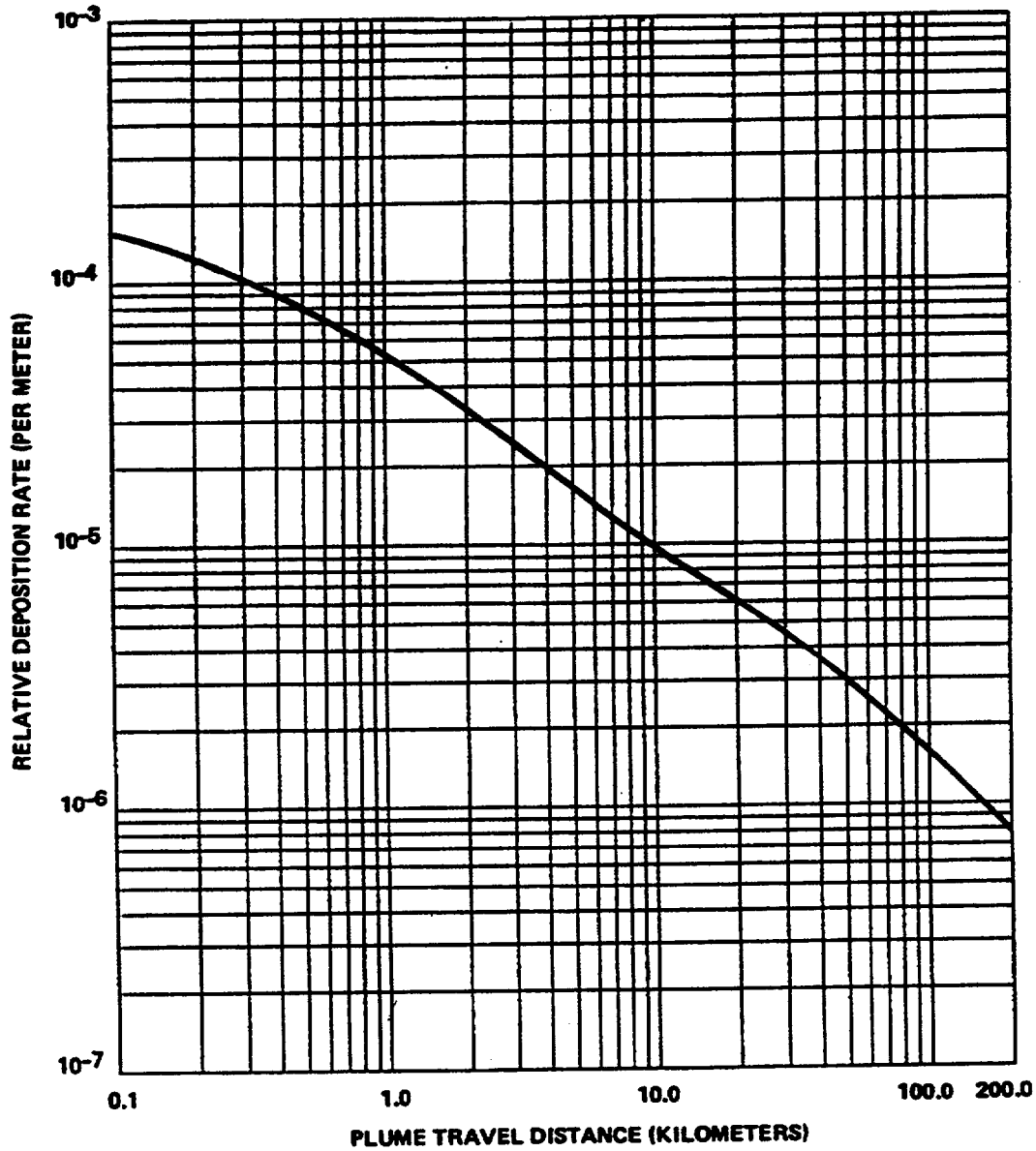
This graph is reproduced from Reference 5 (Figure 4).

Figure 8-5. Plume Depletion Effect for 60-Meter Releases



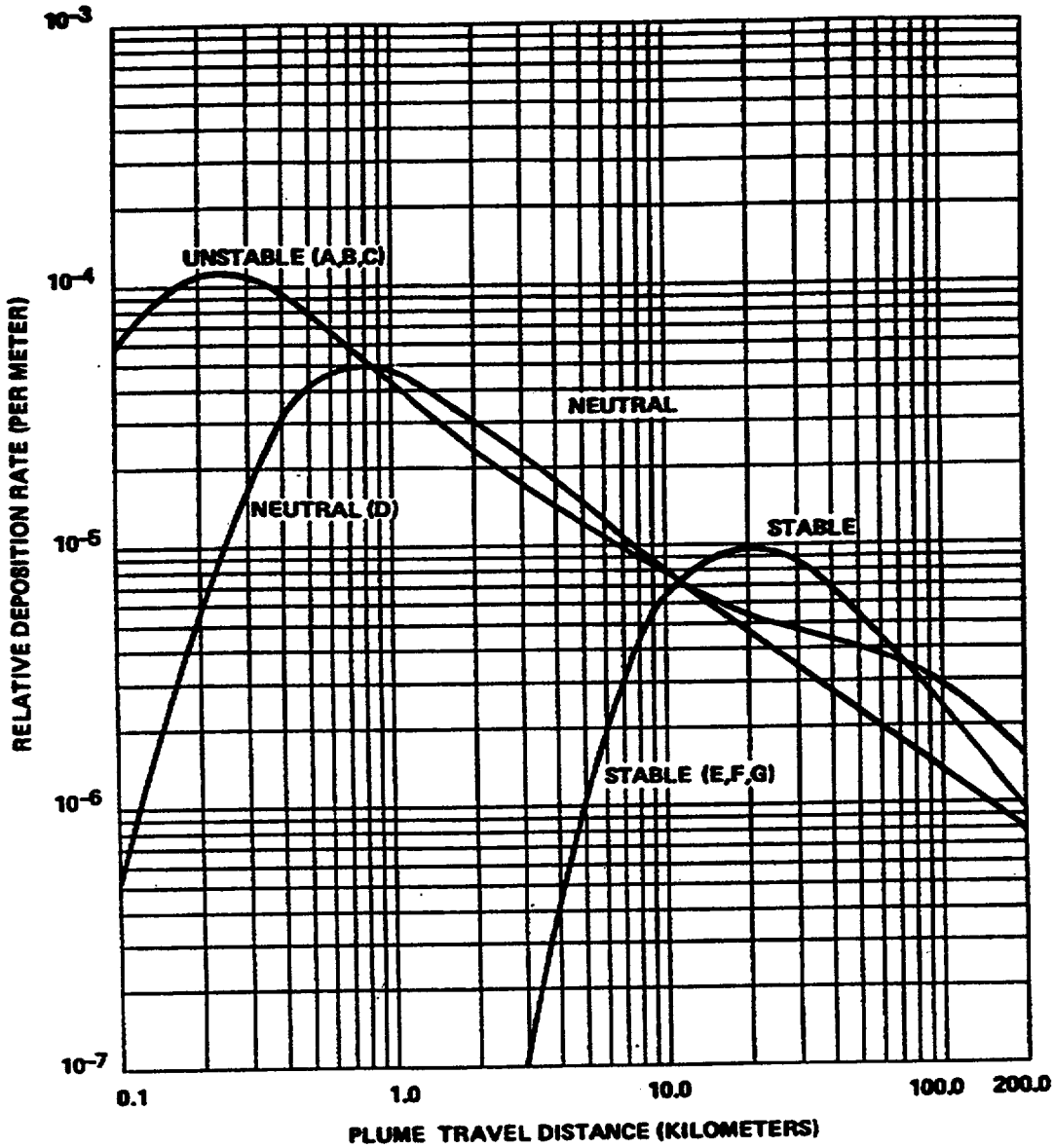
This graph is reproduced from Reference 5 (Figure 5).

Figure 8-6. Plume Depletion Effect for 100-Meter Releases



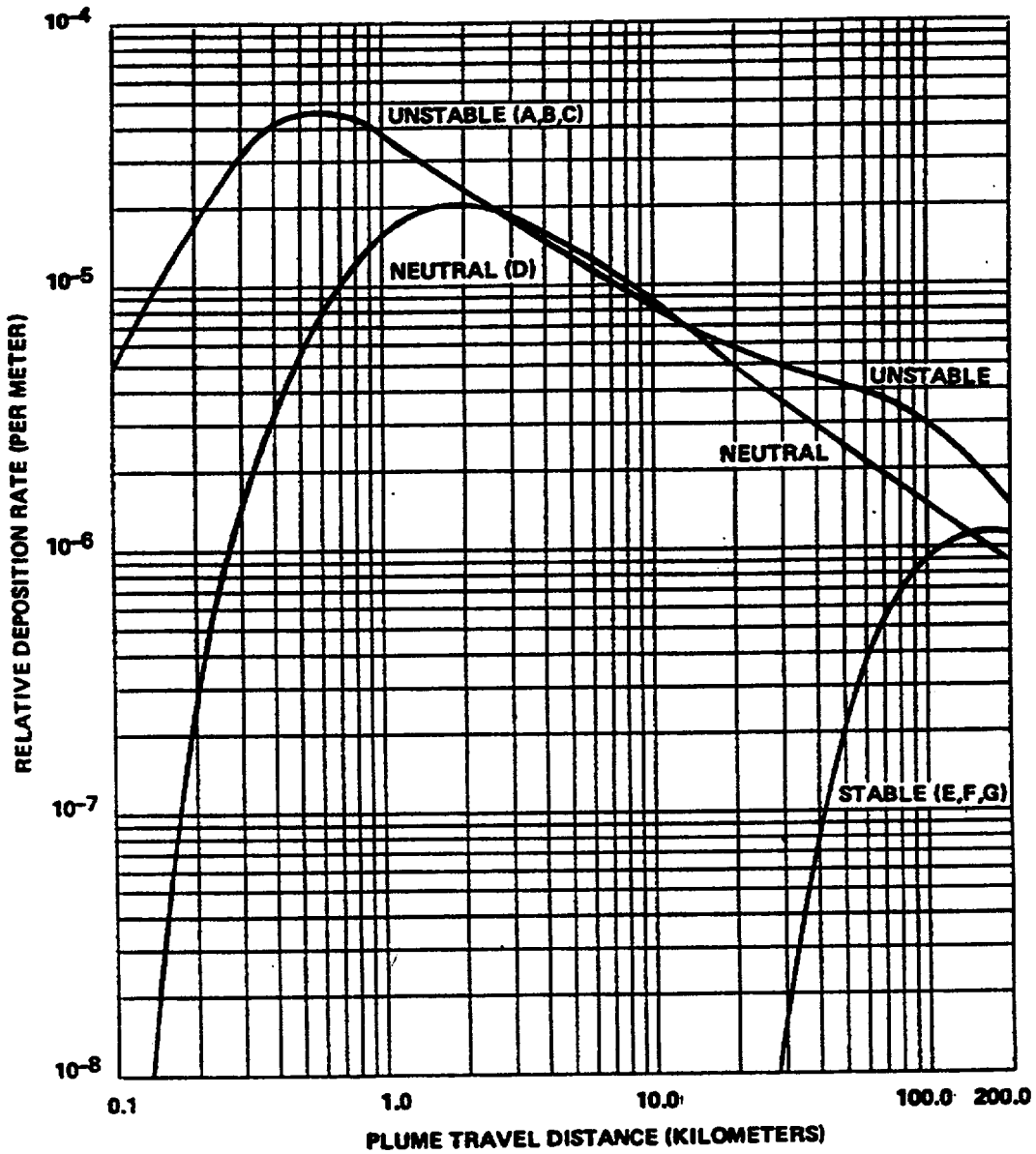
This graph is reproduced from Reference 5 (Figure 6).

Figure 8-7. Relative Deposition for Ground-Level Releases



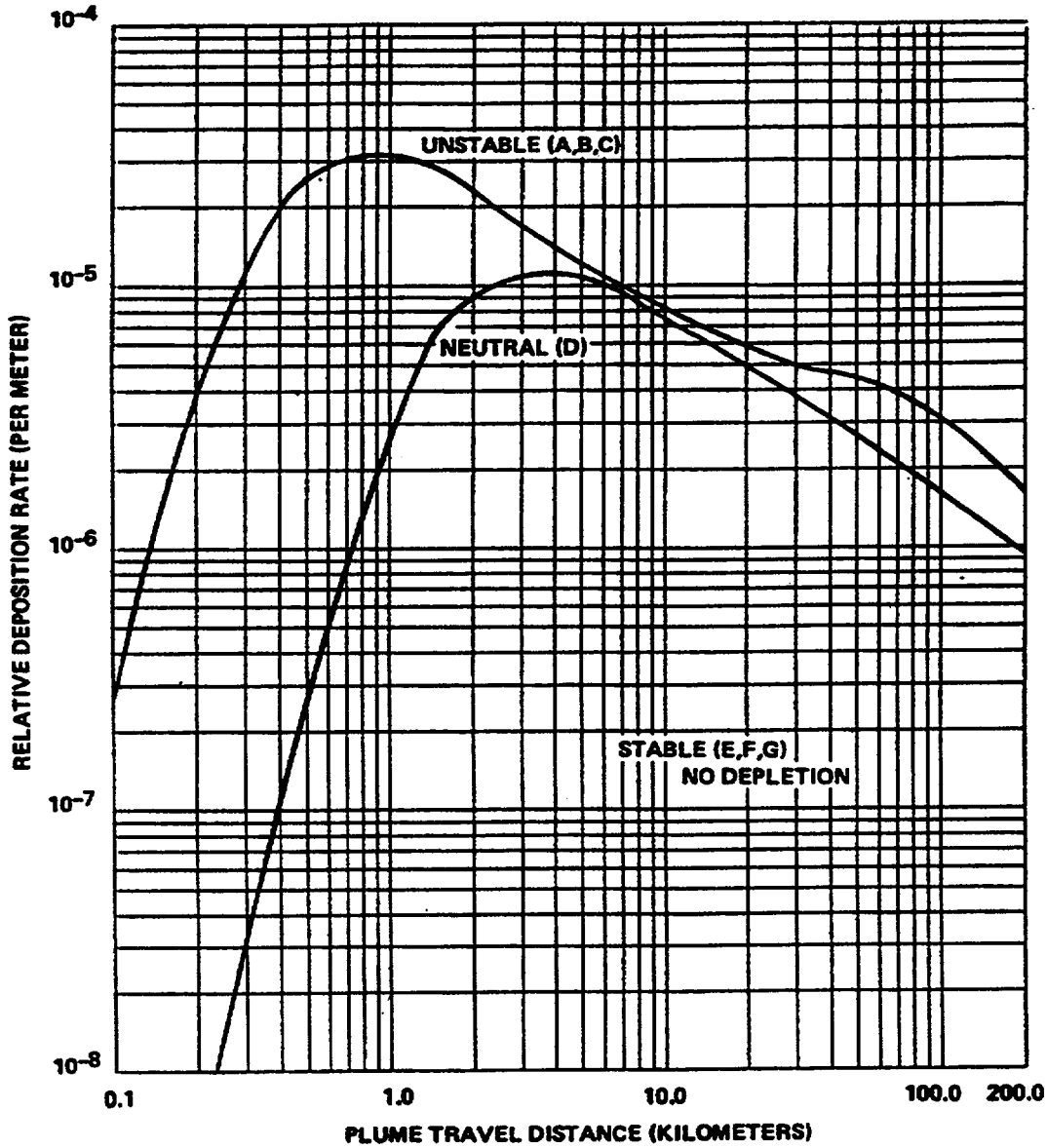
This graph is reproduced from Reference 5 (Figure 7).

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 (µCi/m^3) is calculated as follows (Reference 1, Section 5.3.1.1):

$$R_{aipj} = K_1 \cdot (BR)_a \cdot (DFA)_{aij} \tag{9.1}$$

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·mrem/y) per (μCi/s) is calculated as follows (Reference 1, Section 5.3.1.2):

$$R_{aipj} = K_1 \cdot K_2 \cdot (SHF) \cdot (DFG)_{ij} \cdot \left(\frac{1 - e^{-\lambda_i t}}{\lambda_i} \right) \qquad \textbf{(9.2)}$$

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 20.

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·mrem/y) per (µCi/s) is calculated as follows (Reference 1, Section 5.3.1.5):

$$R_{aipj} = K_1 \cdot \frac{r}{Y_v(\lambda_i + \lambda_w)} \cdot (DFL)_{aij} \cdot \left(U_{aL} f_L e^{-\lambda_i t_L} + U_{aS} f_g e^{-\lambda_i t_{hv}}\right) \quad \textbf{(9.3)}$$

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 20.

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
λw	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·mrem/y) per (µCi/s) is calculated as follows (Reference 1, Section 5.3.1.3):

$$R_{aipj} = K_1 \cdot \frac{r}{(\lambda_i + \lambda_w)} \cdot Q_F \cdot U_{ap} \cdot F_{mi} \cdot (DFL)_{aij} \cdot \left[\frac{f_p f_s}{Y_p} + \frac{(1 - f_p f_s)\, e^{-\lambda_i t_{hm}}}{Y_s} \right] \cdot e^{-\lambda_i t_f} \qquad \textbf{(9.5)}$$

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 20.

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 (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:

$$R_{aipj} = K_1 \cdot K_3 \cdot Q_F \cdot U_{ap} \cdot F_{mi} \cdot (DFL)_{aij} \cdot 0.75 \cdot \left(\frac{0.5}{H}\right) \quad \textbf{(9.6)}$$

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·mrem/y) per (µCi/s) is calculated as follows (Reference 1, Section 5.3.1.3):

$$R_{aipj} = K_1 \cdot \frac{r}{(\lambda_i + \lambda_w)} \cdot Q_F \cdot U_{ap} \cdot F_{mi} \cdot (DFL)_{aij} \cdot \left[\frac{f_p f_s}{Y_p} + \frac{(1 - f_p f_s)\, e^{-\lambda_i t_{hm}}}{Y_s} \right] \cdot e^{-\lambda_i t_f} \qquad \textbf{(9.7)}$$

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 20.

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 (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:

$$R_{aipj} = K_1 \cdot K_3 \cdot Q_F \cdot U_{ap} \cdot F_{mi} \cdot (DFL)_{aij} \cdot 0.75 \cdot \left(\frac{0.5}{H}\right) \quad \textbf{(9.8)}$$

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	5.73×10^{-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·mrem/y) per (µCi/s) is calculated as follows (Reference 1, Section 5.3.1.4):

$$R_{aipj} = K_1 \cdot \frac{r}{(\lambda_i + \lambda_w)} \cdot Q_F \cdot U_{ap} \cdot F_{fi} \cdot (DFL)_{aij} \cdot \left[\frac{f_p f_s}{Y_p} + \frac{(1 - f_p f_s) e^{-\lambda_i t_{hm}}}{Y_s} \right] \cdot e^{-\lambda_i t_f} \qquad \textbf{(9.9)}$$

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 20.

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:

$$R_{aipj} = K_1 \cdot K_3 \cdot Q_F \cdot U_{ap} \cdot F_{f_i} \cdot (DFL)_{aij} \cdot 0.75 \cdot \left(\frac{0.5}{H}\right) \qquad \textbf{(9.10)}$$

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	3.25E-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	8.38E-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	2.01E-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:

ACTION(S)

An ACTION shall be that part of a control that prescribes remedial measures required under designated conditions.

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. To be representative of the quantities and concentrations of radioactive materials in CONTINUOUS RELEASES of liquid effluents, samples shall be collected in proportion to the rate of flow of the effluent stream or to the quantity of liquid waste discharged.

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 WASTE PROCESSING SYSTEM

A GASEOUS WASTE PROCESSING SYSTEM shall be any system designed and installed to reduce radioactive gaseous effluents by collecting Reactor Coolant System offgases from the Reactor Coolant 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 means any individual except when that individual is receiving an *occupational dose*[2]. This category may include persons who use portions of the site for recreational, occupational, or other purposes not associated with the plant.

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 18):

where:

MDC = the *a priori* MINIMUM DETECTABLE CONCENTRATION (µCi per unit mass or volume).

$$MDC = \frac{\dfrac{2.71}{t_s} + 3.29\sqrt{R_b\left(\dfrac{1}{t_s} + \dfrac{1}{t_b}\right)}}{E \cdot V \cdot 2.22 \times 10^6 \cdot Y \cdot e^{-\lambda \Delta t}}$$

R_b = the background counting rate, or the counting rate of a blank sample, as appropriate (counts per minute).

t_s = the length of the sample counting period (minutes).

t_b = the length of the background counting period (minutes).

E = the counting efficiency (counts per disintegration)

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

2.22×10^6 = the number of disintegrations per minute per µCi.

Y = the fractional radiochemical yield, when applicable.

λ = the radioactive decay constant for the given radionuclide (h^{-1}). Values of λ used in effluent calculations should be based on decay data from a recognized and current source, such as Reference 20.

Δt = for effluent samples, the elapsed time between the midpoint of sample collection and the time of counting (h); for environmental samples, the elapsed time between the end of sample collection and the time of counting (h).

[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.

[2] Except as delineated in other parts of 10 CFR chapter I.

Typical values of E, V, Y, and Δt should be used in the calculation. It should be recognized that the MDC is defined as an *a priori* (before the fact) limit representing the capability of a measurement system, and not as an *a posteriori* (after the fact) limit for a particular measurement.

PRINCIPAL GAMMA EMITTERS

The PRINCIPAL GAMMA EMITTERS for which the MINIMUM DETECTABLE CONCENTRATION (MDC) limit applies include exclusively the following radionuclides:

- For liquid radioactive effluents: Mn–54, Fe–59, Co–58, Co–60, Zn–65, Mo–99, Cs–134, Cs–137, and Ce–141. Ce–144 shall also be measured, but with an MDC of 5 x 10^{-6} µCi/mL.

- 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 Radioactive Effluent Release Report, the Annual Radiological Environmental Operating Report, or other applicable report(s).

SITE BOUNDARY

For the purpose of effluent controls defined in the ODCM, the SITE BOUNDARY shall be as shown in Figure 4-1.

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.

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.

VENTILATION EXHAUST TREATMENT SYSTEM

The VENTILATION EXHAUST TREATMENT SYSTEM is any system designed and installed to reduce gaseous radioiodine or radioactive material in particulate form in effluents, by passing ventilation or vent exhaust gases through charcoal adsorbers and/or HEPA filters, for the purpose of removing iodines or particulates from the gaseous exhaust stream prior to the release to the environment. (Such a system is not considered to have any effect on any noble gas effluents). Engineered Safety Feature (ESF) atmospheric cleanup systems are not considered to be VENTILATION EXHAUST TREATMENT SYSTEM components.

10.2 TERMS DEFINED IN THE TECHNICAL SPECIFICATIONS

The following terms are defined in the Technical Specifications, Section 1.0. 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.

CHANNEL CALIBRATION

A CHANNEL CALIBRATION shall be the adjustment, as necessary, of the channel, such that it responds within the required range and accuracy to known values of input. The CHANNEL CALIBRATION shall encompass the entire channel including the required sensor, alarm, interlock, and/or trip functions and may be performed by any series of sequential, overlapping, or total channel steps, so 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 OPERATIONAL TEST (COT)

A CHANNEL OPERATIONAL TEST shall be the injection of a simulated signal into the channel as close to the sensor as practicable to verify operability of required alarm, interlock, and/or trip functions. The CHANNEL OPERATIONAL TEST shall include adjustments, as necessary, of the required alarm, interlock, and/or trip setpoints, so that the setpoints are within the required range and accuracy.

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 E–7 of NRC Regulatory Guide 1.109, Revision 1, 1977.

MODE (or OPERATIONAL MODE)

An OPERATIONAL MODE shall correspond to any one inclusive combination of core reactivity condition, power level, average reactor coolant temperature, and reactor vessel head closure bolt tensioning specified in Section 1.0 of the Technical Specifications with fuel in the reactor vessel.

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).

RATED THERMAL POWER

RATED THERMAL POWER shall be a total reactor core heat transfer rate to the reactor coolant of 3565 MWt.

THERMAL POWER

THERMAL POWER shall be the total reactor core heat transfer rate to the reactor coolant.

VOGTLE ELECTRIC GENERATING PLANT
OFFSITE DOSE CALCULATION MANUAL
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SOUTHERN NUCLEAR COMPANY

VOGTLE ELECTRIC GENERATING PLANT – UNITS 1 AND 2

NRC DOCKET NOS. 50-424 AND 50-425

FACILITY OPERATING LICENSE NOS. NPF-68 AND NPF-81

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

FOR

JANUARY 1 2001 TO DECEMBER 31, 2001

VOGTLE ELECTRIC GENERATING PLANT
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
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1.0 Liquid Effluents

1.1 Regulatory Requirements

1.1.1 Concentration Limits

In accordance with Technical Specification 5.5.4.b, the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS 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 E-04 μCi/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 as follows:

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

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

For gross alpha in liquid radwaste, the ECL is 2 E-09 μCi/ml.

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

1.3.1 Total Radioactivity Determination

Prior to the release of any tank containing liquid radwaste, and following the required recirculations, samples are collected and analyzed in accordance with the Offsite Dose Calculation Manual (ODCM) Table 2-3 "Radioactive Liquid Waste Sampling and Analysis Program". A sample from each tank which is 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

1.3.1 Total Radioactivity Determination cont'd

Gamma isotopic measurements are performed using germanium detectors with a resolution of 2.1 keV or lower. A peak search of the resulting gamma ray spectrum is performed by the computer system. 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 ODCM Chapter 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.

ECL fraction is determined using radionuclide concentrations of a tank planned for release, the most current results available for tritium, gross alpha, Sr-89, Sr-90 and Fe-55 and the corresponding ECL values.
This ECL fraction is used, with appropriate safety factors, tolerance factors, and the minimum assured dilution stream flow to calculate maximum permissible release rates 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 liquid effluent radiation monitor calibrations 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 Department and sent to the Operations Department for approval and release. When the release is completed, the necessary data from the release (i.e., release volume, etc.) are provided by the Operations Department to the Chemistry Department. These data are input to the computer and a post-release printout is generated. The post release printout contains the actual release rates, release concentrations and quantities, actual dilution flow, and calculated doses to an individual.

Typically achieved liquid effluent sample analyses minimum detectable concentrations are reported in Table 1-4.

1.3.2 Total Error Estimation

The total or maximum error associated with the effluent measurement includes the cumulative errors resulting from the total operation of sampling and measurement. Because it may be very difficult to assign error terms for each parameter affecting the final measurement, detailed statistical evaluation of error is not suggested. The objective should be to obtain an overall estimate of the error associated with measurements of radioactive materials released in liquid effluents.

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

Sampling and statistical error	10%
Counting Equipment Calibration	10%
Tank Volumes and System Flow Rates	20%
TOTAL ERROR	40%

b. Total Tritium release was calculated from sample analysis results and release point volumes.

Sampling and statistical errors	10%
Counting equipment calibration	10%
Tank volumes and system flow rate	20%
TOTAL ERROR	40%

c. Dissolved and entrained gases were calculated from sample analysis results and release point volumes.

Sampling and statistical error	20%
Counting equipment calibration	10%
Tank volumes and system flow rate	20%
TOTAL ERROR	50%

d. Gross alpha radioactivity was calculated from sample analysis results and release point volumes.

Sampling and statistical error	10%
Counting Equipment calibration	10%
Tank volumes and system flowrates	20%
TOTAL ERROR	40%

1.3.2 Total Error Estimation cont'd

e. Volume of waste prior to dilution was calculated from level indicators on the tanks and pump discharge flow rates and times.

Level Indicator error	10%
Operator Interpretation of gauge	10%
TOTAL ERROR	20%

f. Volume of dilution water used was calculated from flow totalizers and pump discharge flow rates and times.

Flow totalizer error	10%
Operator interpretation of gauge	10%
TOTAL ERROR	20%

g. Gross alpha, Sr-89, Sr-90, Fe-55 and H-3 radioactivity has an additional error associated with sample compositing.

Compositing sample error	5%

1.4 Liquid Effluent Release Data

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

1.5 Radiological Impact 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 for Unit 1 and 1-3B for Unit 2, for all four quarters.

1.6 Liquid Effluents – Batch Releases

Batch release information for liquid effluents is presented in Table 1-5A for Unit 1 and Table 1-5B for Unit 2.

1.7 Liquid Effluents - Abnormal Releases

There were no abnormal releases for this reporting period.

TABLE 1-1A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Summation of All Releases
Unit: 1
Starting : 1-Jan-2001 Ending : 30-Jun-2001

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	4.15E-02	1.63E-02	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	2.40E-07	6.79E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	1.31E+02	1.64E+02	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	7.59E-04	6.83E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	4.15E-04	0.00E+00	50
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	2.40E-09	0.00E+00	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	1.21E-05	1.02E-06	45
E. WASTE VOL RELEASED(PRE-DILUTION)	LITERS	5.67E+05	6.17E+05	20
F. VOLUME OF DILUTION WATER USED	LITERS	1.72E+08	2.39E+08	20

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

TABLE 1-1A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Summation of All Releases
Unit: 1
Starting : 1-Jul-2001 Ending : 31-Dec-2001

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	1.76E-02	9.87E-03	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	8.14E-08	5.00E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	1.69E+02	9.68E+01	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	7.82E-04	4.91E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	1.09E-05	1.20E-05	50
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	5.05E-11	6.10E-11	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.00E+00	0.00E+00	45
E. WASTE VOL RELEASED(PRE-DILUTION)	LITERS	4.86E+05	3.42E+05	20
F. VOLUME OF DILUTION WATER USED	LITERS	2.16E+08	1.97E+08	20

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

TABLE 1-1B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Summation of All Releases
Unit: 2
Starting : 1-Jan-2001 Ending : 30-Jun-2001

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	8.38E-02	1.70E-02	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	1.84E-07	6.46E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	5.90E+02	2.74E+02	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	1.30E-03	1.04E-03	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	4.11E-04	0.00E+00	50
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	9.04E-10	0.00E+00	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.00E+00	0.00E+00	45
E. WASTE VOL RELEASED(PRE-DILUTION)	LITERS	1.04E+06	5.57E+05	20
F. VOLUME OF DILUTION WATER USED	LITERS	4.54E+08	2.63E+08	20

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

TABLE 1-1B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Summation of All Releases
Unit: 2
Starting : 1-Jul-2001 Ending : 31-Dec-2001

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	2.55E-02	8.14E-03	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	2.60E-07	1.38E-07	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	4.79E+01	2.05E+01	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	4.89E-04	3.49E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	0.00E+00	0.00E+00	50
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	0.00E+00	0.00E+00	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.00E+00	0.00E+00	45
E. WASTE VOL RELEASED(PRE-DILUTION)	LITERS	2.90E+05	1.53E+05	20
F. VOLUME OF DILUTION WATER USED	LITERS	9.77E+07	5.87E+07	20

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

TABLE 1-1C
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Summation of All Releases
Unit: Site
Starting : 1-Jan-2001 Ending : 30-Jun-2001

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	1.25E-01	3.33E-02	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	2.00E-07	6.62E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	7.21E+02	4.37E+02	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	1.15E-03	8.69E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	8.26E-04	0.00E+00	50
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	1.32E-09	0.00E+00	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	1.21E-05	1.02E-06	45
E. WASTE VOL RELEASED(PRE-DILUTION)	LITERS	1.61E+06	1.17E+06	20
F. VOLUME OF DILUTION WATER USED	LITERS	6.26E+08	5.02E+08	20

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

TABLE 1-1C
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Summation of All Releases
Unit: Site
Starting : 1-Jul-2001 Ending : 31-Dec-2001

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	4.33E-02	1.80E-02	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	1.38E-07	7.03E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	2.17E+02	1.17E+02	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	6.90E-04	4.55E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	1.09E-05	1.20E-05	50
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	3.47E-11	4.70E-11	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.00E+00	0.00E+00	45
E. WASTE VOL RELEASED(PRE-DILUTION)	LITERS	7.76E+05	4.94E+05	20
F. VOLUME OF DILUTION WATER USED	LITERS	3.13E+08	2.55E+08	20

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

TABLE 1-2A*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents
Unit: 1
Starting : 1-Jan-2001 Ending : 30-Jun-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDE	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
H-3	CURIES	0.00E+00	0.00E+00	1.31E+02	1.64E+02
FISSION & ACTIVATION PRODUCTS					
CO-57	CURIES	0.00E+00	0.00E+00	2.46E-06	1.57E-06
CO-58	CURIES	0.00E+00	0.00E+00	1.72E-03	7.60E-04
CO-60	CURIES	0.00E+00	0.00E+00	1.47E-02	6.64E-03
CR-51	CURIES	0.00E+00	0.00E+00	1.30E-04	1.85E-04
CS-134	CURIES	0.00E+00	0.00E+00	3.53E-04	1.05E-05
CS-137	CURIES	0.00E+00	0.00E+00	5.23E-04	4.90E-05
FE-55	CURIES	0.00E+00	0.00E+00	1.46E-02	5.72E-03
FE-59	CURIES	0.00E+00	0.00E+00	0.00E+00	1.71E-05
MN-54	CURIES	0.00E+00	0.00E+00	8.78E-04	3.32E-04
NB-95	CURIES	0.00E+00	0.00E+00	2.19E-04	3.05E-05
NB-97	CURIES	0.00E+00	0.00E+00	9.12E-05	1.92E-05
SB-124	CURIES	0.00E+00	0.00E+00	0.00E+00	4.05E-05
SB-125	CURIES	0.00E+00	0.00E+00	1.75E-03	1.55E-03
SR-89	CURIES	0.00E+00	0.00E+00	3.24E-05	3.24E-05
SR-90	CURIES	0.00E+00	0.00E+00	4.59E-05	0.00E+00
SR-92	CURIES	0.00E+00	0.00E+00	3.18E-06	5.89E-06
TE-125M	CURIES	0.00E+00	0.00E+00	6.45E-03	8.18E-04
Y-93	CURIES	0.00E+00	0.00E+00	0.00E+00	4.01E-05
ZR-95	CURIES	0.00E+00	0.00E+00	5.78E-05	0.00E+00
TOTALS	CURIES	0.00E+00	0.00E+00	4.15E-02	1.63E-02
DISSOLVED AND ENTRAINED GASES					
TOTALS	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
G-ALPHA	CURIES	0.00E+00	0.00E+00	1.21E-05	1.02E-06

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

TABLE 1-2A*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents
Unit: 1
Starting : 1-Jul-2001 Ending : 31-Dec-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
H-3	CURIES	0.00E+00	0.00E+00	1.69E+02	9.68E+01
FISSION & ACTIVATION PRODUCTS					
CO-57	CURIES	0.00E+00	0.00E+00	0.00E+00	1.48E-06
CO-58	CURIES	0.00E+00	0.00E+00	5.09E-04	2.00E-04
CO-60	CURIES	0.00E+00	0.00E+00	5.11E-03	3.71E-03
CS-134	CURIES	0.00E+00	0.00E+00	7.90E-05	0.00E+00
CS-137	CURIES	0.00E+00	0.00E+00	2.01E-04	2.76E-06
FE-55	CURIES	0.00E+00	0.00E+00	9.87E-03	3.02E-03
FE-59	CURIES	0.00E+00	0.00E+00	3.74E-06	0.00E+00
MN-54	CURIES	0.00E+00	0.00E+00	3.55E-04	3.53E-04
NB-95	CURIES	0.00E+00	0.00E+00	0.00E+00	4.52E-05
NB-97	CURIES	0.00E+00	0.00E+00	2.16E-05	0.00E+00
SB-124	CURIES	0.00E+00	0.00E+00	1.58E-05	0.00E+00
SB-125	CURIES	0.00E+00	0.00E+00	1.41E-03	2.53E-03
SR-89	CURIES	0.00E+00	0.00E+00	0.00E+00	5.88E-06
SR-90	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-92	CURIES	0.00E+00	0.00E+00	5.83E-06	0.00E+00
TOTALS	CURIES	0.00E+00	0.00E+00	1.76E-02	9.87E-03
DISSOLVED AND ENTRAINED GASES					
XE-133	CURIES	0.00E+00	0.00E+00	0.00E+00	1.20E-05
TOTALS	CURIES	0.00E+00	0.00E+00	0.00E+00	1.20E-05

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

TABLE 1-2B*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents
Unit: 2
Starting : 1-Jan-2001 Ending : 30-Jun-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDE	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
H-3	CURIES	0.00E+00	0.00E+00	5.90E+02	2.74E+02
FISSION & ACTIVATION PRODUCTS					
CO-57	CURIES	0.00E+00	0.00E+00	4.88E-06	0.00E+00
CO-58	CURIES	0.00E+00	0.00E+00	2.27E-03	1.02E-03
CO-60	CURIES	0.00E+00	0.00E+00	1.45E-02	5.92E-03
CR-51	CURIES	0.00E+00	0.00E+00	6.89E-04	3.13E-04
CS-134	CURIES	0.00E+00	0.00E+00	1.09E-03	6.73E-06
CS-137	CURIES	0.00E+00	0.00E+00	1.75E-03	4.05E-05
FE-55	CURIES	0.00E+00	0.00E+00	9.62E-03	8.84E-03
FE-59	CURIES	0.00E+00	0.00E+00	1.31E-05	0.00E+00
I-133	CURIES	0.00E+00	0.00E+00	3.57E-05	0.00E+00
MN-54	CURIES	0.00E+00	0.00E+00	1.24E-03	3.09E-04
NB-95	CURIES	0.00E+00	0.00E+00	3.28E-04	2.16E-06
NB-97	CURIES	0.00E+00	0.00E+00	2.65E-05	0.00E+00
SB-122	CURIES	0.00E+00	0.00E+00	4.65E-06	0.00E+00
SB-124	CURIES	0.00E+00	0.00E+00	9.91E-05	0.00E+00
SB-125	CURIES	0.00E+00	0.00E+00	1.02E-02	5.51E-04
SR-89	CURIES	0.00E+00	0.00E+00	1.76E-04	1.12E-05
SR-90	CURIES	0.00E+00	0.00E+00	1.00E-04	7.38E-07
SR-92	CURIES	0.00E+00	0.00E+00	6.31E-06	0.00E+00
TE-125M	CURIES	0.00E+00	0.00E+00	4.15E-02	0.00E+00
ZR-95	CURIES	0.00E+00	0.00E+00	1.40E-04	0.00E+00
TOTALS	CURIES	0.00E+00	0.00E+00	8.37E-02	1.70E-02
DISSOLVED AND ENTRAINED GASES					
XE-133	CURIES	0.00E+00	0.00E+00	3.73E-04	0.00E+00
XE-135	CURIES	0.00E+00	0.00E+00	3.83E-05	0.00E+00
TOTALS	CURIES	0.00E+00	0.00E+00	4.11E-04	0.00E+00

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

TABLE 1-2B*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents
Unit: 2
Starting : 1-Jul-2001 Ending : 31-Dec-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
H-3	CURIES	0.00E+00	0.00E+00	4.79E+01	2.05E+01
FISSION & ACTIVATION PRODUCTS					
CO-57	CURIES	0.00E+00	0.00E+00	0.00E+00	4.24E-06
CO-58	CURIES	0.00E+00	0.00E+00	3.73E-04	8.75E-05
CO-60	CURIES	0.00E+00	0.00E+00	4.19E-03	1.69E-03
CR-51	CURIES	0.00E+00	0.00E+00	2.05E-05	0.00E+00
CS-134	CURIES	0.00E+00	0.00E+00	1.26E-05	0.00E+00
CS-137	CURIES	0.00E+00	0.00E+00	6.67E-05	8.06E-06
FE-55	CURIES	0.00E+00	0.00E+00	2.04E-02	5.03E-03
MN-54	CURIES	0.00E+00	0.00E+00	1.53E-04	8.89E-05
NB-95	CURIES	0.00E+00	0.00E+00	8.71E-06	0.00E+00
SB-124	CURIES	0.00E+00	0.00E+00	1.03E-05	0.00E+00
SB-125	CURIES	0.00E+00	0.00E+00	2.84E-04	1.22E-03
SR-89	CURIES	0.00E+00	0.00E+00	8.95E-06	5.32E-06
SR-92	CURIES	0.00E+00	0.00E+00	2.49E-06	0.00E+00
TOTALS	CURIES	0.00E+00	0.00E+00	2.55E-02	8.14E-03
DISSOLVED AND ENTRAINED GASES					
	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

TABLE 1-2C*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents
Unit: Site
Starting : 1-Jan-2001 Ending : 30-Jun-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDE	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
H-3	CURIES	0.00E+00	0.00E+00	7.21E+02	4.37E+02
FISSION & ACTIVATION PRODUCTS					
CO-57	CURIES	0.00E+00	0.00E+00	7.34E-06	1.57E-06
CO-58	CURIES	0.00E+00	0.00E+00	3.99E-03	1.78E-03
CO-60	CURIES	0.00E+00	0.00E+00	2.92E-02	1.26E-02
CR-51	CURIES	0.00E+00	0.00E+00	8.18E-04	4.97E-04
CS-134	CURIES	0.00E+00	0.00E+00	1.44E-03	1.72E-05
CS-137	CURIES	0.00E+00	0.00E+00	2.27E-03	8.95E-05
FE-55	CURIES	0.00E+00	0.00E+00	2.42E-02	1.46E-02
FE-59	CURIES	0.00E+00	0.00E+00	1.31E-05	1.71E-05
I-133	CURIES	0.00E+00	0.00E+00	3.57E-05	0.00E+00
MN-54	CURIES	0.00E+00	0.00E+00	2.11E-03	6.41E-04
NB-95	CURIES	0.00E+00	0.00E+00	5.47E-04	3.27E-05
NB-97	CURIES	0.00E+00	0.00E+00	1.18E-04	1.92E-05
SB-122	CURIES	0.00E+00	0.00E+00	4.65E-06	0.00E+00
SB-124	CURIES	0.00E+00	0.00E+00	9.91E-05	4.05E-05
SB-125	CURIES	0.00E+00	0.00E+00	1.19E-02	2.10E-03
SR-89	CURIES	0.00E+00	0.00E+00	2.08E-04	4.36E-05
SR-90	CURIES	0.00E+00	0.00E+00	1.46E-04	7.38E-07
SR-92	CURIES	0.00E+00	0.00E+00	9.49E-06	5.89E-06
TE-125M	CURIES	0.00E+00	0.00E+00	4.79E-02	8.18E-04
Y-93	CURIES	0.00E+00	0.00E+00	0.00E+00	4.01E-05
ZR-95	CURIES	0.00E+00	0.00E+00	1.98E-04	0.00E+00
TOTALS	CURIES	0.00E+00	0.00E+00	1.25E-01	3.33E-02
DISSOLVED AND ENTRAINED GASES					
XE-133	CURIES	0.00E+00	0.00E+00	3.73E-04	0.00E+00
XE-135	CURIES	0.00E+00	0.00E+00	3.83E-05	0.00E+00
TOTALS	CURIES	0.00E+00	0.00E+00	4.11E-04	0.00E+00
G-ALPHA	CURIES	0.00E+00	0.00E+00	1.21E-05	1.02E-06

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

TABLE 1-2C*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents
Unit: Site
Starting : 1-Jul-2001 Ending : 31-Dec-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDE	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
H-3	CURIES	0.00E+00	0.00E+00	2.17E+02	1.17E+02
FISSION & ACTIVATION PRODUCTS					
CO-57	CURIES	0.00E+00	0.00E+00	0.00E+00	5.72E-06
CO-58	CURIES	0.00E+00	0.00E+00	8.82E-04	2.87E-04
CO-60	CURIES	0.00E+00	0.00E+00	9.30E-03	5.40E-03
CR-51	CURIES	0.00E+00	0.00E+00	2.05E-05	0.00E+00
CS-134	CURIES	0.00E+00	0.00E+00	9.16E-05	0.00E+00
CS-137	CURIES	0.00E+00	0.00E+00	2.67E-04	1.08E-05
FE-55	CURIES	0.00E+00	0.00E+00	3.03E-02	8.05E-03
FE-59	CURIES	0.00E+00	0.00E+00	3.74E-06	0.00E+00
MN-54	CURIES	0.00E+00	0.00E+00	5.08E-04	4.41E-04
NB-95	CURIES	0.00E+00	0.00E+00	8.71E-06	4.52E-05
NB-97	CURIES	0.00E+00	0.00E+00	2.16E-05	0.00E+00
SB-124	CURIES	0.00E+00	0.00E+00	2.61E-05	0.00E+00
SB-125	CURIES	0.00E+00	0.00E+00	1.70E-03	3.75E-03
SR-89	CURIES	0.00E+00	0.00E+00	8.95E-06	1.12E-05
SR-90	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR-92	CURIES	0.00E+00	0.00E+00	8.31E-06	0.00E+00
TOTALS	CURIES	0.00E+00	0.00E+00	4.31E-02	1.80E-02
DISSOLVED AND ENTRAINED GASES					
XE-133	CURIES	0.00E+00	0.00E+00	0.00E+00	1.20E-05
TOTALS	CURIES	0.00E+00	0.00E+00	1.09E+00	1.20E-05

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 1-4 for typical minimum detectable concentrations.

TABLE 1-3A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
DOSES TO A MEMBER OF THE PUBLIC DUE TO LIQUID RELEASES
Unit: 1
Starting: 01-Jan-2001 Ending: 30-Jun-2001

Cumulative Doses per Quarter

Organ	ODCM Limit	Units	Quarter 1	% of ODCM Limit	Quarter 2	% of ODCM Limit
Bone	5.0	mrem	3.28E-02	6.57E-01	3.94E-04	7.89E-03
Liver	5.0	mrem	4.75E-02	9.49E-01	3.92E-03	7.84E-02
TBody	1.5	mrem	4.38E-02	2.92E+00	3.78E-03	2.52E-01
Thyroid	5.0	mrem	3.61E-02	7.23E-01	3.42E-03	6.83E-02
Kidney	5.0	mrem	9.43E-02	1.89E+00	3.63E-03	7.27E-02
Lung	5.0	mrem	4.88E-02	9.76E-01	6.72E-03	1.34E-01
GILLI	5.0	mrem	1.16E-01	2.32E+00	4.48E-03	8.97E-02

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	10.0	mrem	3.32E-02	3.32E-01
Liver	10.0	mrem	5.14E-02	5.14E-01
TBody	3.0	mrem	4.76E-02	1.59E+00
Thyroid	10.0	mrem	3.96E-02	3.96E-01
Kidney	10.0	mrem	9.79E-02	9.79E-01
Lung	10.0	mrem	5.55E-02	5.55E-01
GILLI	10.0	mrem	1.20E-01	1.20E+00

TABLE 1-3A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
DOSES TO A MEMBER OF THE PUBLIC DUE TO LIQUID RELEASES
Unit: 1
Starting: 01-Jul-2001 Ending: 31-Dec-2001

Cumulative Doses per Quarter

Organ	ODCM Limit	Units	Quarter 3	% of ODCM Limit	Quarter 4	% of ODCM Limit
Bone	5.0	mrem	2.81E-03	5.63E-02	6.50E-05	1.30E-03
Liver	5.0	mrem	7.30E-03	1.46E-01	1.43E-03	2.87E-02
TBody	1.5	mrem	6.04E-03	4.02E-01	1.42E-03	9.48E-02
Thyroid	5.0	mrem	2.86E-03	5.72E-02	1.37E-03	2.75E-02
Kidney	5.0	mrem	4.32E-03	8.63E-02	1.38E-03	2.77E-02
Lung	5.0	mrem	6.33E-03	1.27E-01	4.45E-03	8.90E-02
GILLI	5.0	mrem	3.83E-03	7.66E-02	1.92E-03	3.85E-02

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	10.0	mrem	3.61E-02	3.61E-01
Liver	10.0	mrem	6.01E-02	6.01E-01
TBody	3.0	mrem	5.50E-02	1.83E+00
Thyroid	10.0	mrem	4.38E-02	4.38E-01
Kidney	10.0	mrem	1.04E-01	1.04E+00
Lung	10.0	mrem	6.63E-02	6.63E-01
GILLI	10.0	mrem	1.26E-01	1.26E+00

TABLE 1-3B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
DOSES TO A MEMBER OF THE PUBLIC DUE TO LIQUID RELEASES
Unit: 2
Starting: 01-Jan-2001 Ending: 30-Jun-2001

Cumulative Doses per Quarter

Organ	ODCM Limit	Units	Quarter 1	% of ODCM Limit	Quarter 2	% of ODCM Limit
Bone	5.0	mrem	1.69E-02	3.38E-01	3.39E-04	6.78E-03
Liver	5.0	mrem	3.50E-02	7.01E-01	5.51E-03	1.10E-01
TBody	1.5	mrem	2.83E-02	1.89E+00	5.37E-03	3.58E-01
Thyroid	5.0	mrem	1.05E-02	2.10E-01	5.06E-03	1.01E-01
Kidney	5.0	mrem	2.40E-02	4.80E-01	5.18E-03	1.04E-01
Lung	5.0	mrem	2.84E-02	5.68E-01	6.10E-03	1.22E-01
GILLI	5.0	mrem	1.92E-02	3.84E-01	5.76E-03	1.15E-01

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	10.0	mrem	1.72E-02	1.72E-01
Liver	10.0	mrem	4.06E-02	4.06E-01
TBody	3.0	mrem	3.37E-02	1.12E+00
Thyroid	10.0	mrem	1.55E-02	1.55E-01
Kidney	10.0	mrem	2.92E-02	2.92E-01
Lung	10.0	mrem	3.45E-02	3.45E-01
GILLI	10.0	mrem	2.49E-02	2.49E-01

TABLE 1-3B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
DOSES TO A MEMBER OF THE PUBLIC DUE TO LIQUID RELEASES
Unit: 2
Starting: 01-Jul-2001 Ending: 31-Dec-2001

Cumulative Doses per Quarter

Organ	ODCM Limit	Units	Quarter 3	% of ODCM Limit	Quarter 4	% of ODCM Limit
Bone	5.0	mrem	7.84E-04	1.57E-02	9.80E-05	1.96E-03
Liver	5.0	mrem	1.96E-03	3.92E-02	4.07E-04	8.14E-03
TBody	1.5	mrem	1.61E-03	1.08E-01	3.71E-04	2.48E-02
Thyroid	5.0	mrem	9.35E-04	1.87E-02	3.12E-04	6.25E-03
Kidney	5.0	mrem	1.23E-03	2.46E-02	3.33E-04	6.66E-03
Lung	5.0	mrem	1.79E-03	3.58E-02	1.89E-03	3.78E-02
GILLI	5.0	mrem	1.58E-03	3.17E-02	5.72E-04	1.14E-02

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	10.0	mrem	1.81E-02	1.81E-01
Liver	10.0	mrem	4.29E-02	4.29E-01
TBody	3.0	mrem	3.57E-02	1.19E+00
Thyroid	10.0	mrem	1.68E-02	1.68E-01
Kidney	10.0	mrem	3.08E-02	3.08E-01
Lung	10.0	mrem	3.82E-02	3.82E-01
GILLI	10.0	mrem	2.71E-02	2.71E-01

TABLE 1-4
VOGTLE ELECTRIC GENERATING PLANT
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
MINIMUM DETECTABLE CONCENTRATIONS - LIQUID SAMPLE ANALYSES

JANUARY 2001 - DECEMBER 2001

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

RADIONUCLIDE	MDC	UNITS
Mn-54	2.73E-08	µCi/ml
Fe-59	8.33E-08	µCi/ml
Co-58	3.78E-08	µCi/ml
Co-60	6.76E-08	µCi/ml
Zn-65	1.32E-07	µCi/ml
Mo-99	4.31E-07	µCi/ml
Cs-134	3.06E-08	µCi/ml
Cs-137	4.51E-08	µCi/ml
Ce-141	6.99E-08	µCi/ml
Ce-144	2.95E-07	µCi/ml
I-131	5.97E-08	µCi/ml
Xe-133	9.11E-08	µCi/ml
Xe-135	4.27E-08	µCi/ml
Fe-55	1.00E-06	µCi/ml
Sr-89	5.00E-08	µCi/ml
Sr-90	7.00E-09	µCi/ml
H-3	2.00E-06	µCi/ml
Gross Alpha	7.00E-08	µCi/ml

TABLE 1-5A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Batch Release Summary
Unit: 1
Starting : 1-Jan-2001 Ending : 30-Jun-2001

NUMBER OF BATCH RELEASES	:	43	
TOTAL TIME PERIOD FOR BATCH RELEASES	:	5726.58	MINUTES
MAXIMUM TIME PERIOD FOR A BATCH RELEASE	:	336.00	MINUTES
AVERAGE TIME PERIOD FOR BATCH RELEASES	:	133.18	MINUTES
MINIMUM TIME PERIOD FOR A BATCH RELEASE	:	2.00	MINUTES

TABLE 1-5A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Batch Release Summary
Unit: 1
Starting : 1-Jul-2001 Ending : 31-Dec-2001

NUMBER OF BATCH RELEASES	:	29	
TOTAL TIME PERIOD FOR BATCH RELEASES	:	5056.62	MINUTES
MAXIMUM TIME PERIOD FOR A BATCH RELEASE	:	590.00	MINUTES
AVERAGE TIME PERIOD FOR BATCH RELEASES	:	174.37	MINUTES
MINIMUM TIME PERIOD FOR A BATCH RELEASE	:	1.00	MINUTES

The average flow rate of the Savannah River at Augusta for the Radioactive Effluent Release Report period was obtained from the U.S. Army Corps of Engineers Savannah District Historic Data web page http://water.sas.usace.army.mil/tdis.html.
The average flow rate for 2001 was 4198 cubic feet per sec.

TABLE 1-5B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Batch Release Summary
Unit: 2
Starting : 1-Jan-2001 Ending : 30-Jun-2001

NUMBER OF BATCH RELEASES	:	47	
TOTAL TIME PERIOD FOR BATCH RELEASES	:	9524.17	MINUTES
MAXIMUM TIME PERIOD FOR A BATCH RELEASE	:	671.00	MINUTES
AVERAGE TIME PERIOD FOR BATCH RELEASES	:	202.64	MINUTES
MINIMUM TIME PERIOD FOR A BATCH RELEASE	:	2.50	MINUTES

TABLE 1-5B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Batch Release Summary
Unit: 2
Starting : 1-Jul-2001 Ending : 31-Dec-2001

NUMBER OF BATCH RELEASES	:	12	
TOTAL TIME PERIOD FOR BATCH RELEASES	:	2128.58	MINUTES
MAXIMUM TIME PERIOD FOR A BATCH RELEASE	:	297.98	MINUTES
AVERAGE TIME PERIOD FOR BATCH RELEASES	:	177.38	MINUTES
MINIMUM TIME PERIOD FOR A BATCH RELEASE	:	67.38	MINUTES

The average flow rate of the Savannah River at Augusta for the Radioactive Effluent Release Report period was obtained from the U.S. Army Corps of Engineers Savannah District Historic Data web page http://water.sas.usace.army.mil/tdis.html.
The average flow rate for 2001 was 4198 cubic feet per sec.

TABLE 1-6A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Abnormal Release Summary
Unit: 1
Starting : 1-Jan-2001 Ending : 30-Jun-2001

NUMBER OF RELEASES	:	0	
TOTAL TIME FOR ALL RELEASES	:	0.00	MINUTES
MAXIMUM TIME FOR A RELEASE	:	0.00	MINUTES
AVERAGE TIME FOR A RELEASE	:	0.00	MINUTES
MINIMUM TIME FOR A RELEASE	:	0.00	MINUTES
TOTAL ACTIVITY FOR ALL RELEASES	:	0.00E+00	CURIES

TABLE 1-6A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Abnormal Release Summary
Unit: 1
Starting : 1-Jul-2001 Ending : 31-Dec-2001

NUMBER OF RELEASES	:	0	
TOTAL TIME FOR ALL RELEASES	:	0.00	MINUTES
MAXIMUM TIME FOR A RELEASE	:	0.00	MINUTES
AVERAGE TIME FOR A RELEASE	:	0.00	MINUTES
MINIMUM TIME FOR A RELEASE	:	0.00	MINUTES
TOTAL ACTIVITY FOR ALL RELEASES	:	0.00E+00	CURIES

TABLE 1-6B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Abnormal Release Summary
Unit: 2
Starting : 1-Jan-2001 Ending : 30-Jun-2001

NUMBER OF RELEASES	:	0	
TOTAL TIME FOR ALL RELEASES	:	0.00	MINUTES
MAXIMUM TIME FOR A RELEASE	:	0.00	MINUTES
AVERAGE TIME FOR A RELEASE	:	0.00	MINUTES
MINIMUM TIME FOR A RELEASE	:	0.00	MINUTES
TOTAL ACTIVITY FOR ALL RELEASES	:	0.00E+00	CURIES

TABLE 1-6B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Liquid Effluents - Abnormal Release Summary
Unit: 2
Starting : 1-Jul-2001 Ending : 31-Dec-2001

NUMBER OF RELEASES	:	0	
TOTAL TIME FOR ALL RELEASES	:	0.00	MINUTES
MAXIMUM TIME FOR A RELEASE	:	0.00	MINUTES
AVERAGE TIME FOR A RELEASE	:	0.00	MINUTES
MINIMUM TIME FOR A RELEASE	:	0.00	MINUTES
TOTAL ACTIVITY FOR ALL RELEASES	:	0.00E+00	CURIES

2.0 Gaseous Effluents

2.1 Regulatory Requirements

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

2.1.1 Dose Rate Limits

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, for Iodine-133, for 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 Doses Due to Noble Gases in Gaseous Releases

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 Doses to a Member of the Public

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.

2.2 Measurements and Approximations of Total Radioactivity

2.2.1 Sample Collection and Analysis

Gaseous Effluents at the Vogtle Electric Generating Plant are currently confined to six paths: plant vents (Unit 1 and Unit 2), the condenser air ejector, the steam packing exhauster systems (Unit 1 and Unit 2), Radwaste Processing Facility and the DAW (Dry Active Waste Building).

Waste gas decay tanks are batch released through the Unit 1 plant vent. The containment purges are released through their respective plant vents.

All of the paths with the exception of the DAW and RPF can be continuously monitored for gaseous radioactivity. The RPF is equipped with an integrated-type sample collection device for collecting particulates. Plant vent, containment, steam jet air ejector, steam-packing exhauster are equipped with an integrated-type sample collection device for collecting particulates and iodines. Samples of the DAW are collected using portable monitoring equipment during periods of operation. During this reporting period, there were no continuous radioactive releases through the condenser air ejector and the steam packing exhauster system vents. There were no releases from the DAW. Batch Waste Gas Decay Tank releases are analyzed for noble gases before each release. The containment atmosphere is analyzed for noble gases prior to each release and for tritium at least on a monthly basis.

Sample analyses results and release flow rates 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.

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

Typically achieved minimum detectable concentrations for gaseous effluent sample analyses are reported in Table 2-6.

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

The methods for determining release quantities of radioactivity, dose rates, and cumulative doses are as follows:

2.2.2.1 Fission and Activation Gases

The released radioactivity is determined from sample analyses results collected as described above and average release flow rates over the period represented by the collected sample. Dose rates due to noble gases, radioiodines, tritium,

2.2.2.1 Fission and Activation Gases cont'd

and particulates are calculated. Calculated dose rates are compared to the dose rate limits specified in ODCM 3.1.2 for noble gases, radioiodines, 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 with the dose limits specified in ODCM 3.1.3. Current percent of the ODCM limits are shown on the printout for each release period. Air dose calculation methodology is presented in the ODCM.

2.2.2.2 Radioiodines, Tritium and Particulate Releases

The released quantities of radioiodines, tritium and particulates are determined using the weekly samples and release flow rates for the two plant vent release points.

After each quarter, the particulate filters from each plant vent are combined, for strontium analysis. Strontium concentrations are input to the composite file of the computer to be used for release dose rate and individual dose calculations.

Doses to a Member of the Public due to radioiodines, tritium and particulates are calculated for the controlling receptor, which is described in Table 3-7of the ODCM. Doses are calculated for each release period, and cumulative totals are kept for each unit for the current calendar quarter and year. Cumulative doses are compared to the dose limits specified in ODCM 3.1.4.

Current percent of ODCM limits are shown in this report for each release period.

2.2.2.3 Gross Alpha Release

The gross alpha release is calculated each month by counting the particulate filters for each week for gross alpha activity. The four or five weeks' numbers are then recorded on a data sheet and the activity is summed at the end of the month. This concentration is used for release calculations.

2.2.3 Total Error Estimation

The total or maximum error associated with the effluent measurement will include the cumulative errors resulting from the total operation of sampling and measurement. Because it may be very difficult to assign error terms for each parameter affecting the final measurement, detailed statistical evaluation of error are not suggested.

2.2.3 Total Error Estimation cont'd

The objective should be 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.

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

Sampling and statistical error in counting	10%
Counting equipment calibration	10%
Vent flow Rates	10%
Non-steady release rates	20%
TOTAL ERROR	50%

b. I-131 releases were calculated from each weekly sample:

Statistical error in counting	10%
Counting equipment calibration	10%
Vent Flow Rates	10%
Vent Sample Flow Rates	50%
Non-Steady release rates	10%
Losses from charcoal cartridges	10%
TOTAL ERROR	100%

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

Statistical error at MDC concentration	10%
Counting equipment calibration	10%
Vent flow rates	10%
Vent sample flow rates	50%
Non steady release rates	10%
TOTAL ERROR	90%

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

Water vapor in sample stream determination	10%
Vent flow rates	10%
Counting calibration and statistics	10%
Non-steady release rates	10%
TOTAL ERROR	40%

2.2.3 Total Error Estimation cont'd

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

Statistical error at MDC concentration	10%
Counting equipment calibration	10%
Vent flow rates	10%
Vent sample flow rates	50%
Non Steady release rates	10%
TOTAL ERROR	90%

2.3 Gaseous Effluent Release Data

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

To complete table 2-1A, and 2-1B, the total release for each of the four categories (fission and activation gases, iodines, particulates, and tritium) was divided by the number of seconds in the quarter to obtain a release rate in µCi/second for each category. However, the percent of the ODCM limits are not applicable because VEGP has 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 radioiodines, tritium, and particulate releases were calculated as part of the pre-release and post-release permits. No limits were exceeded for this reporting period.

Gross alpha radioactivity is reported in Table 2-1A, and 2-1B 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 the percent of the ODCM limits.

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

2.4 Radiological Impact Due to Gaseous Releases

Dose rates due to the release of noble gases were calculated for the site in accordance with ODCM 3.4.1.1. Dose rates due to radioiodines, tritium, and particulates in gaseous releases were calculated in accordance with ODCM 3.4.1.2.

Dose rates were calculated as part of pre-release and post 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 3.4.2. These results are presented in Tables 2-4A and 2-4B.

Cumulative doses to a Member of the Public were calculated for each unit in accordance with ODCM 3.4.3. These results are presented in Tables 2-5A and 2-5B.

Dose rates and doses were calculated using the methodology presented in the Vogtle Electric Generating Plant Offsite Dose Calculation Manual.

2.5 Gaseous Effluents - Batch Releases

Other data pertinent to batch releases of radioactive gaseous effluent from Unit 1 and Unit 2 are listed in Table 2-7A and 2-7B.

2.6 Gaseous Effluents - Abnormal Releases

Condition Report # 2001001003 was written on 4/25/2001 for an unplanned release that happened on 4/12/2001. This resulted with a loss of 25 psig of WGDT #4 (2-1902-V6-004) contents. Since no alarm came in on 2RE-12442C/12444C, no ODCM limits were exceeded. Also due to the fact that no samples were obtained during the incident, curie content of this incident could not be determined.

TABLE 2-1A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Summation of All Releases
Unit: 1
Starting : 1-Jan-2001 Ending : 30-Jun-2001

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	1.35E+00	6.54E+00	50
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.73E-01	8.32E-01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	1.24E-06	0.00E+00	100
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.60E-07	0.00E+00	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	2.59E-06	2.14E-07	90
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	3.33E-07	2.72E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
4. GROSS ALPHA RADIOACTIVITY	CURIES	0.00E+00	0.00E+00	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	1.66E+01	4.53E+01	40
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	2.14E+00	5.76E+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 2-1A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Summation of All Releases
Unit: 1
Starting : 1-Jul-2001 Ending : 31-Dec-2001

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	6.64E-02	4.17E+00	50
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	8.35E-03	5.24E-01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	3.68E-06	1.83E-06	100
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	4.63E-07	2.30E-07	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	1.79E-06	1.31E-06	90
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	2.25E-07	1.65E-07	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
4. GROSS ALPHA RADIOACTIVITY	CURIES	0.00E+00	0.00E+00	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	5.82E+01	3.61E+01	40
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	7.32E+00	4.54E+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 2-1B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Summation of All Releases
Unit: 2
Starting : 1-Jan-2001 Ending : 30-Jun-2001

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	9.28E-02	2.30E-01	50
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.19E-02	2.92E-02	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	9.36E-06	6.00E-07	100
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.20E-06	7.63E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	6.99E-06	3.55E-06	90
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	8.99E-07	4.51E-07	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
4. GROSS ALPHA RADIOACTIVITY	CURIES	0.00E+00	0.00E+00	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	9.63E+00	1.93E+01	40
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.24E+00	2.45E+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 2-1B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Summation of All Releases
Unit: 2
Starting : 1-Jul-2001 Ending : 31-Dec-2001

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	4.39E-02	6.29E-02	50
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	5.53E-03	7.91E-03	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	2.33E-07	0.00E+00	100
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	2.93E-08	0.00E+00	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	5.33E-06	1.10E-07	90
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	6.70E-07	1.39E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
4. GROSS ALPHA RADIOACTIVITY	CURIES	0.00E+00	0.00E+00	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	2.73E+00	1.11E+01	40
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	3.44E-01	1.40E+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 2-1C
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Summation of All Releases
Unit: Site
Starting : 1-Jan-2001 Ending : 30-Jun-2001

TYPE OF EFFLUENT	UNITS	QUARTER 1	QUARTER 2	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	1.44E+00	6.77E+00	50
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.85E-01	8.61E-01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	1.06E-05	6.00E-07	100
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.36E-06	7.63E-08	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	9.58E-06	3.76E-06	90
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.23E-06	4.78E-07	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
4. GROSS ALPHA RADIOACTIVITY	CURIES	0.00E+00	0.00E+00	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	2.62E+01	6.45E+01	40
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	3.37E+00	8.21E+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 2-1C
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Summation of All Releases
Unit: Site
Starting : 1-Jul-2001 Ending : 31-Dec-2001

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE	CURIES	1.10E-01	4.23E+00	50
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	1.39E-02	5.32E-01	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	3.92E-06	1.83E-06	100
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	4.93E-07	2.30E-07	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. PARTICULATES				
1. PARTICULATES(HALF-LIVES>8 DAYS)	CURIES	7.12E-06	1.42E-06	90
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	8.95E-07	1.79E-07	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
4. GROSS ALPHA RADIOACTIVITY	CURIES	0.00E+00	0.00E+00	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	6.09E+01	4.72E+01	40
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/Sec	7.66E+00	5.94E+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 2-2A*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents-Mixed-Mode Level Releases
Unit: 1
Starting : 1-Jan-2001 Ending : 30-Jun-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
FISSION GASES					
AR-41	CURIES	0.00E+00	1.17E+00	5.72E-02	5.31E-02
XE-135	CURIES	0.00E+00	2.34E-01	4.12E-04	0.00E+00
XE-133	CURIES	0.00E+00	5.07E+00	1.03E-02	4.02E-03
KR-85	CURIES	0.00E+00	0.00E+00	1.28E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	0.00E+00	6.48E+00	1.35E+00	5.72E-02
IODINES					
I-131	CURIES	1.24E-06	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.24E-06	0.00E+00	0.00E+00	0.00E+00
PARTICULATES					
SR-89	CURIES	7.99E-08	2.14E-07	0.00E+00	0.00E+00
BE-7	CURIES	2.51E-06	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.59E-06	2.14E-07	0.00E+00	0.00E+00
H-3	CURIES	1.66E+01	4.53E+01	2.10E-02	6.01E-03

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

TABLE 2-2A*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents-Mixed-Mode Level Releases
Unit: 1
Starting : 1-Jul-2001 Ending : 31-Dec-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
FISSION GASES					
AR-41	CURIES	0.00E+00	0.00E+00	6.05E-02	6.26E-02
XE-135	CURIES	0.00E+00	0.00E+00	0.00E+00	2.01E-05
XE-133	CURIES	0.00E+00	3.89E+00	5.87E-03	2.16E-01
TOTAL FOR PERIOD	CURIES	0.00E+00	3.89E+00	6.64E-02	2.78E-01
IODINES					
I-133	CURIES	4.24E-05	9.42E-06	0.00E+00	0.00E+00
I-131	CURIES	3.68E-06	1.83E-06	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	4.61E-05	1.12E-05	0.00E+00	0.00E+00
PARTICULATES					
SR-89	CURIES	2.05E-07	1.73E-07	0.00E+00	0.00E+00
BE-7	CURIES	1.59E-06	0.00E+00	0.00E+00	0.00E+00
CO-60	CURIES	0.00E+00	1.14E-06	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.79E-06	1.31E-06	0.00E+00	0.00E+00
H-3	CURIES	5.82E+01	3.61E+01	1.38E-02	3.29E-02

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

TABLE 2-2B*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents-Mixed-Mode Level Releases
Unit: 2
Starting : 1-Jan-2001 Ending : 30-Jun-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
FISSION GASES					
AR-41	CURIES	0.00E+00	0.00E+00	3.72E-02	1.11E-01
XE-135	CURIES	0.00E+00	0.00E+00	2.34E-03	2.05E-03
XE-133	CURIES	0.00E+00	0.00E+00	5.33E-02	1.11E-01
TOTAL FOR PERIOD	CURIES	0.00E+00	0.00E+00	9.28E-02	2.24E-01
IODINES					
I-133	CURIES	4.37E-05	0.00E+00	0.00E+00	0.00E+00
I-131	CURIES	9.36E-06	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	5.31E-05	0.00E+00	0.00E+00	0.00E+00
PARTICULATES					
CR-51	CURIES	2.42E-06	0.00E+00	0.00E+00	0.00E+00
SR-89	CURIES	1.08E-07	1.14E-07	0.00E+00	0.00E+00
BE-7	CURIES	7.49E-07	0.00E+00	0.00E+00	0.00E+00
CO-58	CURIES	1.27E-06	2.40E-07	0.00E+00	0.00E+00
CO-60	CURIES	2.22E-06	3.19E-06	0.00E+00	0.00E+00
CS-137	CURIES	2.17E-07	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	6.99E-06	3.55E-06	0.00E+00	0.00E+00
H-3	CURIES	9.59E+00	1.89E+01	3.87E-02	3.21E-01

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

TABLE 2-2B*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents-Mixed-Mode Level Releases
Unit: 2
Starting : 1-Jul-2001 Ending : 31-Dec-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
FISSION GASES					
AR-41	CURIES	0.00E+00	0.00E+00	2.01E-02	2.62E-02
XE-135	CURIES	0.00E+00	0.00E+00	3.56E-04	3.18E-04
XE-133	CURIES	0.00E+00	0.00E+00	2.34E-02	3.64E-02
TOTAL FOR PERIOD	CURIES	0.00E+00	0.00E+00	4.39E-02	6.29E-02
IODINES					
I-131	CURIES	2.33E-07	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.33E-07	0.00E+00	0.00E+00	0.00E+00
PARTICULATES					
SR-89	CURIES	9.35E-08	1.10E-07	0.00E+00	0.00E+00
BE-7	CURIES	2.18E-06	0.00E+00	0.00E+00	0.00E+00
CO-60	CURIES	3.05E-06	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	5.33E-06	1.10E-07	0.00E+00	0.00E+00
H-3	CURIES	2.72E+00	1.11E+01	8.40E-03	1.08E-02

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

TABLE 2-2C*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents-Mixed-Mode Level Releases
Unit: Site
Starting : 1-Jan-2001 Ending : 30-Jun-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
FISSION GASES					
AR-41	CURIES	0.00E+00	1.17E+00	9.44E-02	1.64E-01
XE-135	CURIES	0.00E+00	2.34E-01	2.76E-03	2.05E-03
XE-133	CURIES	0.00E+00	5.07E+00	6.36E-02	1.15E-01
KR-85	CURIES	0.00E+00	0.00E+00	1.28E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	0.00E+00	6.48E+00	1.44E+00	2.81E-01
IODINES					
I-133	CURIES	4.37E-05	0.00E+00	0.00E+00	0.00E+00
I-131	CURIES	1.06E-05	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	5.43E-05	0.00E+00	0.00E+00	0.00E+00
PARTICULATES					
CR-51	CURIES	2.42E-06	0.00E+00	0.00E+00	0.00E+00
SR-89	CURIES	1.88E-07	3.27E-07	0.00E+00	0.00E+00
BE-7	CURIES	3.26E-06	0.00E+00	0.00E+00	0.00E+00
CO-58	CURIES	1.27E-06	2.40E-07	0.00E+00	0.00E+00
CO-60	CURIES	2.22E-06	3.19E-06	0.00E+00	0.00E+00
CS-137	CURIES	2.17E-07	0.00E+00	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	9.58E-06	3.76E-06	0.00E+00	0.00E+00
H-3	CURIES	2.62E+01	6.42E+01	5.97E-02	3.27E-01

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

TABLE 2-2C*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents-Mixed-Mode Level Releases
Unit: Site
Starting : 1-Jul-2001 Ending : 31-Dec-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
FISSION GASES					
AR-41	CURIES	0.00E+00	0.00E+00	8.07E-02	8.87E-02
XE-135	CURIES	0.00E+00	0.00E+00	3.56E-04	3.38E-04
XE-133	CURIES	0.00E+00	3.89E+00	2.93E-02	2.52E-01
TOTAL FOR PERIOD	CURIES	0.00E+00	3.89E+00	1.10E-01	3.41E-01
IODINES					
I-133	CURIES	4.24E-05	9.42E-06	0.00E+00	0.00E+00
I-131	CURIES	3.92E-06	1.83E-06	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	4.63E-05	1.12E-05	0.00E+00	0.00E+00
PARTICULATES					
SR-89	CURIES	2.98E-07	2.84E-07	0.00E+00	0.00E+00
BE-7	CURIES	3.77E-06	0.00E+00	0.00E+00	0.00E+00
CO-60	CURIES	3.05E-06	1.14E-06	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	7.12E-06	1.42E-06	0.00E+00	0.00E+00
H-3	CURIES	6.09E+01	4.72E+01	2.22E-02	4.37E-02

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

TABLE 2-3A*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents-Ground Level Releases
Unit: 1
Starting : 1-Jan-2001 Ending : 30-Jun-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
TOTAL FOR PERIOD	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

TABLE 2-3A*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents-Ground Level Releases
Unit: 1
Starting : 1-Jul-2001 Ending : 31-Dec-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
TOTAL FOR PERIOD	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

TABLE 2-3B*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents-Ground Level Releases
Unit: 2
Starting : 1-Jan-2001 Ending : 30-Jun-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
FISSION GASES					
XE-133	CURIES	0.00E+00	0.00E+00	0.00E+00	5.47E-03
TOTAL FOR PERIOD	CURIES	0.00E+00	0.00E+00	0.00E+00	5.47E-03
IODINES					
I-132	CURIES	0.00E+00	0.00E+00	0.00E+00	3.57E-06
I-131	CURIES	0.00E+00	0.00E+00	0.00E+00	6.00E-07
TOTAL FOR PERIOD	CURIES	0.00E+00	0.00E+00	0.00E+00	4.17E-06
H-3	CURIES	0.00E+00	0.00E+00	0.00E+00	3.57E-02

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

TABLE 2-3B*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents-Ground Level Releases
Unit: 2
Starting : 1-Jul-2001 Ending : 31-Dec-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	UNIT	QUARTER 0	QUARTER 0	QUARTER 0	QUARTER 0
TOTAL FOR PERIOD	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

TABLE 2-3C*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents-Ground Level Releases
Unit: Site
Starting : 1-Jan-2001 Ending : 30-Jun-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	UNIT	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
FISSION GASES					
XE-133	CURIES	0.00E+00	0.00E+00	0.00E+00	5.47E-03
TOTAL FOR PERIOD	CURIES	0.00E+00	0.00E+00	0.00E+00	5.47E-03
IODINES					
I-132	CURIES	0.00E+00	0.00E+00	0.00E+00	3.57E-06
I-131	CURIES	0.00E+00	0.00E+00	0.00E+00	6.00E-07
TOTAL FOR PERIOD	CURIES	0.00E+00	0.00E+00	0.00E+00	4.17E-06
H-3	CURIES	0.00E+00	0.00E+00	0.00E+00	3.57E-02

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

TABLE 2-3C*
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents-Ground Level Releases
Unit: Site
Starting : 1-Jul-2001 Ending : 31-Dec-2001

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES RELEASED	UNIT	QUARTER 3	QUARTER 4	QUARTER 3	QUARTER 4
TOTAL FOR PERIOD	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00

* Zeroes in this table indicate that no radioactivity was present at detectable levels.
See Table 2-6 for typical minimum detectable concentrations.

TABLE 2-4A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
AIR DOSES DUE TO GASEOUS RELEASES
Unit: 1

Starting: 01-Jan-2001 Ending: 30-Jun-2001

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	8.18E-06	1.64E-04	2.00E-04	4.00E-03
Beta	10.0	mrad	3.94E-05	3.94E-04	1.45E-04	1.45E-03

Cumulative Doses per Year

Type of Radi-ation	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Gamma	10.0	mrad	2.08E-04	2.08E-03
Beta	20.0	mrad	1.85E-04	9.24E-04

TABLE 2-4A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
AIR DOSES DUE TO GASEOUS RELEASES
Unit: 1

Starting: 01-Jul-2001 Ending: 31-Dec-2001

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	8.27E-06	1.65E-04	2.98E-05	5.95E-04
Beta	10.0	mrad	3.00E-06	3.00E-05	6.62E-05	6.62E-04

Cumulative Doses per Year

Type of Radi-ation	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Gamma	10.0	mrad	2.46E-04	2.46E-03
Beta	20.0	mrad	2.54E-04	1.27E-03

TABLE 2-4B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
AIR DOSES DUE TO GASEOUS RELEASES
Unit: 2

Starting: 01-Jan-2001 Ending: 30-Jun-2001

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	5.41E-06	1.08E-04	1.59E-05	3.19E-04
Beta	10.0	mrad	2.69E-06	2.69E-05	7.59E-06	7.59E-05

Cumulative Doses per Year

Type of Radi-ation	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Gamma	10.0	mrad	2.14E-05	2.14E-04
Beta	20.0	mrad	1.03E-05	5.14E-05

TABLE 2-4B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
AIR DOSES DUE TO GASEOUS RELEASES
Unit: 2

Starting: 01-Jul-2001 Ending: 31-Dec-2001

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	2.87E-06	5.75E-05	3.76E-06	7.52E-05
Beta	10.0	mrad	1.34E-06	1.34E-05	1.83E-06	1.83E-05

Cumulative Doses per Year

Type of Radi-ation	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Gamma	10.0	mrad	2.80E-05	2.80E-04
Beta	20.0	mrad	1.34E-05	6.72E-05

TABLE 2-5A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
DOSES TO A MEMBER OF THE PUBLIC DUE TO RADIOIODINES, TRITIUM, AND PARTICULATES IN GASEOUS RELEASES
Unit: 1
Starting: 01-Jan-2001 Ending: 30-Jun-2001

Cumulative Doses per Quarter

Organ	ODCM Limit	Unit	Quarter 1	% of ODCM Limit	Quarter 2	% of ODCM Limit
Bone	7.5	mrem	5.40E-08	7.20E-07	5.06E-08	6.74E-07
Liver	7.5	mrem	1.07E-04	1.42E-03	2.91E-04	3.88E-03
TBody	7.5	mrem	1.07E-04	1.42E-03	2.91E-04	3.88E-03
Thyroid	7.5	mrem	1.08E-04	1.44E-03	2.91E-04	3.88E-03
Kidney	7.5	mrem	1.07E-04	1.42E-03	2.91E-04	3.88E-03
Lung	7.5	mrem	1.07E-04	1.42E-03	2.91E-04	3.88E-03
GILLI	7.5	mrem	1.07E-04	1.42E-03	2.91E-04	3.88E-03

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	15.0	mrem	1.05E-07	6.97E-07
Liver	15.0	mrem	3.98E-04	2.65E-03
TBody	15.0	mrem	3.98E-04	2.65E-03
Thyroid	15.0	mrem	3.99E-04	2.66E-03
Kidney	15.0	mrem	3.98E-04	2.65E-03
Lung	15.0	mrem	3.98E-04	2.65E-03
GILLI	15.0	mrem	3.98E-04	2.65E-03

TABLE 2-5A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
DOSES TO A MEMBER OF THE PUBLIC DUE TO RADIOIODINES, TRITIUM, AND PARTICULATES IN GASEOUS RELEASES
Unit: 1

Starting: 01-Jul-2001 Ending: 31-Dec-2001

Cumulative Doses per Quarter

Organ	ODCM Limit	Unit	Quarter 3	% of ODCM Limit	Quarter 4	% of ODCM Limit
Bone	7.5	mrem	4.69E-08	6.25E-07	4.06E-07	5.41E-06
Liver	7.5	mrem	2.66E-04	3.55E-03	2.33E-04	3.10E-03
TBody	7.5	mrem	2.66E-04	3.55E-03	2.33E-04	3.10E-03
Thyroid	7.5	mrem	2.68E-04	3.57E-03	2.33E-04	3.11E-03
Kidney	7.5	mrem	2.66E-04	3.55E-03	2.33E-04	3.10E-03
Lung	7.5	mrem	2.66E-04	3.55E-03	2.33E-04	3.10E-03
GILLI	7.5	mrem	2.66E-04	3.55E-03	2.33E-04	3.10E-03

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	15.0	mrem	5.58E-07	3.72E-06
Liver	15.0	mrem	8.97E-04	5.98E-03
TBody	15.0	mrem	8.96E-04	5.98E-03
Thyroid	15.0	mrem	9.00E-04	6.00E-03
Kidney	15.0	mrem	8.97E-04	5.98E-03
Lung	15.0	mrem	8.97E-04	5.98E-03
GILLI	15.0	mrem	8.96E-04	5.98E-03

TABLE 2-5B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
DOSES TO A MEMBER OF THE PUBLIC DUE TO RADIOIODINES, TRITIUM, AND PARTICULATES IN GASEOUS RELEASES
Unit: 2
Starting: 01-Jan-2001 Ending: 30-Jun-2001

Cumulative Doses per Quarter

Organ	ODCM Limit	Unit	Quarter 1	% of ODCM Limit	Quarter 2	% of ODCM Limit
Bone	7.5	mrem	3.92E-07	5.23E-06	4.62E-07	6.16E-06
Liver	7.5	mrem	6.23E-05	8.30E-04	1.25E-04	1.66E-03
TBody	7.5	mrem	6.23E-05	8.30E-04	1.25E-04	1.66E-03
Thyroid	7.5	mrem	6.60E-05	8.79E-04	1.25E-04	1.67E-03
Kidney	7.5	mrem	6.23E-05	8.30E-04	1.25E-04	1.66E-03
Lung	7.5	mrem	6.22E-05	8.30E-04	1.25E-04	1.66E-03
GILLI	7.5	mrem	6.23E-05	8.30E-04	1.25E-04	1.66E-03

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	15.0	mrem	8.54E-07	5.69E-06
Liver	15.0	mrem	1.87E-04	1.25E-03
TBody	15.0	mrem	1.87E-04	1.25E-03
Thyroid	15.0	mrem	1.91E-04	1.27E-03
Kidney	15.0	mrem	1.87E-04	1.25E-03
Lung	15.0	mrem	1.87E-04	1.25E-03
GILLI	15.0	mrem	1.87E-04	1.25E-03

TABLE 2-5B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
DOSES TO A MEMBER OF THE PUBLIC DUE TO RADIOIODINES, TRITIUM, AND PARTICULATES IN GASEOUS RELEASES
Unit: 2

Starting: 01-Jul-2001 Ending: 31-Dec-2001

Cumulative Doses per Quarter

Organ	ODCM Limit	Unit	Quarter 3	% of ODCM Limit	Quarter 4	% of ODCM Limit
Bone	7.5	mrem	9.53E-07	1.27E-05	2.61E-08	3.48E-07
Liver	7.5	mrem	1.80E-05	2.40E-04	7.14E-05	9.52E-04
TBody	7.5	mrem	1.80E-05	2.40E-04	7.14E-05	9.52E-04
Thyroid	7.5	mrem	1.81E-05	2.41E-04	7.14E-05	9.52E-04
Kidney	7.5	mrem	1.80E-05	2.40E-04	7.14E-05	9.52E-04
Lung	7.5	mrem	1.80E-05	2.40E-04	7.14E-05	9.52E-04
GILLI	7.5	mrem	1.81E-05	2.41E-04	7.14E-05	9.52E-04

Cumulative Doses per Year

Organ	ODCM Limit	Units	Year to Ending Date	% of ODCM Limit
Bone	15.0	mrem	1.83E-06	1.22E-05
Liver	15.0	mrem	2.76E-04	1.84E-03
TBody	15.0	mrem	2.76E-04	1.84E-03
Thyroid	15.0	mrem	2.80E-04	1.87E-03
Kidney	15.0	mrem	2.76E-04	1.84E-03
Lung	15.0	mrem	2.76E-04	1.84E-03
GILLI	15.0	mrem	2.76E-04	1.84E-03

TABLE 2-6
VOGTLE ELECTRIC GENERATING PLANT
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
MINIMUM DETECTABLE CONCENTRATIONS - GASEOUS SAMPLE ANALYSES

JANUARY, 2001 THROUGH DECEMBER, 2001

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

RADIONUCLIDE	MDC	UNITS
Kr-87	1.82E-08	µCi/ml
Kr-88	2.53E-08	µCi/ml
Xe-133	2.05E-08	µCi/ml
Xe-133m	8.63E-08	µCi/ml
Xe-135	7.12E-08	µCi/ml
Xe-138	1.05E-07	µCi/ml
I-131	7.93E-15*	µCi/ml
Mn-54	3.94E-14*	µCi/ml
Fe-59	2.45E-14*	µCi/ml
Co-58	1.39E-14*	µCi/ml
Co-60	1.75E-14*	µCi/ml
Zn-65	2.82E-14*	µCi/ml
Mo-99	9.57E-14*	µCi/ml
Cs-134	1.12E-14*	µCi/ml
Cs-137	8.71E-15*	µCi/ml
Ce-141	8.62E-15*	µCi/ml
Ce-144	2.77E-14*	µCi/ml
Sr-89	1.00E-13	µCi/ml
Sr-90	1.00E-13	µCi/ml
H-3	9.00E-08	µCi/ml
Gross Alpha	1.00E-13	µCi/ml

* Based on an estimated sample volume of 5.7E+08 ml.

TABLE 2-7A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Batch Release Summary
Unit: 1
Starting : 1-Jan-2001 Ending : 30-Jun-2001

GASEOUS RELEASES

NUMBER OF BATCH RELEASES	:	58	
TOTAL TIME PERIOD FOR BATCH RELEASES	:	7598.00	MINUTES
MAXIMUM TIME PERIOD FOR A BATCH RELEASE	:	1941.00	MINUTES
AVERAGE TIME PERIOD FOR BATCH RELEASES	:	131.00	MINUTES
MINIMUM TIME FOR A BATCH RELEASE	:	15.00	MINUTES

TABLE 2-7A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Batch Release Summary
Unit: 1
Starting : 1-Jul-2001 Ending : 31-Dec-2001

GASEOUS RELEASES

NUMBER OF BATCH RELEASES	:	56	
TOTAL TIME PERIOD FOR BATCH RELEASES	:	4783.00	MINUTES
MAXIMUM TIME PERIOD FOR A BATCH RELEASE	:	316.00	MINUTES
AVERAGE TIME PERIOD FOR BATCH RELEASES	:	85.41	MINUTES
MINIMUM TIME FOR A BATCH RELEASE	:	39.00	MINUTES

TABLE 2-7B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Batch Release Summary
Unit: 2
Starting : 1-Jan-2001 Ending : 30-Jun-2001

GASEOUS RELEASES

NUMBER OF BATCH RELEASES	:	53	
TOTAL TIME PERIOD FOR BATCH RELEASES	:	35552.58	MINUTES
MAXIMUM TIME PERIOD FOR A BATCH RELEASE	:	10064.92	MINUTES
AVERAGE TIME PERIOD FOR BATCH RELEASES	:	670.80	MINUTES
MINIMUM TIME FOR A BATCH RELEASE	:	8.00	MINUTES

TABLE 2-7B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Batch Release Summary
Unit: 2
Starting : 1-Jul-2001 Ending : 31-Dec-2001

GASEOUS RELEASES

NUMBER OF BATCH RELEASES	:	27	
TOTAL TIME PERIOD FOR BATCH RELEASES	:	2029.00	MINUTES
MAXIMUM TIME PERIOD FOR A BATCH RELEASE	:	112.00	MINUTES
AVERAGE TIME PERIOD FOR BATCH RELEASES	:	75.15	MINUTES
MINIMUM TIME FOR A BATCH RELEASE	:	14.00	MINUTES

TABLE 2-8A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Abnormal Release Summary
Unit: 1
Starting : 1-Jan-2001 Ending : 30-Jun-2001

NUMBER OF RELEASES	:	0	
TOTAL TIME FOR ALL RELEASES	:	0.00	MINUTES
MAXIMUM TIME FOR A RELEASE	:	0.00	MINUTES
AVERAGE TIME FOR A RELEASE	:	0.00	MINUTES
MINIMUM TIME FOR A RELEASE	:	0.00	MINUTES
TOTAL ACTIVITY FOR ALL RELEASES	:	0.00E+00	CURIES

TABLE 2-8A
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Abnormal Release Summary
Unit: 1
Starting : 1-Jul-2001 Ending : 31-Dec-2001

NUMBER OF RELEASES	:	0	
TOTAL TIME FOR ALL RELEASES	:	0.00	MINUTES
MAXIMUM TIME FOR A RELEASE	:	0.00	MINUTES
AVERAGE TIME FOR A RELEASE	:	0.00	MINUTES
MINIMUM TIME FOR A RELEASE	:	0.00	MINUTES
TOTAL ACTIVITY FOR ALL RELEASES	:	0.00E+00	CURIES

TABLE 2-8B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Abnormal Release Summary
Unit: 2
Starting : 1-Jan-2001 Ending : 30-Jun-2001

NUMBER OF RELEASES	:	0	
TOTAL TIME FOR ALL RELEASES	:	0.00	MINUTES
MAXIMUM TIME FOR A RELEASE	:	0.00	MINUTES
AVERAGE TIME FOR A RELEASE	:	0.00	MINUTES
MINIMUM TIME FOR A RELEASE	:	0.00	MINUTES
TOTAL ACTIVITY FOR ALL RELEASES	:	0.00E+00	CURIE

TABLE 2-8B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
Gaseous Effluents - Abnormal Release Summary
Unit: 2
Starting : 1-Jul-2001 Ending : 31-Dec-2001

NUMBER OF RELEASES	:	0	
TOTAL TIME FOR ALL RELEASES	:	0.00	MINUTES
MAXIMUM TIME FOR A RELEASE	:	0.00	MINUTES
AVERAGE TIME FOR A RELEASE	:	0.00	MINUTES
MINIMUM TIME FOR A RELEASE	:	0.00	MINUTES
TOTAL ACTIVITY FOR ALL RELEASES	:	0.00E+00	CURIES

3.0 Solid Waste

3.1 Regulatory Requirements

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

3.1.1 Solid Radioactive Waste System

10.2.1 Process Control Program (PCP)

Radioactive wastes shall be solidified or dewatered in accordance with the PCP to meet shipping and transportation requirements during transit and disposal site requirements when received at the disposal site.

3.1.2 Reporting Requirements

12.1 PCP 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.

3.2 Solid Waste Data

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

TABLE 3-1
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
Units 1 and 2

JANUARY 1, 2001 THROUGH JUNE 30, 2001

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.	m3 Ci	None None	N/A
b. Dry compressible waste, contaminated equip, etc.	m3 Ci	14.12 138.6	40
c. Irradiated components, control rods, etc.	m3 Ci	NONE	N/A
d. Other (describe)	m3 Ci	NONE	N/A

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

a.	N/A	%	N/A
	N/A	%	N/A
	N/A	%	N/A
	N/A	%	N/A
b.	Ni-63	%	29.5
	Cs-137	%	26.7
	Cs-134	%	20.9
	All others	%	22.9
c.	N/A	%	N/A
	N/A	%	N/A
	N/A	%	N/A
	N/A	%	N/A
d.	N/A	%	N/A
	N/A	%	N/A

TABLE 3-1
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
Units 1 and 2

JANUARY 1, 2001 THROUGH JUNE 30, 2001

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
5	Tractor/Cask/Trailer	Studsvik, Erwin TN
1	Tractor/Trailer	AERC, Oak Ridge TN
3	Tractor/Trailer	Duratek, Oak Ridge, TN

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
None	None	None

ADDITIONAL INFORMATION REQUIRED BY ODCM:

Shipments to a Waste Processor

Shipment No.	Waste Class	Type Container	Shipping Class	Solidification Agent
RVRS-01-001	B	STRONG TIGHT	LSA (2)	NONE
RVRS-01-002	B	STRONG TIGHT	LSA (2)	NONE
RVRS-01-003	B	STRONG TIGHT	LSA (2)	NONE
RVRS-01-004	A UNSTABLE	STRONG TIGHT	LSA (2)	NONE
RVRS-01-005	A UNSTABLE	STRONG TIGHT	LSA (2)/LQ	NONE
RVRS-01-006	A UNSTABLE	STRONG TIGHT	LSA (2)	NONE
RVRS-01-007	B	STRONG TIGHT	LSA (2)	NONE
RVRS-01-008	A UNSTABLE	STRONG TIGHT	LSA (2)	NONE
RVRS-01-009	LQ	STRONG TIGHT	LQ	NONE

TABLE 3-1
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
Units 1 and 2

JULY 1, 2001 THROUGH DECEMBER 31, 2001.

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.	m3 Ci	NONE NONE	
b. Dry compressible waste, contaminated equip, etc.	m3 Ci	16.59 829.6	40
c. Irradiated components, control rods, etc.	m3 Ci	NONE NONE	N/A
d. Other (describe)	m3 Ci	NONE	N/A

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

a.	N/A	%	N/A
	N/A	%	N/A
	N/A	%	N/A
	N/A	%	N/A
b.	Ni-63	%	65.3
	Fe-55	%	11.0
	Co-60	%	7.81
	All others	%	15.89
c.	N/A	%	N/A
	N/A	%	N/A
	N/A	%	N/A
	N/A	%	N/A
d.	N/A	%	N/A
	N/A	%	N/A
	N/A	%	N/A

TABLE 3-1
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
Units 1 and 2

JULY 1, 2001 THROUGH DECEMBER 31, 2001

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
2	Tractor/Trailer/Cask	Studsvik, Erwin, TN
4	Tractor/Trailer	Duratek, Oak Ridge, TN
10	Tractor/Trailer	AERC, Oak Ridge, TN
2	Tractor/Trailer	DSSI, Kingston, TN

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
None	None	None

ADDITIONAL INFORMATION REQUIRED BY ODCM:

Shipments Sent Directly to Disposal at Barnwell, SC

Shipment No.	Waste Class	Type Container	Shipping Class	Solidification Agent	Volume (Direct disposal only)
NONE					

Shipments to a waste processor:

Shipment No.	Waste Class	Type Container	Shipping Class	Solidification Agent
RVRS-01-010	A UNSTABLE	STRONG TIGHT	LSA (2)/LQ	NONE
RVRS-01-011	A UNSTABLE	STRONG TIGHT	LSA (2)	NONE
RVRS-01-012	A UNSTABLE	STRONG TIGHT	LQ	NONE
RVRS-01-013	B	STRONG TIGHT	LSA (2)	NONE
RVRS-01-014	A UNSTABLE	STRONG TIGHT	LQ	NONE
RVRS-01-015	A UNSTABLE	STRONG TIGHT	LQ	NONE
RVRS-01-016	A UNSTABLE	Type B	LSA (2)	NONE
RVRS-01-017	A UNSTABLE	STRONG TIGHT	LSA (2)	NONE
RVRS-01-018	A UNSTABLE	STRONG TIGHT	LSA (2)	NONE
RVRS-01-019	A UNSTABLE	STRONG TIGHT	LQ	NONE
RVRS-01-020	A UNSTABLE	STRONG TIGHT	LQ	NONE
RVRS-01-021	A UNSTABLE	STRONG TIGHT	LQ	NONE
RVRS-01-022	A UNSTABLE	STRONG TIGHT	LQ	NONE
RVRS-01-023	A UNSTABLE	STRONG TIGHT	LQ	NONE
RVRS-01-024	A UNSTABLE	STRONG TIGHT	LQ	NONE
RVRS-01-025	A UNSTABLE	STRONG TIGHT	LQ	NONE
RVRS-01-026	A UNSTABLE	STRONG TIGHT	LQ	NONE
RVRS-01-027	A UNSTABLE	STRONG TIGHT	LQ	NONE

4.0 Doses to Members of the Public Inside the Site Boundary

4.1 Regulatory Requirements

ODCM 7.2.2.3 states in part:

"The report shall also include 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 Chapter 6. All assumptions used in making these assessments (i.e., specific activity, exposure time, and location) shall be included in the report".

4.2 Demonstration of Compliance

The location of concern within the site boundary is the Visitors Center. The activities at the Visitor Center consist of occasional attendance at meetings and/or short visits for informational purposes.

There will be no radiation dose at this location due to radioactive liquid effluents. Delineated in Table 4-1 for this location are the values of the basic data assumed in the dose assessment due to radioactive gaseous effluents. Listed in this table are 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 plant vent (mixed mode) and from the turbine building (ground level), and the estimated maximum occupancy factor for an individual and the assumed age group of this individual.

The source term is listed in Tables 2-2A, and 2-2B for the mixed mode releases. Similarly, it is listed in tables 2-3A and 2-3B for the ground level releases.

4.2 Demonstration of Compliance cont'd

The maximum doses in units of mrem to a MEMBER OF THE PUBLIC due to their activities inside the site boundary during the reporting period were assessed to be as follows:

	VISITOR CENTER			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Total Body: (Direct Radiation from Plume)	9.12E-09	2.70E-07	7.42E-09	2.08E-08

	VISITOR CENTER			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Maximum Organ (Thyroid) Quarters 1,2,3,4 (Inhalation Ground Plane)	3.11E-07	8.63E-07	6.79E-07	5.39E-07

TABLE 4-1
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
DOSE TO A MEMBER OF THE PUBLIC
DUE TO ACTIVITIES INSIDE THE SITE BOUNDARY
Unit: Site

Starting: 01-Jan-2001 Ending: 30-Jun-2001

Location Name	VISITOR CENTER
Distance (kilometers)	4.47E-01
Sector	SE
Occupancy Factor	4.57E-04 (4.00E+00 hr/yr)
Age Group	CHILD

Ground Level Releases:	
Noble Gas X/Q (sec/m3)	5.93E-06
Particulate X/Q (sec/m3)	5.58E-06
Particulate D/Q (m-2)	2.28E-08
Mixed Mode Releases:	
Noble Gas X/Q (sec/m3)	7.12E-07
Particulate X/Q (sec/m3)	6.74E-07
Particulate D/Q (m-2)	5.77E-09
Elevated Releases:	
Noble Gas X/Q (sec/m3)	N/A
Particulate X/Q (sec/m3)	N/A
Particulate D/Q (m-2)	N/A

	Units	Quarter 1	Quarter 2	Quarters 1 and 2	Year to Ending Date
Total Body Dose	mrem	9.12E-09	2.70E-07	2.80E-07	2.80E-07
Bone	mrem	1.33E-08	1.53E-07	1.66E-07	1.66E-07
Liver	mrem	3.08E-07	8.62E-07	1.17E-06	1.17E-06
TBody	mrem	3.08E-07	8.62E-07	1.17E-06	1.17E-06
Thyroid	mrem	3.11E-07	8.63E-07	1.17E-06	1.17E-06
Kidney	mrem	3.08E-07	8.62E-07	1.17E-06	1.17E-06
Lung	mrem	3.08E-07	8.62E-07	1.17E-06	1.17E-06
GI-LLI	mrem	3.08E-07	8.62E-07	1.17E-06	1.17E-06

TABLE 4-1
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2001
DOSE TO A MEMBER OF THE PUBLIC
DUE TO ACTIVITIES INSIDE THE SITE BOUNDARY
Unit: Site

Starting: 01-Jul-2001 Ending: 31-Dec-2001

Location Name	VISITOR CENTER
Distance (kilometers)	4.47E-01
Sector	SE
Occupancy Factor	4.57E-04 (4.00E+00 hr/yr)
Age Group	CHILD

Ground Level Releases:	
Noble Gas X/Q (sec/m3)	5.93E-06
Particulate X/Q (sec/m3)	5.58E-06
Particulate D/Q (m-2)	2.28E-08
Mixed Mode Releases:	
Noble Gas X/Q (sec/m3)	7.12E-07
Particulate X/Q (sec/m3)	6.74E-07
Particulate D/Q (m-2)	5.77E-09
Elevated Releases:	
Noble Gas X/Q (sec/m3)	N/A
Particulate X/Q (sec/m3)	N/A
Particulate D/Q (m-2)	N/A

	Units	Quarter 3	Quarter 4	Quarters 3 and 4	Year to Ending Date
Total Body Dose	mrem	7.42E-09	2.08E-08	2.82E-08	3.08E-07
Bone	mrem	8.35E-09	2.27E-08	3.11E-08	1.97E-07
Liver	mrem	6.77E-07	5.38E-07	1.21E-06	2.38E-06
TBody	mrem	6.77E-07	5.38E-07	1.21E-06	2.38E-06
Thyroid	mrem	6.79E-07	5.39E-07	1.22E-06	2.39E-06
Kidney	mrem	6.77E-07	5.38E-07	1.21E-06	2.38E-06
Lung	mrem	6.77E-07	5.38E-07	1.21E-06	2.38E-06
GI-LLI	mrem	6.77E-07	5.38E-07	1.21E-06	2.38E-06

5.0 Total Dose from Uranium Fuel Cycle (40CFR190)

5.1 Regulatory Requirements

ODCM 5.1 states in part that 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.

5.2 Demonstration of Compliance

The requirements of 40CFR190 were met.

6.0 Meteorological Data

ODCM 7.2.2.2 states in part:

The Radioactive Effluent Release 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, 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 the option of retaining this summary of required meteorological data on site in a file that shall be provided to the NRC upon request.

7.0 Program Deviations

7.1 Inoperable Liquid or Gaseous Effluent Monitoring Instrumentation

7.1.1 Regulatory Requirement

ODCM 7.2.2.6 states in part that 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 liquid or gaseous effluent monitoring instrumentation was not corrected within the specified time requirement.

7.1.2 Description of Deviations

The inoperability of liquid and gaseous effluent monitors was corrected within the specified time for this reporting period.

7.2 Tanks Exceeding Curie Content Limits

7.2.1 Regulatory Requirements

ODCM 7.2.2.6 states in part that the report shall include a description of the events leading to liquid holdup tanks or gas storage tanks exceeding the limits of Technical Specifications 5.5.12.

7.2.2 Description of Deviations

There were no outdoor liquid hold-up tanks used for radioactive liquids during this reporting period. Limits for the gas storage tanks were not exceeded during this reporting period.

8.0 Changes to the Vogtle Electric Generating Plant Offsite Dose Calculation Manual (ODCM)

8.1 Regulatory Requirements

ODCM 7.2.2.5 states in part that changes to the ODCM shall be submitted with the Radioactive Effluent Release Report. These changes may be due to changes in the radiological environmental monitoring program sampling locations as required by ODCM 4.1.1.2.3 or changes to dose calculation locations as required by ODCM 4.1.2.2.2. Land uses and dose calculation locations within five miles of VEGP must be determined by a land use census as required by ODCM 4.1.2.

8.2 Description of Changes

There were changes made to the Vogtle Electric Generating Plant ODCM for the period January 1, 2001 through December 31, 2001. Revision 18 became effective August 2001. Revision 19 became effective November 2001. These changes are being submitted with The Radioactive Effluent Release Report in the form of a complete legible copy of the entire ODCM in accordance with Technical Specification 5.5.1.c

The Land Use Census was conducted December 11, 2001 by Georgia Power Company Environmental Lab personnel. The results of the census for 2001 require no changes to the REMP sampling locations or to the dose calculation locations.

9.0 Major Changes to Liquid, Gaseous, or Solid Radwaste Treatment Systems

9.1 Regulatory Requirements

ODCM 7.2.2.7 states in part:

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 Radioactive Effluent Release Report covering the period in which the change was reviewed and accepted for implementation.

Note 1: In lieu of inclusion in the Radioactive Effluents Release Report, this same information may be submitted as part of the annual FSAR update.

PCP 12.1 states in part:

Licensee major initiated 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 change was implemented.

9.2 Description of Major Changes

Gaseous Radwaste System

A new offsite gaseous release point was added with the upgrade of the liquid radwaste processing system infrastructure, the RPF, along with the Heating Ventilation and Air Conditioning (HVAC) system that supports it. The RPF is equipped with HEPA ventilation and radiation monitoring capability that supports this facility. However, none of the design criteria or release limits associated with the gaseous radwaste system changes.

Liquid Radwaste System

Major changes to the liquid, gaseous and solid radwaste facilities are those that contribute to significant changes in release; i.e., either decreases or increases in release volume or activity/dose. This is to indicate that no major changes to the liquid, solid and gaseous radwaste systems occurred during the 2001 assessment period. With the design and installation of the Radwaste Processing Facility (RPF) significant structural, civil and support system changes occurred with regards to the infrastructure that supports liquid radwaste processing while the processing technologies, process design criteria, process efficiencies, and release goals remained unchanged during this period. All structural, civil, support and infrastructure changes were processed in accordance with existing plant administrative procedures and any incidental changes to the Updated Final Safety and Analysis report were appropriately made. None of the infrastructure changes affected the design criteria and design parameters associated with the liquid radwaste processing system and these parameters remain unchanged from the previous assessment period.

Solid Radwaste System

There were no major changes to the solid, liquid and gaseous radwaste systems in the 2001 assessment period.

TABLE 1-1B
Vogtle Electric Generating Plant
RADIOACTIVE EFFLUENT RELEASE REPORT - 2000
Liquid Effluents - Summation of All Releases
Unit: 2
Starting : 1-Jul-2000 Ending : 31-Dec-2000

9.3 Addendum to 2000 Report- G-ALPHA

TYPE OF EFFLUENT	UNITS	QUARTER 3	QUARTER 4	EST. TOT ERROR %
A. FISSION & ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	CURIES	9.03E-03	2.13E-02	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	9.49E-08	3.09E-07	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	4.93E+01	2.05E+01	40
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	5.18E-04	2.98E-04	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	6.67E-06	0.00E+00	50
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	7.01E-11	0.00E+00	
3. PERCENT OF APPLICABLE LIMIT	%	*	*	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	**0.00E+00**	8.70E-06	45
E. WASTE VOL RELEASED(PRE-DILUTION)	LITERS	2.40E+05	1.59E+05	20
F. VOLUME OF DILUTION WATER USED	LITERS	9.49E+07	6.86E+07	20

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

Corrected for G-ALPHA 3 rd quarter 2000