ENCLOSURE 1 TO NYN-03041 / LIC-03045

Effluent Release Data as Required by Regulatory Guide 1.21

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
Supplemental Information 2002

Facility: Seabrook Station Unit 1 — Licensee: FPL Energy Seabrook, LLC

1. Regulatory Limits

   A. Gaseous Effluents

      a. 5.0 mrad per quarter gamma air dose.
      b. 10.0 mrad per quarter beta air dose.
      c. 7.5 mrem per quarter to any organ.

   B. Liquid Effluents

      a. 1.5 mrem per quarter total body.
      b. 5.0 mrem per quarter any organ.
      c. 2.0E-04 μCi/ml dissolved or entrained gas.

2. Maximum Permissible Concentrations

   Provide the MPC's used in determining allowable release rates or concentrations.

      a. Fission and activation gases: 1 MPC
      b. Iodines: 1 MPC
      c. Particulates, half-lives >8 days: 1 MPC
      d. Liquid Effluents: 1 MPC

3. Average Energy

   Not applicable

4. Measurements and Approximations of Total Radioactivity

   Provide the methods used to measure or approximate the total radioactivity in effluents and the methods used to determine radionuclide composition.

   A. Fission and activation gases: Determined by gamma spectroscopy. Total error is based on stack flow error, analytical error, and calculated sampling error.

   B. Iodines: Determined by collection on charcoal with subsequent gamma spectroscopy analysis. Total error is based on stack flow error, analytical error, and calculated sampling error.

   C. Particulates: Determined by collection on fixed filter with subsequent gamma spectroscopy analysis. Strontium is determined by composite analysis of filters by liquid scintillation, gross alpha by proportional counter and iron 55 by liquid scintillation. Total error is based on stack flow error, analytical error, and calculated sampling error.

   D. Liquid Effluents: Determined by gamma spectroscopy. A composite sample is analyzed for strontium by liquid scintillation, tritium by liquid scintillation, gross alpha by proportional counter and iron 55 by liquid scintillation. Total error is based on the volume discharge error and analytical error.

   E. ND: None Detected or No Detectable Activity

5. Batch Releases

Provide the following information relating to batch releases of radioactive materials in liquid and gaseous effluents.

A. Liquid

a. Number of batch releases: 145
b. Total time for batch releases: 33227 minutes
c. Maximum time period for batch release: 706 minutes
d. Average time period for batch release: 229 minutes
e. Minimum time period for batch release: 6 minutes
f. Average stream flow during periods of release of effluents into a flowing stream: 1.61E+06 liters per minute

B. Gaseous

a. Number of batch releases: 68
b. Total time for batch releases: 44236 minutes
c. Maximum time period for batch release: 11502 minutes
d. Average time period for batch release: 1106 minutes
e. Minimum time period for batch release: 1 minute

6. Abnormal Releases

A. Liquid

a. Number of releases: 0
b. Total activity released: N/A

B. Gaseous

a. Number of releases: 0
b. Total activity released: N/A

TABLE 1A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2002

GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Est. Total Error, %
A. Fission and activation gases						
1. Total releases	Ci	6.18E+00	2.89E+01	1.62E+00	3.64E-04	1.70E+01
2. Average release rate for period	uCi/sec	7.83E-01	3.66E+00	2.05E-01	4.61E-05	
3. Percent of applicable Technical Specification limit	%	1.41E-02	7.51E-02	3.10E-03	2.06E-05	
B. Iodines						
1. Total release	Ci	ND	5.50E-04	9.46E-07	ND	1.50E+01
2. Average release rate for period	uCi/sec	N/A	6.97E-05	1.20E-07	N/A	
3. Percent of applicable Technical Specification limit	%	3.31E-01	4.89E+00	5.45E-01	4.75E-01	
C. Particulates						
1. Total release	Ci	ND	9.55E-06	ND	ND	1.80E+01
2. Average release rate for period	uCi/sec	N/A	1.21E-06	N/A	N/A	
3. Percent of applicable Technical Specification limit	%	3.31E-01	4.89E+00	5.45E-01	4.75E-01	
4. Total alpha radioactivity	Ci	ND	ND	ND	ND	
D. Tritium						
1. Total release	Ci	2.46E+01	3.83E+01	4.08E+01	3.56E+01	1.60E+01
2. Average release rate for period	uCi/sec	3.12E+00	4.85E+00	5.17E+00	4.51E+00	
3. Percent of applicable Technical Specification limit	%	3.31E-01	4.89E+00	5.45E-01	4.75E-01	

TABLE 1B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT (2002)

GASEOUS EFFLUENTS-ELEVATED RELEASES

BATCH

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4

1. Fission and activation gases

argon-41	Ci	2.68E-01	1.55E-02	1.21E-01	3.45E-04
krypton-85	Ci	2.37E+00	3.26E-02	7.27E-01	ND
krypton-85m	Ci	5.16E-03	1.01E-03	ND	ND
krypton-87	Ci	2.30E-03	ND	ND	ND
krypton-88	Ci	7.09E-03	ND	ND	ND
xenon-131m	Ci	3.43E-02	1.84E-02	ND	ND
xenon-133	Ci	3.38E+00	1.35E+00	7.63E-01	1.56E-05
xenon-133m	Ci	3.62E-02	1.90E-02	ND	ND
xenon-135	Ci	7.63E-02	1.04E-01	8.78E-03	ND
xenon-135m	Ci	9.96E-05	ND	ND	ND
xenon-138	Ci	ND	ND	ND	ND
	Ci				
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	6.18E+00	1.54E+00	1.62E+00	3.61E-04

2. Iodines

iodine-131	Ci	ND	ND	ND	ND
iodine-133	Ci	ND	ND	ND	ND
iodine-135	Ci	ND	ND	ND	ND
Total for period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

3. Particulates

strontium-89	Ci	ND	ND	ND	ND
strontium-90	Ci	ND	ND	ND	ND
cesium-134	Ci	ND	ND	ND	ND
cesium-137	Ci	ND	ND	ND	ND
barium-lanthanum-140	Ci	ND	ND	ND	ND
	Ci				
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 1B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT (2002)

GASEOUS EFFLUENTS-ELEVATED RELEASES

CONTINUOUS

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4
1. Fission and activation gases					
argon-41	Ci	ND	ND	ND	ND
krypton-85	Ci	ND	2.04E-01	ND	ND
krypton-85m	Ci	ND	3.46E-03	ND	ND
krypton-87	Ci	ND	ND	ND	ND
krypton-88	Ci	ND	ND	ND	ND
xenon-131m	Ci	ND	ND	ND	ND
xenon-133	Ci	ND	2.21E+01	ND	ND
xenon-133m	Ci	ND	2.13E-01	ND	ND
xenon-135	Ci	ND	4.80E+00	ND	ND
xenon-135m	Ci	ND	ND	ND	ND
xenon-138	Ci	ND	ND	ND	ND
	Ci				
	Ci				
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	0.00E+00	2.73E+01	0.00E+00	0.00E+00
2. Iodines					
iodine-131	Ci	ND	3.78E-04	9.46E-07	ND
iodine-133	Ci	ND	1.69E-04	ND	ND
iodine-135	Ci	ND	ND	ND	ND
Total for period	Ci	0.00E+00	5.47E-04	9.46E-07	0.00E+00
3. Particulates					
strontium-89	Ci	ND	ND	ND	ND
strontium-90	Ci	ND	ND	ND	ND
cesium-134	Ci	ND	ND	ND	ND
cesium-137	Ci	ND	ND	ND	ND
barium-lanthanum-140	Ci	ND	ND	ND	ND
cobalt-58	Ci	ND	8.73E-06	ND	ND
cobalt-60	Ci	ND	ND	ND	ND
chromium-51	Ci	ND	ND	ND	ND
manganese-54	Ci	ND	ND	ND	ND
niobium-95	Ci	ND	ND	ND	ND
iron-59	Ci	ND	ND	ND	ND
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	0.00E+00	8.73E-06	0.00E+00	0.00E+00

TABLE 1C

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT (2002)

GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

BATCH

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4
1. Fission and activation gases					
argon-41	Ci	ND	1.06E-05	ND	ND
krypton-85	Ci	ND	ND	ND	ND
krypton-85m	Ci	ND	ND	ND	ND
krypton-87	Ci	ND	ND	ND	ND
krypton-88	Ci	ND	ND	ND	ND
xenon-131m	Ci	ND	ND	ND	ND
xenon-133m	Ci	ND	ND	ND	ND
xenon-133	Ci	ND	ND	ND	ND
xenon-135	Ci	ND	ND	ND	ND
xenon-135m	Ci	ND	ND	ND	ND
xenon-138	Ci	ND	ND	ND	ND
	Ci				
	Ci				
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	0.00E+00	1.06E-05	0.00E+00	0.00E+00
2. Iodines					
iodine-131	Ci	ND	7.69E-07	ND	ND
iodine-132	Ci	ND	ND	ND	ND
iodine-133	Ci	ND	ND	ND	ND
iodine-135	Ci	ND	ND	ND	ND
Total for period	Ci	0.00E+00	7.69E-07	0.00E+00	0.00E+00
3. Particulates					
strontium-89	Ci	ND	ND	ND	ND
strontium-90	Ci	ND	ND	ND	ND
cesium-134	Ci	ND	ND	ND	ND
cesium-136	Ci	ND	ND	ND	ND
cesium-137	Ci	ND	ND	ND	ND
barium-lanthanum-140	Ci	ND	ND	ND	ND
cobalt-57	Ci	ND	ND	ND	ND
cobalt-58	Ci	ND	6.73E-07	ND	ND
cobalt-60	Ci	ND	ND	ND	ND
manganese-54	Ci	ND	ND	ND	ND
iron-59	Ci	ND	ND	ND	ND
niobium/zirconium-95	Ci	ND	4.55E-08	ND	ND
chromium-51	Ci	ND	ND	ND	ND
technetium-99m	Ci	ND	ND	ND	ND
bromine-82	Ci	ND	ND	ND	ND
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	0.00E+00	7.19E-07	0.00E+00	0.00E+00

TABLE 1C

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT (2002)

GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

CONTINUOUS

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4

1. Fission and activation gases

argon-41	Ci	ND	ND	ND	ND
krypton-85	Ci	ND	ND	ND	ND
krypton-85m	Ci	ND	ND	ND	ND
krypton-87	Ci	ND	ND	ND	ND
krypton-88	Ci	ND	ND	ND	ND
xenon-133	Ci	ND	ND	ND	ND
xenon-135	Ci	ND	ND	ND	ND
xenon-135m	Ci	ND	ND	ND	ND
xenon-138	Ci	ND	ND	ND	ND
	Ci				
	Ci				
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

2. Iodines

iodine-131	Ci	ND	2.29E-06	ND	ND
iodine-133	Ci	ND	ND	ND	ND
	Ci				
Total for period	Ci	0.00E+00	2.29E-06	0.00E+00	0.00E+00

3. Particulates

strontium-89	Ci	ND	ND	ND	ND
strontium-90	Ci	ND	ND	ND	ND
cesium-134	Ci	ND	ND	ND	ND
cesium-136	Ci	ND	ND	ND	ND
cesium-137	Ci	ND	ND	ND	ND
barium-lanthanum-140	Ci	ND	ND	ND	ND
cobalt-58	Ci	ND	9.63E-08	ND	ND
cobalt-60	Ci	ND	ND	ND	ND
	Ci				
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	0.00E+00	9.63E-08	0.00E+00	0.00E+00

TABLE 2A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2002

LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES

	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Est. Total Error, %
A. Fission and activation products						
1. Total releases	Ci	1.80E-02	1.55E-02	1.36E-02	6.47E-03	6.00E+00
2. Average diluted concentration during period	uCi/ml	4.48E-11	4.63E-11	2.84E-11	1.16E-11	
3. Percent of applicable limit	%	3.36E-02	1.16E-01	8.20E-03	6.65E-03	
B. Tritium						
1. Total release	Ci	8.56E+02	2.49E+02	1.02E+02	1.43E+02	8.00E+00
2. Average diluted concentration during period	uCi/ml	2.13E-06	7.43E-07	2.13E-07	2.56E-07	
3. Percent of applicable limit	%	3.36E-02	1.16E-01	8.20E-03	6.65E-03	
C. Dissolved and entrained gases						
1. Total release	Ci	ND	1.42E-04	ND	ND	1.90E+01
2. Average diluted concentration during period	uCi/ml	N/A	4.24E-13	N/A	N/A	
3. Percent of applicable limit	%	N/A	2.12E-07	N/A	N/A	
D. Gross alpha radioactivity						
1. Total release	Ci	ND	ND	ND	ND	1.00E+01
E. Volume of waste released (prior to dilution)	liters	1.44E+07	2.66E+07	1.61E+07	2.20E+07	1.30E+00
F. Volume of dilution water used during period	liters	4.02E+11	3.35E+11	4.79E+11	5.59E+11	9.00E+00

TABLE 2B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2002

LIQUID EFFLUENTS

BATCH MODE

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4
strontium-89	Ci	ND	ND	ND	ND
strontium-90	Ci	ND	ND	ND	ND
cesium-134	Ci	1.34E-05	3.39E-06	5.25E-05	2.24E-05
cesium-137	Ci	2.69E-05	1.48E-05	6.17E-05	2.96E-05
iodine-131	Ci	1.47E-05	1.10E-05	1.34E-05	9.00E-05
iodine-133	Ci	4.04E-05	ND	ND	7.60E-05
cobalt-57	Ci	ND	1.05E-05	ND	ND
cobalt-58	Ci	2.48E-04	5.61E-03	6.57E-03	5.04E-04
cobalt-60	Ci	1.69E-03	1.16E-03	6.07E-04	1.56E-04
chromium-51	Ci	ND	1.31E-04	7.41E-05	ND
iron-55	Ci	4.10E-03	3.81E-03	2.64E-03	2.63E-03
iron-59	Ci	ND	ND	4.46E-06	ND
zinc-65	Ci	ND	ND	ND	ND
manganese-54	Ci	4.46E-04	2.45E-04	6.92E-05	8.34E-06
zirconium-niobium-95	Ci	ND	ND	ND	ND
molybdenum-99	Ci	ND	ND	ND	ND
technetium-99m	Ci	2.89E-05	ND	8.99E-05	7.78E-05
silver-110m	Ci	ND	ND	8.84E-06	ND
barium-lanthanum-140	Ci	ND	ND	ND	ND
cerium-141	Ci	ND	ND	ND	ND
antimony-124	Ci	ND	4.81E-06	1.22E-05	ND
antimony-125	Ci	1.14E-02	1.01E-03	3.36E-03	2.80E-03
niobium-97	Ci	ND	ND	ND	ND
tin-117m	Ci	ND	ND	ND	ND
sodium-24	Ci	ND	ND	ND	ND
unidentified	Ci	ND	ND	ND	ND

Total for period(above)	Ci	1.80E-02	1.20E-02	1.36E-02	6.39E-03

xenon-133	Ci	ND	1.42E-04	ND	ND
xenon-135	Ci	ND	ND	ND	ND

TABLE 2B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2002

LIQUID EFFLUENTS

CONTINUOUS MODE

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4
strontium-89	Ci	ND	ND	ND	ND
strontium-90	Ci	ND	ND	ND	ND
cesium-134	Ci	ND	1.46E-04	ND	3.44E-05
cesium-137	Ci	ND	1.08E-04	ND	4.45E-05
iodine-131	Ci	ND	7.14E-06	ND	ND
iodine-133	Ci	ND	ND	ND	ND
cobalt-58	Ci	ND	3.26E-03	ND	ND
cobalt-60	Ci	ND	ND	ND	ND
iron-55	Ci	ND	ND	ND	ND
iron-59	Ci	ND	ND	ND	ND
zinc-65	Ci	ND	ND	ND	ND
manganese-54	Ci	ND	ND	ND	ND
chromium-51	Ci	ND	ND	ND	ND
zirconium-niobium-95	Ci	ND	ND	ND	ND
molybdenum-99	Ci	ND	ND	ND	ND
technetium-99m	Ci	ND	ND	ND	ND
barium-lanthanum-140	Ci	ND	ND	ND	ND
cerium-141	Ci	ND	ND	ND	ND
unidentified	Ci	ND	ND	ND	ND
Total for period(above)	Ci	0.00E+00	3.52E-03	0.00E+00	7.89E-05
xenon-131m	Ci	ND	ND	ND	ND
xenon-133m	Ci	ND	ND	ND	ND
xenon-133	Ci	ND	ND	ND	ND
xenon-135	Ci	ND	ND	ND	ND

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2002
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

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

1. Type of waste	Unit	1 year Period	Est. Total Error, %
a. Spent resins, filter sludges, evaporator Bottoms, etc.	m^3 Ci	1.71E+01 1.65E+02	2.50E+01
b. Dry compressible waste, contaminated Equip, etc.	m^3 Ci	2.14E+01 3.11E+00	2.50E+01
c. Irradiated components, control Rods, etc.	m^3 Ci	NA	NA
d. Other (describe): Cartridge Filters	m^3 Ci	2.36E+00 3.94E+01	2.50E+01

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

a.

H-3	%	1.26E-01
C-14	%	1.38E-01
Mn-54	%	1.13E+00
Fe-55	%	1.59E+01
Co-57	%	2.36E-02
Co-58	%	1.53E-01
Co-60	%	1.07E+01
Ni-63	%	6.14E+01
Sr-90	%	1.66E-02
Sb-125	%	4.28E-01
Cs-134	%	2.20E+00
Cs-137	%	7.67E+00
Ce-144	%	7.89E-02
Pu-238	%	2.33E-05
Pu-239	%	1.57E-05
Pu-241	%	2.18E-03
Am-241	%	1.37E-05
Cm-242	%	2.42E-06
Cm-243	%	9.37E-06

b.

Mn-54	%	7.48E-01
Fe-55	%	5.93E+01
Co-57	%	5.48E-02
Co-58	%	4.21E-01
Co-60	%	1.38E+01
Ni-63	%	2.18E+01
Zr-95	%	5.62E-03
Nb-95	%	5.56E-03
Sn-113	%	4.50E-03
Sb-125	%	6.08E-01
Cs-137	%	4.16E-01
Ag-110m	%	8.16E-02
Ce-144	%	8.59E-01
Pu-241	%	1.82E+00

c.

	%	
	%	

d.

Cr-51	%	1.04E-04
Mn-54	%	1.06E+00
Fe-55	%	5.68E+01
Co-57	%	1.27E-01
Co-58	%	1.44E+00
Co-60	%	1.05E+01
Ni-63	%	2.94E+01
Zr-95	%	2.27E-02
Nb-95	%	2.30E-04
Sn-113	%	1.66E-02
Sb-125	%	6.11E-02
Cs-137	%	5.73E-01

3. Solid Waste Disposition

Number of Shipments	Waste Class	Container Type	Solidification Agent	Mode of Transportation	Destination
1	C	LSA	NA	Truck	CNS Barnwell, SC
5	B	LSA	NA	Truck	CNS Barnwell, SC
1	A	LSA	NA	Truck	CNS Barnwell, SC
4	A	LSA	NA	Truck	Duratek Kingston, TN
3	A	LSA	NA	Truck	Duratek, Oak Ridge, TN
1	A	LSA	NA	Truck	Studsvik Erwin, TN
1	A	LSA	NA	Truck	PermaFix Gainesville, FL

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
NA	NA	NA

C. REVIEW AND APPROVAL

Prepared By: [signature] Date: 4/24/03

Reviewed By: [signature] Date: 4-24-03

Approved By: [signature] Date: 4-24-03

LIST OF APPENDICES

Appendix A

Offsite Dose Calculation Manual

Requirement: Technical Specification 6.13.2c requires that licensee initiated changes to the Offsite Dose Calculation Manual be submitted to the Commission in the Annual Radioactive Effluent Release Report for the period in which the change(s) was made effective. Include in this changes to the Radiological Environmental Program in accordance with Offsite Dose Calculation Manual (ODCM)-C.9.1.1 and -C.9.2.1.

Response: The ODCM was changed twice in 2002.

- The first change clarified the Heat tracing requirement of the plant vent sample lines. The low temperature setpoint was changed from 105 °F, to a variable setpoint based on maintaining sample line tubing metal temperature greater than 20 °F above outside ambient air temperature to prevent condensation.

- The second change incorporated the following items:

    1. Removed the ODCM from the Technical Requirements Program and made it a stand-alone manual controlled by Technical Specification 6.13.

    2. Added a Control and Applicability section.

    3. In table A.5.2-1and -2, added Sample Line temperature to the Plant Vent Monitor (Item 2) and Noble Gas Activity Monitor to the Turbine Gland Seal Condenser Exhaust, removing the # footnote reference for Item 4.

    4. In table A.5.2-2, clarified compensatory actions to take when Sample Flow Rate Monitor is inoperable and the action to take for Plant Vent Monitor Sample Line Temperature inoperable.

    5. Relocated control of beta emitting nuclides for liquid discharges from the radiation monitor setpoint calculations to the minimum dilution flow calculation; there is no impact to offsite doses from this change.

    6. A more accurate 31day-dose projection methodology for use during plant outages for Containment releases was incorporated.

    7. The primary calibration data for the Condenser Air Removal monitor was incorporated into the setpoint determination.

    8. The REMP milk sample locations TM-15 was changed to a required location and TM-23 was added as an additional informational location, reflecting current land use census information.

Appendix B

Process Control Program

Requirement: Technical Specification 6.12.2a requires that licensee initiated changes to the Process Control Program be submitted to the Commission in the Annual Radioactive Effluent Release Report for the period in which the change(s) was made.

Response: The Process Control Program (PCP) was changed once in 2002.

The change incorporated several items:

- Corrected referenced procedure numbers, names, and removed revision and date information.
- Deleted reference 5.7 for 24" Chem-Nuclear Pressure vessel dewatering, as these vessels are not used at Seabrook.
- Deleted the requirement for resins supplied by other than Chem-Nuclear to be procured under nuclear grade procurement clauses as the nuclear grade procurement clauses are specific to resin used in the primary system and are not applicable to wastewater processing.
- Changed reference to Waste Services (WS) Manager to Health Physics (HP) Department Manager as the WS Manager was combined with the HP Department Manager position.
- Changed person verifying dewatering procedure acceptance criteria has been met from the WS Manager to Radwaste personnel.
- Changed condition on use of natural filter drying that limited use of this process to high radiation conditions to now apply to all filters processed. Prompt dewatering would be performed when the time to natural dry is not available.
- Added a statement on software control to comply with the FPL Energy Seabrook Information Manual.
- Clarified reasoning for disposal of filters as Dry Active Waste and added reference to stability requirements.

Appendix C

Radioactive Liquid Effluent Monitoring Instrumentation

Requirement: Radioactive liquid effluent monitoring instrumentation channels are required to be operable in accordance with Offsite Dose Calculation Manual (ODCM)-C.5.1. With less than the minimum number of channels operable for 30 days, Offsite Dose Calculation Manual (ODCM)-C.5.1 requires an explanation for the delay in correcting the inoperability in the next Annual Effluent Release Report in accordance with Technical Specification 6.8.1.4.

Response: A review of the Action Statement Status and the Shift Operations Management System LCO tracking system for the period from January 1, 2002 to December 31, 2002 indicated ODCM C.5.1 was not entered for more than 30 consecutive days.

Appendix D

Radioactive Gaseous Effluent Monitoring Instrumentation

Requirement: Radioactive gaseous effluent monitoring instrumentation channels are required to be operable in accordance with Offsite Dose Calculation Manual (ODCM)-C.5.2. With less than the minimum number of channels operable for 30 days, Offsite Dose Calculation Manual (ODCM)-C.5.2 requires an explanation for the delay in correcting the inoperability in the next Annual Effluent Release Report in accordance with Tech. Spec. 6.8.1.4.

Response: A review of the Action Statement Status and the Shift Operations Management System LCO tracking system for the period from January 1, 2002 to December 31, 2002 indicated ODCM C.5.2 was not entered for more than 30 consecutive days.

Appendix E

Liquid Holdup Tanks

Requirement: Technical Specification 3.11.1.4 limits the quantity of radioactive material contained in any outside temporary tank. With the quantity of radioactive material in any outside temporary tank exceeding the limits of Technical Specification 3.11.1.4, a description of the events leading to this condition is required in the next Annual Effluent Release Report in accordance with Tech. Spec. 6.8.1.4.

Response: From January 1, 2002 to December 31, 2002, there was no radioactive material stored in any temporary outdoor tank that exceeded the limits of T. S. 3.11.1.4.

Appendix F

Radwaste Treatment Systems

Requirement: Technical Specification 6.14.1a requires that licensee initiated changes to the Radwaste Treatment Systems (liquid, gaseous, and solid) be submitted to the Commission in the Annual Radioactive Effluent Release Report for the period in which the change was made.

Response: For 2002, FPL Energy Seabrook LLC, will submit any changes to the Radwaste Treatment Systems (liquid, gaseous and solid) as part of the FSAR update.

Appendix G

Unplanned Releases

Requirement: Technical Specification 6.8.1.4 requires a list and description of unplanned releases from the site to UNRESTRICTED AREAS of radioactive materials in gaseous and liquid effluents made during the reporting period.

Response: A review of the January 1, 2002 to December 31, 2002 time period indicated there were no unplanned, unanticipated or abnormal releases from the site to unrestricted areas of radioactive materials of gaseous or liquid effluents.

ENCLOSURE 2 TO NYN-03041 / LIC-03045

Joint Frequency Distributions of Wind Speed, Wind Direction and Atmospheric Stability

SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS A CLASS FREQUENCY (PERCENT) = 3.05

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C-3	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	4
(1)	.38	.00	.00	.00	.00	.00	.00	.00	.38	.00	.00	.00	.00	.38	.00	.38	.00	1.52
(2)	.01	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.01	.00	.01	.00	.05
4-7	1	0	0	1	6	3	17	3	1	3	2	3	2	2	0	3	0	47
(1)	.38	.00	.00	.38	2.28	1.14	6.46	1.14	.38	1.14	.76	1.14	.76	.76	.00	1.14	.00	17.87
(2)	.01	.00	.00	.01	.07	.03	.20	.03	.01	.03	.02	.03	.02	.02	.00	.03	.00	.55
8-12	1	0	0	4	30	14	38	8	1	3	18	4	12	17	8	3	0	161
(1)	.38	.00	.00	1.52	11.41	5.32	14.45	3.04	.38	1.14	6.84	1.52	4.56	6.46	3.04	1.14	.00	61.22
(2)	.01	.00	.00	.05	.35	.16	.44	.09	.01	.03	.21	.05	.14	.20	.09	.03	.00	1.87
13-18	0	0	5	4	1	0	7	0	0	3	4	7	4	6	8	0	0	49
(1)	.00	.00	1.90	1.52	.38	.00	2.66	.00	.00	1.14	1.52	2.66	1.52	2.28	3.04	.00	.00	18.63
(2)	.00	.00	.06	.05	.01	.00	.08	.00	.00	.03	.05	.08	.05	.07	.09	.00	.00	.57
19-24	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
(1)	.00	.00	.38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.38	.00	.00	.00	.00	.76
(2)	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.02
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ALL SPEEDS	3	0	6	9	37	17	62	11	3	9	24	14	19	26	16	7	0	263
(1)	1.14	.00	2.28	3.42	14.07	6.46	23.57	4.18	1.14	3.42	9.13	5.32	7.22	9.89	6.08	2.66	.00	100.00
(2)	.03	.00	.07	.10	.43	.20	.72	.13	.03	.10	.28	.16	.22	.30	.19	.08	.00	3.05

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD
C= CALM (WIND SPEED LESS THAN OR EQUAL TO .95 MPH)

SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS B CLASS FREQUENCY (PERCENT) = 4.08

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C-3	1	1	2	0	0	0	1	0	0	0	0	0	0	0	0	1	0	6
(1)	.28	.28	.57	.00	.00	.00	.28	.00	.00	.00	.00	.00	.00	.00	.00	.28	.00	1.71
(2)	.01	.01	.02	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.07
4-7	2	0	0	2	11	9	16	1	0	3	6	8	8	3	6	2	0	77
(1)	.57	.00	.00	.57	3.13	2.56	4.56	.28	.00	.85	1.71	2.28	2.28	.85	1.71	.57	.00	21.94
(2)	.02	.00	.00	.02	.13	.10	.19	.01	.00	.03	.07	.09	.09	.03	.07	.02	.00	.89
8-12	3	1	0	6	25	8	13	8	3	15	25	25	15	19	26	2	0	194
(1)	.85	.28	.00	1.71	7.12	2.28	3.70	2.28	.85	4.27	7.12	7.12	4.27	5.41	7.41	.57	.00	55.27
(2)	.03	.01	.00	.07	.29	.09	.15	.09	.03	.17	.29	.29	.17	.22	.30	.02	.00	2.25
13-18	1	0	2	2	0	0	2	0	0	2	11	7	9	12	22	0	0	70
(1)	.28	.00	.57	.57	.00	.00	.57	.00	.00	.57	3.13	1.99	2.56	3.42	6.27	.00	.00	19.94
(2)	.01	.00	.02	.02	.00	.00	.02	.00	.00	.02	.13	.08	.10	.14	.26	.00	.00	.81
19-24	0	0	0	0	0	0	0	0	0	0	1	0	2	1	0	0	0	4
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.28	.00	.57	.28	.00	.00	.00	1.14
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.02	.01	.00	.00	.00	.05
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ALL SPEEDS	7	2	4	10	36	17	32	9	3	20	43	40	34	35	54	5	0	351
(1)	1.99	.57	1.14	2.85	10.26	4.84	9.12	2.56	.85	5.70	12.25	11.40	9.69	9.97	15.38	1.42	.00	100.00
(2)	.08	.02	.05	.12	.42	.20	.37	.10	.03	.23	.50	.46	.39	.41	.63	.06	.00	4.08

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD
C= CALM (WIND SPEED LESS THAN OR EQUAL TO .95 MPH)

SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA　　STABILITY CLASS C　　CLASS FREQUENCY (PERCENT) = 6.23

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C-3	2	0	0	0	0	0	0	1	0	0	2	0	2	0	1	2	0	10
(1)	.37	.00	.00	.00	.00	.00	.00	.19	.00	.00	.37	.00	.37	.00	.19	.37	.00	1.87
(2)	.02	.00	.00	.00	.00	.00	.00	.01	.00	.00	.02	.00	.02	.00	.01	.02	.00	.12
4-7	6	3	3	5	18	8	12	5	1	6	9	10	18	14	12	9	0	139
(1)	1.12	.56	.56	.93	3.36	1.49	2.24	.93	.19	1.12	1.68	1.87	3.36	2.61	2.24	1.68	.00	25.93
(2)	.07	.03	.03	.06	.21	.09	.14	.06	.01	.07	.10	.12	.21	.16	.14	.10	.00	1.61
8-12	5	0	6	27	24	8	16	8	2	10	20	38	31	46	37	7	0	285
(1)	.93	.00	1.12	5.04	4.48	1.49	2.99	1.49	.37	1.87	3.73	7.09	5.78	8.58	6.90	1.31	.00	53.17
(2)	.06	.00	.07	.31	.28	.09	.19	.09	.02	.12	.23	.44	.36	.53	.43	.08	.00	3.31
13-18	0	0	7	1	5	0	0	0	1	2	3	10	15	23	29	0	0	96
(1)	.00	.00	1.31	.19	.93	.00	.00	.00	.19	.37	.56	1.87	2.80	4.29	5.41	.00	.00	17.91
(2)	.00	.00	.08	.01	.06	.00	.00	.00	.01	.02	.03	.12	.17	.27	.34	.00	.00	1.11
19-24	0	0	1	0	1	0	0	0	0	0	0	0	1	3	0	0	0	6
(1)	.00	.00	.19	.00	.19	.00	.00	.00	.00	.00	.00	.00	.19	.56	.00	.00	.00	1.12
(2)	.00	.00	.01	.00	.01	.00	.00	.00	.00	.00	.00	.00	.01	.03	.00	.00	.00	.07
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ALL SPEEDS	13	3	17	33	48	16	28	14	4	18	34	58	67	86	79	18	0	536
(1)	2.43	.56	3.17	6.16	8.96	2.99	5.22	2.61	.75	3.36	6.34	10.82	12.50	16.04	14.74	3.36	.00	100.00
(2)	.15	.03	.20	.38	.56	.19	.33	.16	.05	.21	.39	.67	.78	1.00	.92	.21	.00	6.23

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
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C= CALM (WIND SPEED LESS THAN OR EQUAL TO .95 MPH)

SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS D CLASS FREQUENCY (PERCENT) = 40.65

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(1)	.00	.00	.03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.03
(2)	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01
C-3	18	17	6	18	13	4	7	16	5	17	3	12	11	26	27	27	0	227
(1)	.51	.49	.17	.51	.37	.11	.20	.46	.14	.49	.09	.34	.31	.74	.77	.77	.00	6.49
(2)	.21	.20	.07	.21	.15	.05	.08	.19	.06	.20	.03	.14	.13	.30	.31	.31	.00	2.64
4-7	81	68	65	63	74	51	70	79	63	77	86	88	112	115	141	132	0	1365
(1)	2.31	1.94	1.86	1.80	2.11	1.46	2.00	2.26	1.80	2.20	2.46	2.51	3.20	3.29	4.03	3.77	.00	39.00
(2)	.94	.79	.75	.73	.86	.59	.81	.92	.73	.89	1.00	1.02	1.30	1.34	1.64	1.53	.00	15.85
8-12	58	35	103	82	75	11	37	27	21	82	179	152	127	192	151	57	0	1389
(1)	1.66	1.00	2.94	2.34	2.14	.31	1.06	.77	.60	2.34	5.11	4.34	3.63	5.49	4.31	1.63	.00	39.69
(2)	.67	.41	1.20	.95	.87	.13	.43	.31	.24	.95	2.08	1.77	1.48	2.23	1.75	.66	.00	16.13
13-18	2	6	34	27	36	1	0	1	2	21	45	22	54	109	73	2	0	435
(1)	.06	.17	.97	.77	1.03	.03	.00	.03	.06	.60	1.29	.63	1.54	3.11	2.09	.06	.00	12.43
(2)	.02	.07	.39	.31	.42	.01	.00	.01	.02	.24	.52	.26	.63	1.27	.85	.02	.00	5.05
19-24	0	0	15	11	20	0	0	0	0	0	2	1	8	5	10	1	0	73
(1)	.00	.00	.43	.31	.57	.00	.00	.00	.00	.00	.06	.03	.23	.14	.29	.03	.00	2.09
(2)	.00	.00	.17	.13	.23	.00	.00	.00	.00	.00	.02	.01	.09	.06	.12	.01	.00	.85
GT 24	0	0	7	2	1	0	0	0	0	0	0	0	0	0	0	0	0	10
(1)	.00	.00	.20	.06	.03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.29
(2)	.00	.00	.08	.02	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.12
ALL SPEEDS	159	126	231	203	219	67	114	123	91	197	315	275	312	447	402	219	0	3500
(1)	4.54	3.60	6.60	5.80	6.26	1.91	3.26	3.51	2.60	5.63	9.00	7.86	8.91	12.77	11.49	6.26	.00	100.00
(2)	1.85	1.46	2.68	2.36	2.54	.78	1.32	1.43	1.06	2.29	3.66	3.19	3.62	5.19	4.67	2.54	.00	40.65

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD
C= CALM (WIND SPEED LESS THAN OR EQUAL TO .95 MPH)

SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS E CLASS FREQUENCY (PERCENT) = 31.06

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	3
(1)	.04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	.04	.00	.11
(2)	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.00	.03
C-3	22	18	13	18	20	6	8	9	32	35	42	50	48	52	35	32	0	440
(1)	.82	.67	.49	.67	.75	.22	.30	.34	1.20	1.31	1.57	1.87	1.80	1.94	1.31	1.20	.00	16.45
(2)	.26	.21	.15	.21	.23	.07	.09	.10	.37	.41	.49	.58	.56	.60	.41	.37	.00	5.11
4-7	30	16	29	27	21	29	35	46	54	109	179	243	207	213	135	60	0	1433
(1)	1.12	.60	1.08	1.01	.79	1.08	1.31	1.72	2.02	4.08	6.69	9.09	7.74	7.97	5.05	2.24	.00	53.59
(2)	.35	.19	.34	.31	.24	.34	.41	.53	.63	1.27	2.08	2.82	2.40	2.47	1.57	.70	.00	16.64
8-12	3	3	13	22	14	9	7	17	24	42	129	183	71	94	54	6	0	691
(1)	.11	.11	.49	.82	.52	.34	.26	.64	.90	1.57	4.82	6.84	2.66	3.52	2.02	.22	.00	25.84
(2)	.03	.03	.15	.26	.16	.10	.08	.20	.28	.49	1.50	2.13	.82	1.09	.63	.07	.00	8.03
13-18	2	5	5	18	14	5	0	0	2	6	7	5	0	12	10	2	0	93
(1)	.07	.19	.19	.67	.52	.19	.00	.00	.07	.22	.26	.19	.00	.45	.37	.07	.00	3.48
(2)	.02	.06	.06	.21	.16	.06	.00	.00	.02	.07	.08	.06	.00	.14	.12	.02	.00	1.08
19-24	0	0	3	5	2	0	0	0	0	1	0	0	0	0	1	0	0	12
(1)	.00	.00	.11	.19	.07	.00	.00	.00	.00	.04	.00	.00	.00	.00	.04	.00	.00	.45
(2)	.00	.00	.03	.06	.02	.00	.00	.00	.00	.01	.00	.00	.00	.00	.01	.00	.00	.14
GT 24	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
(1)	.00	.00	.00	.04	.04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.07
(2)	.00	.00	.00	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02
ALL SPEEDS	58	42	63	91	72	49	50	72	112	193	357	481	326	371	236	101	0	2674
(1)	2.17	1.57	2.36	3.40	2.69	1.83	1.87	2.69	4.19	7.22	13.35	17.99	12.19	13.87	8.83	3.78	.00	100.00
(2)	.67	.49	.73	1.06	.84	.57	.58	.84	1.30	2.24	4.15	5.59	3.79	4.31	2.74	1.17	.00	31.06

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
(2)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PERIOD
C= CALM (WIND SPEED LESS THAN OR EQUAL TO .95 MPH)

SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS F CLASS FREQUENCY (PERCENT) = 8.03

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
(1)	.00	.14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.14	.00	.29
(2)	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.02
C-3	12	3	10	11	9	6	5	2	13	14	21	46	71	78	42	16	0	359
(1)	1.74	.43	1.45	1.59	1.30	.87	.72	.29	1.88	2.03	3.04	6.66	10.27	11.29	6.08	2.32	.00	51.95
(2)	.14	.03	.12	.13	.10	.07	.06	.02	.15	.16	.24	.53	.82	.91	.49	.19	.00	4.17
4-7	3	2	2	1	3	1	2	0	1	12	29	64	59	59	73	14	0	325
(1)	.43	.29	.29	.14	.43	.14	.29	.00	.14	1.74	4.20	9.26	8.54	8.54	10.56	2.03	.00	47.03
(2)	.03	.02	.02	.01	.03	.01	.02	.00	.01	.14	.34	.74	.69	.69	.85	.16	.00	3.77
8-12	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	1	0	5
(1)	.00	.00	.00	.00	.14	.00	.00	.14	.00	.00	.14	.14	.00	.00	.00	.14	.00	.72
(2)	.00	.00	.00	.00	.01	.00	.00	.01	.00	.00	.01	.01	.00	.00	.00	.01	.00	.06
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ALL SPEEDS	15	6	12	12	13	7	7	3	14	26	51	111	130	137	115	32	0	691
(1)	2.17	.87	1.74	1.74	1.88	1.01	1.01	.43	2.03	3.76	7.38	16.06	18.81	19.83	16.64	4.63	.00	100.00
(2)	.17	.07	.14	.14	.15	.08	.08	.03	.16	.30	.59	1.29	1.51	1.59	1.34	.37	.00	8.03

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
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C= CALM (WIND SPEED LESS THAN OR EQUAL TO .95 MPH)

SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS G CLASS FREQUENCY (PERCENT) = 6.91

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3
(1)	.17	.00	.17	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.17	.00	.00	.50
(2)	.01	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.03
C-3	2	6	7	7	3	3	2	2	1	8	26	59	125	155	54	10	0	470
(1)	.34	1.01	1.18	1.18	.50	.50	.34	.34	.17	1.34	4.37	9.92	21.01	26.05	9.08	1.68	.00	78.99
(2)	.02	.07	.08	.08	.03	.03	.02	.02	.01	.09	.30	.69	1.45	1.80	.63	.12	.00	5.46
4-7	0	0	1	1	1	0	1	0	0	2	2	9	13	48	41	1	0	120
(1)	.00	.00	.17	.17	.17	.00	.17	.00	.00	.34	.34	1.51	2.18	8.07	6.89	.17	.00	20.17
(2)	.00	.00	.01	.01	.01	.00	.01	.00	.00	.02	.02	.10	.15	.56	.48	.01	.00	1.39
8-12	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
(1)	.00	.00	.00	.00	.17	.00	.00	.00	.00	.00	.17	.00	.00	.00	.00	.00	.00	.34
(2)	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.02
13-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ALL SPEEDS	3	6	9	8	5	3	3	2	1	10	29	68	138	203	96	11	0	595
(1)	.50	1.01	1.51	1.34	.84	.50	.50	.34	.17	1.68	4.87	11.43	23.19	34.12	16.13	1.85	.00	100.00
(2)	.03	.07	.10	.09	.06	.03	.03	.02	.01	.12	.34	.79	1.60	2.36	1.11	.13	.00	6.91

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C= CALM (WIND SPEED LESS THAN OR EQUAL TO .95 MPH)

SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA STABILITY CLASS A CLASS FREQUENCY (PERCENT) = 3.07

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C-3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	3
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.38	.38	.00	.38	.00	1.14
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.00	.01	.00	.04
4-7	1	0	0	1	3	2	4	0	0	0	1	0	0	1	1	2	0	16
(1)	.38	.00	.00	.38	1.14	.76	1.52	.00	.00	.00	.38	.00	.00	.38	.38	.76	.00	6.08
(2)	.01	.00	.00	.01	.04	.02	.05	.00	.00	.00	.01	.00	.00	.01	.01	.02	.00	.19
8-12	0	0	0	3	18	17	34	6	2	4	9	4	2	4	1	2	0	106
(1)	.00	.00	.00	1.14	6.84	6.46	12.93	2.28	.76	1.52	3.42	1.52	.76	1.52	.38	.76	.00	40.30
(2)	.00	.00	.00	.04	.21	.20	.40	.07	.02	.05	.11	.05	.02	.05	.01	.02	.00	1.24
13-18	0	0	2	7	5	1	20	6	0	3	13	6	8	16	7	1	0	95
(1)	.00	.00	.76	2.66	1.90	.38	7.60	2.28	.00	1.14	4.94	2.28	3.04	6.08	2.66	.38	.00	36.12
(2)	.00	.00	.02	.08	.06	.01	.23	.07	.00	.04	.15	.07	.09	.19	.08	.01	.00	1.11
19-24	0	0	4	0	0	0	6	0	0	2	2	7	4	7	7	0	0	39
(1)	.00	.00	1.52	.00	.00	.00	2.28	.00	.00	.76	.76	2.66	1.52	2.66	2.66	.00	.00	14.83
(2)	.00	.00	.05	.00	.00	.00	.07	.00	.00	.02	.02	.08	.05	.08	.08	.00	.00	.46
GT 24	0	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0	0	4
(1)	.00	.00	.00	.00	.00	.00	.76	.38	.00	.00	.00	.00	.38	.00	.00	.00	.00	1.52
(2)	.00	.00	.00	.00	.00	.00	.02	.01	.00	.00	.00	.00	.01	.00	.00	.00	.00	.05
ALL SPEEDS	1	0	6	11	26	20	66	13	2	9	25	17	16	29	16	6	0	263
(1)	.38	.00	2.28	4.18	9.89	7.60	25.10	4.94	.76	3.42	9.51	6.46	6.08	11.03	6.08	2.28	.00	100.00
(2)	.01	.00	.07	.13	.30	.23	.77	.15	.02	.11	.29	.20	.19	.34	.19	.07	.00	3.07

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
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C= CALM (WIND SPEED LESS THAN OR EQUAL TO .95 MPH)

SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA STABILITY CLASS B CLASS FREQUENCY (PERCENT) = 4.10

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C-3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(1)	.00	.00	.00	.28	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.28
(2)	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01
4-7	2	0	1	0	6	0	5	2	0	0	3	1	0	4	0	4	0	28
(1)	.57	.00	.28	.00	1.71	.00	1.42	.57	.00	.00	.85	.28	.00	1.14	.00	1.14	.00	7.98
(2)	.02	.00	.01	.00	.07	.00	.06	.02	.00	.00	.04	.01	.00	.05	.00	.05	.00	.33
8-12	2	0	0	7	16	20	21	6	2	6	15	13	18	5	6	1	0	138
(1)	.57	.00	.00	1.99	4.56	5.70	5.98	1.71	.57	1.71	4.27	3.70	5.13	1.42	1.71	.28	.00	39.32
(2)	.02	.00	.00	.08	.19	.23	.25	.07	.02	.07	.18	.15	.21	.06	.07	.01	.00	1.61
13-18	3	1	3	2	4	1	8	4	0	13	22	16	5	27	19	1	0	129
(1)	.85	.28	.85	.57	1.14	.28	2.28	1.14	.00	3.70	6.27	4.56	1.42	7.69	5.41	.28	.00	36.75
(2)	.04	.01	.04	.02	.05	.01	.09	.05	.00	.15	.26	.19	.06	.32	.22	.01	.00	1.51
19-24	0	0	0	0	0	0	1	0	0	2	5	6	7	8	18	0	0	47
(1)	.00	.00	.00	.00	.00	.00	.28	.00	.00	.57	1.42	1.71	1.99	2.28	5.13	.00	.00	13.39
(2)	.00	.00	.00	.00	.00	.00	.01	.00	.00	.02	.06	.07	.08	.09	.21	.00	.00	.55
GT 24	0	0	0	0	0	0	0	0	0	0	1	0	4	3	0	0	0	8
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.28	.00	1.14	.85	.00	.00	.00	2.28
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.05	.04	.00	.00	.00	.09
ALL SPEEDS	7	1	4	10	26	21	35	12	2	21	46	36	34	47	43	6	0	351
(1)	1.99	.28	1.14	2.85	7.41	5.98	9.97	3.42	.57	5.98	13.11	10.26	9.69	13.39	12.25	1.71	.00	100.00
(2)	.08	.01	.05	.12	.30	.25	.41	.14	.02	.25	.54	.42	.40	.55	.50	.07	.00	4.10

(1)=PERCENT OF ALL GOOD OBSERVATIONS FOR THIS PAGE
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C= CALM (WIND SPEED LESS THAN OR EQUAL TO .95 MPH)

SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA   STABILITY CLASS C   CLASS FREQUENCY (PERCENT) = 6.26

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C-3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	2
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.19	.00	.00	.00	.00	.19	.00	.37
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.01	.00	.02
4-7	6	4	1	3	3	7	4	2	1	4	5	5	8	8	2	7	0	70
(1)	1.12	.75	.19	.56	.56	1.31	.75	.37	.19	.75	.93	.93	1.49	1.49	.37	1.31	.00	13.06
(2)	.07	.05	.01	.04	.04	.08	.05	.02	.01	.05	.06	.06	.09	.09	.02	.08	.00	.82
8-12	5	1	4	29	18	19	11	9	4	4	11	17	23	24	11	6	0	196
(1)	.93	.19	.75	5.41	3.36	3.54	2.05	1.68	.75	.75	2.05	3.17	4.29	4.48	2.05	1.12	.00	36.57
(2)	.06	.01	.05	.34	.21	.22	.13	.11	.05	.05	.13	.20	.27	.28	.13	.07	.00	2.29
13-18	2	0	5	4	7	3	7	9	1	6	19	30	25	48	23	3	0	192
(1)	.37	.00	.93	.75	1.31	.56	1.31	1.68	.19	1.12	3.54	5.60	4.66	8.96	4.29	.56	.00	35.82
(2)	.02	.00	.06	.05	.08	.04	.08	.11	.01	.07	.22	.35	.29	.56	.27	.04	.00	2.24
19-24	0	0	4	0	1	0	0	0	1	1	1	7	11	22	17	0	0	65
(1)	.00	.00	.75	.00	.19	.00	.00	.00	.19	.19	.19	1.31	2.05	4.10	3.17	.00	.00	12.13
(2)	.00	.00	.05	.00	.01	.00	.00	.00	.01	.01	.01	.08	.13	.26	.20	.00	.00	.76
GT 24	0	1	0	0	0	0	0	0	0	0	0	0	6	3	1	0	0	11
(1)	.00	.19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	1.12	.56	.19	.00	.00	2.05
(2)	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.07	.04	.01	.00	.00	.13
ALL SPEEDS	13	6	14	36	29	29	22	20	7	15	37	59	73	105	54	17	0	536
(1)	2.43	1.12	2.61	6.72	5.41	5.41	4.10	3.73	1.31	2.80	6.90	11.01	13.62	19.59	10.07	3.17	.00	100.00
(2)	.15	.07	.16	.42	.34	.34	.26	.23	.08	.18	.43	.69	.85	1.23	.63	.20	.00	6.26

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C= CALM (WIND SPEED LESS THAN OR EQUAL TO .95 MPH)

SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA   STABILITY CLASS D   CLASS FREQUENCY (PERCENT) = 40.48

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C-3	7	2	6	8	9	8	1	5	3	4	2	4	11	9	9	11	0	99
(1)	.20	.06	.17	.23	.26	.23	.03	.14	.09	.12	.06	.12	.32	.26	.26	.32	.00	2.86
(2)	.08	.02	.07	.09	.11	.09	.01	.06	.04	.05	.02	.05	.13	.11	.11	.13	.00	1.16
4-7	36	21	38	28	36	25	51	39	34	25	31	27	36	43	42	45	0	557
(1)	1.04	.61	1.10	.81	1.04	.72	1.47	1.13	.98	.72	.89	.78	1.04	1.24	1.21	1.30	.00	16.07
(2)	.42	.25	.44	.33	.42	.29	.60	.46	.40	.29	.36	.32	.42	.50	.49	.53	.00	6.50
8-12	87	56	75	71	50	44	44	58	60	76	102	89	88	128	111	99	0	1238
(1)	2.51	1.62	2.16	2.05	1.44	1.27	1.27	1.67	1.73	2.19	2.94	2.57	2.54	3.69	3.20	2.86	.00	35.72
(2)	1.02	.65	.88	.83	.58	.51	.51	.68	.70	.89	1.19	1.04	1.03	1.49	1.30	1.16	.00	14.46
13-18	54	49	68	35	33	7	16	31	18	74	176	100	117	169	101	31	0	1079
(1)	1.56	1.41	1.96	1.01	.95	.20	.46	.89	.52	2.14	5.08	2.89	3.38	4.88	2.91	.89	.00	31.13
(2)	.63	.57	.79	.41	.39	.08	.19	.36	.21	.86	2.06	1.17	1.37	1.97	1.18	.36	.00	12.60
19-24	12	17	25	15	32	3	1	2	1	16	34	12	59	90	49	3	0	371
(1)	.35	.49	.72	.43	.92	.09	.03	.06	.03	.46	.98	.35	1.70	2.60	1.41	.09	.00	10.70
(2)	.14	.20	.29	.18	.37	.04	.01	.02	.01	.19	.40	.14	.69	1.05	.57	.04	.00	4.33
GT 24	0	3	18	15	13	1	0	0	0	0	2	1	32	24	12	1	0	122
(1)	.00	.09	.52	.43	.38	.03	.00	.00	.00	.00	.06	.03	.92	.69	.35	.03	.00	3.52
(2)	.00	.04	.21	.18	.15	.01	.00	.00	.00	.00	.02	.01	.37	.28	.14	.01	.00	1.42
ALL SPEEDS	196	148	230	172	173	88	113	135	116	195	347	233	343	463	324	190	0	3466
(1)	5.65	4.27	6.64	4.96	4.99	2.54	3.26	3.89	3.35	5.63	10.01	6.72	9.90	13.36	9.35	5.48	.00	100.00
(2)	2.29	1.73	2.69	2.01	2.02	1.03	1.32	1.58	1.35	2.28	4.05	2.72	4.01	5.41	3.78	2.22	.00	40.48

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SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA STABILITY CLASS E CLASS FREQUENCY (PERCENT) = 31.08

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
(1)	.00	.00	.00	.00	.00	.00	.04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04
(2)	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01
C-3	6	2	4	7	3	3	7	7	6	8	4	3	3	2	3	5	0	73
(1)	.23	.08	.15	.26	.11	.11	.26	.26	.23	.30	.15	.11	.11	.08	.11	.19	.00	2.74
(2)	.07	.02	.05	.08	.04	.04	.08	.08	.07	.09	.05	.04	.04	.02	.04	.06	.00	.85
4-7	13	13	22	14	11	22	15	20	22	14	27	20	17	24	19	22	0	295
(1)	.49	.49	.83	.53	.41	.83	.56	.75	.83	.53	1.01	.75	.64	.90	.71	.83	.00	11.09
(2)	.15	.15	.26	.16	.13	.26	.18	.23	.26	.16	.32	.23	.20	.28	.22	.26	.00	3.45
8-12	61	23	18	12	16	17	23	38	72	103	168	134	120	142	136	46	0	1129
(1)	2.29	.86	.68	.45	.60	.64	.86	1.43	2.71	3.87	6.31	5.04	4.51	5.34	5.11	1.73	.00	42.43
(2)	.71	.27	.21	.14	.19	.20	.27	.44	.84	1.20	1.96	1.56	1.40	1.66	1.59	.54	.00	13.18
13-18	9	13	14	25	9	8	9	19	39	53	208	193	126	209	77	7	0	1018
(1)	.34	.49	.53	.94	.34	.30	.34	.71	1.47	1.99	7.82	7.25	4.74	7.85	2.89	.26	.00	38.26
(2)	.11	.15	.16	.29	.11	.09	.11	.22	.46	.62	2.43	2.25	1.47	2.44	.90	.08	.00	11.89
19-24	1	3	4	4	13	6	2	2	3	8	11	9	11	22	12	4	0	115
(1)	.04	.11	.15	.15	.49	.23	.08	.08	.11	.30	.41	.34	.41	.83	.45	.15	.00	4.32
(2)	.01	.04	.05	.05	.15	.07	.02	.02	.04	.09	.13	.11	.13	.26	.14	.05	.00	1.34
GT 24	1	4	3	12	5	1	0	0	0	1	0	0	0	2	1	0	0	30
(1)	.04	.15	.11	.45	.19	.04	.00	.00	.00	.04	.00	.00	.00	.08	.04	.00	.00	1.13
(2)	.01	.05	.04	.14	.06	.01	.00	.00	.00	.01	.00	.00	.00	.02	.01	.00	.00	.35
ALL SPEEDS	91	58	65	74	57	57	57	86	142	187	418	359	277	401	248	84	0	2661
(1)	3.42	2.18	2.44	2.78	2.14	2.14	2.14	3.23	5.34	7.03	15.71	13.49	10.41	15.07	9.32	3.16	.00	100.00
(2)	1.06	.68	.76	.86	.67	.67	.67	1.00	1.66	2.18	4.88	4.19	3.23	4.68	2.90	.98	.00	31.08

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SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA STABILITY CLASS F CLASS FREQUENCY (PERCENT) = 8.07

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C-3	2	0	2	5	0	3	1	4	4	0	3	3	3	2	5	0	0	37
(1)	.29	.00	.29	.72	.00	.43	.14	.58	.58	.00	.43	.43	.43	.29	.72	.00	.00	5.35
(2)	.02	.00	.02	.06	.00	.04	.01	.05	.05	.00	.04	.04	.04	.02	.06	.00	.00	.43
4-7	6	7	6	8	5	5	11	11	20	17	15	10	9	7	3	7	0	147
(1)	.87	1.01	.87	1.16	.72	.72	1.59	1.59	2.89	2.46	2.17	1.45	1.30	1.01	.43	1.01	.00	21.27
(2)	.07	.08	.07	.09	.06	.06	.13	.13	.23	.20	.18	.12	.11	.08	.04	.08	.00	1.72
8-12	15	12	4	4	3	3	3	4	15	17	33	44	56	48	36	33	0	330
(1)	2.17	1.74	.58	.58	.43	.43	.43	.58	2.17	2.46	4.78	6.37	8.10	6.95	5.21	4.78	.00	47.76
(2)	.18	.14	.05	.05	.04	.04	.04	.05	.18	.20	.39	.51	.65	.56	.42	.39	.00	3.85
13-18	16	0	0	0	0	1	0	2	1	7	10	32	21	33	41	12	0	176
(1)	2.32	.00	.00	.00	.00	.14	.00	.29	.14	1.01	1.45	4.63	3.04	4.78	5.93	1.74	.00	25.47
(2)	.19	.00	.00	.00	.00	.01	.00	.02	.01	.08	.12	.37	.25	.39	.48	.14	.00	2.06
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.14	.00	.14
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.01
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ALL SPEEDS	39	19	12	17	8	12	15	21	40	41	61	89	89	90	85	53	0	691
(1)	5.64	2.75	1.74	2.46	1.16	1.74	2.17	3.04	5.79	5.93	8.83	12.88	12.88	13.02	12.30	7.67	.00	100.00
(2)	.46	.22	.14	.20	.09	.14	.18	.25	.47	.48	.71	1.04	1.04	1.05	.99	.62	.00	8.07

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SEABROOK JAN02-DEC02 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA STABILITY CLASS G CLASS FREQUENCY (PERCENT) = 6.95

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C-3	2	7	6	9	2	4	1	3	3	0	3	2	1	4	5	2	0	54
(1)	.34	1.18	1.01	1.51	.34	.67	.17	.50	.50	.00	.50	.34	.17	.67	.84	.34	.00	9.08
(2)	.02	.08	.07	.11	.02	.05	.01	.04	.04	.00	.04	.02	.01	.05	.06	.02	.00	.63
4-7	16	18	9	6	4	6	10	11	12	7	19	18	14	15	15	12	0	192
(1)	2.69	3.03	1.51	1.01	.67	1.01	1.68	1.85	2.02	1.18	3.19	3.03	2.35	2.52	2.52	2.02	.00	32.27
(2)	.19	.21	.11	.07	.05	.07	.12	.13	.14	.08	.22	.21	.16	.18	.18	.14	.00	2.24
8-12	17	10	2	2	0	3	5	5	6	13	17	34	40	32	41	46	0	273
(1)	2.86	1.68	.34	.34	.00	.50	.84	.84	1.01	2.18	2.86	5.71	6.72	5.38	6.89	7.73	.00	45.88
(2)	.20	.12	.02	.02	.00	.04	.06	.06	.07	.15	.20	.40	.47	.37	.48	.54	.00	3.19
13-18	3	0	0	0	1	0	0	0	2	5	8	9	5	5	22	16	0	76
(1)	.50	.00	.00	.00	.17	.00	.00	.00	.34	.84	1.34	1.51	.84	.84	3.70	2.69	.00	12.77
(2)	.04	.00	.00	.00	.01	.00	.00	.00	.02	.06	.09	.11	.06	.06	.26	.19	.00	.89
19-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ALL SPEEDS	38	35	17	17	7	13	16	19	23	25	47	63	60	56	83	76	0	595
(1)	6.39	5.88	2.86	2.86	1.18	2.18	2.69	3.19	3.87	4.20	7.90	10.59	10.08	9.41	13.95	12.77	.00	100.00
(2)	.44	.41	.20	.20	.08	.15	.19	.22	.27	.29	.55	.74	.70	.65	.97	.89	.00	6.95

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ENCLOSURE 3 TO NYN-03041 / LIC-03045

Radiation Dose Assessment

Seabrook Station
Radiological Effluent Impact Assessment For 2002
(Annual Radioactive Effluent Release Report)

I. Summary

Seabrook Technical Specification Sections 6.7.6.g.4 & 9 require that limitations be placed on the quarterly and annual doses or dose commitments to Members of the Public from radioactive materials in liquid and gaseous effluents released from the station to Unrestricted Areas at or beyond the site boundary conforming to the dose objectives of Appendix I to 10 CFR Part 50. Technical Specification 6.7.6.g.8 requires limitations on the quarterly and annual air doses resulting from noble gases released in gaseous effluents to areas beyond the site boundary also conform to Appendix I to 10 CFR Part 50. In a similar fashion, Technical Specification 6.7.6.g.11 requires limitations on the annual dose or dose commitment to any Member of the Public due to radioactivity and radiation from uranium fuel cycle sources conforming to the EPA Radiation Standards in 40 CFR Part 190. The following table details the above referenced effluent dose limits.

DOSE OBJECTIVE CRITERIA FOR COMPLIANCE

EFFLUENT TYPE	DOSE TYPE	QUARTERLY LIMITS	ANNUAL LIMITS
LIQUIDS (10CFR50, APP. I)	Total Body Max. Organ	1.5 mrem 5 mrem	3 mrem 10 mrem
NOBLE GAS (10CFR50, APP. I)	Gamma Air Beta Air	5 mrad 10 mrad	10 mrad 20 mrad
GAS PARTICULATE (10CFR50, APP. I)	Max. Organ	7.5 mrem	15 mrem
TOTAL DOSE (40CFR190) [liquids, gas, direct]	Total Body & organ Thyroid	---	25 mrem 75 mrem

Technical Specification 6.8.1.4 and the Seabrook Offsite Dose Calculation Manual (ODCM) Part A, Section 10.2, provides that the Station's Annual Radioactive Effluent Release Report include a demonstration of compliance with the above off-site dose limitations, as well as the determination of dose impacts to Members of the Public who may be associated with permitted activities inside the site boundary.

Doses resulting from actual liquid and gaseous effluents from Seabrook Station during 2002 were calculated in accordance with Method II as defined in the Station Offsite Dose Calculation Manual. The calculation methods follow the models in Regulatory Guide 1.109 (Reference 1). The assessments included maximum whole body doses and organ doses from all liquid releases, maximum offsite organ doses resulting from airborne iodines, tritium and particulate radionuclides with half-lives greater than eight days, and maximum offsite beta air and gamma air doses from airborne noble gases. In addition, the potential direct dose from fixed radiation sources from plant operations was evaluated as part of the assessment required under 40 CFR part 190 for doses from the uranium fuel cycle.

Doses were also calculated for the special receptor locations inside the site boundary where the public might be granted access for recreational or educational purposes. The Science and Nature Center is located in the southwest portion of the site and offers educational opportunities on nuclear power and the

environment. The "Rocks" is an area northeast of the main plant facilities with access to Brown's Creek and the tidal marsh that borders the site.

All calculated liquid and gaseous pathway doses for the 2002 reporting period are well below the dose criteria of 10CFR50, Appendix I, and the dose limits for effluent releases stated in the ODCM. In addition, the total dose to the most limiting Member of the Public due to the combined exposure to plant-related direct radiation, and liquid and gaseous effluents, was below the dose standards of 40CFR190.

II. Method for Calculating the Total Body and Maximum Organ Doses Resulting from Liquid Releases

Liquid waste generated during plant operations is processed and discharged to the environment via the station's circulating water cooling system. The cooling system utilizes an offshore submerged multiport diffuser discharge for rapid dissipation and mixing of liquid effluents in the ocean environment. A 22-port diffuser section of the discharge system is located in approximately 50 to 60 feet of water with each nozzle 7 to 10 feet above the sea floor. Eleven riser shafts, with two diffuser nozzles each for the diffuser, are spaced about 100 feet apart over a distance of about 1000 feet. Water is discharged in a generally eastward direction away from the shoreline through the multiport diffuser, beginning at a location over one mile off-shore. During power operations, these high velocity jets passively entrain about ten volumes of fresh water into the near field jet mixing region before the plume reaches the water surface. This arrangement also effectively prevents the discharge plume (at least to the 1 degree or 40 to 1 dilution isopleth) from impacting the shoreline over the tidal cycle.

During shutdown periods, the high velocity jet mixing created by the normal circulating water flow at the diffuser nozzles is reduced. However, mixing within the discharge tunnel water volume is significantly increased due to the long transit time for batch discharges to travel the three miles from the plant through the 19-foot diameter tunnels to the diffuser nozzles. Additional mixing of the effluent in the near field assures that an equivalent overall 10 to 1 dilution occurs by the time it reaches the ocean surface.

The exposure pathways considered in the calculations of total body and maximum organ doses resulting from liquid discharges from Seabrook Station are limited to ingestion of aquatic foods and exposure to shoreline deposits. The dose calculations do not include the ingestion of potable water or irrigated vegetation as potential exposure pathways because the liquid effluents from the plant are discharged into salt water.

The dose assessment models utilized in the Offsite Dose Calculation Manual (ODCM) (Reference 2) are taken from Regulatory Guide 1.109 (Reference 1). The total body and organ doses are evaluated for each of the four age groups (i.e., infant, child, teen and adult) to determine the maximum total body dose and maximum organ dose via all existing exposure pathways (i.e., fish and aquatic invertebrate ingestion, and shoreline exposure) to an age-dependent individual from all detected radionuclides in plant releases. The values for the various factors considered in the model equations are provided in Regulatory Guide 1.109 and the ODCM (see Table D). The flow rate of the liquid effluent (F) and the radionuclide activities (Q_i) are measured specifically prior to each liquid release. The values for half-lives for radionuclides ($T_{1/2}$) and their radioactive decay constants (λ_i) have been taken from Kocher (Reference 3).

Table A presents the calculated liquid pathway doses for each calendar quarter and total for the year. The calculated annual doses as a percent of the applicable regulatory limits are shown in Table C. The estimated quarterly and annual doses resulting from liquid effluents to members of the public are well below all dose limit criteria.

III. Method for Calculating the Gamma and Beta Air Doses from Noble Gases

Gamma and beta air doses due to noble gases in gaseous effluents are calculated for several receptor locations when noble gases are recorded in effluents. Those locations include the points of estimated highest off-site ground level air concentration of radioactive material, site boundary (or closets point on the opposite shoreline in directions which are bordered by the tidal marsh), nearest resident, nearest vegetable garden, and nearest milk animal within five miles for each of the sixteen principle compass directions. The special on-site receptor locations (Science and Nature Center and the "Rocks") are also included.

Atmospheric dispersion factors (i.e., X/Q factors) calculated from recorded concurrent site meteorological data (i.e., meteorological data measurements taken during the time of the release) are used in the estimation of receptor specific air concentrations due to station effluents. The atmospheric dispersion estimations utilize methodology generally consistent with US NRC Regulatory Guide 1.111 (Reference 4). Beta air doses use undepleted X/Q's and assume a semi-infinite plume at the point of exposure. Gamma air doses are calculated using the finite cloud model presented in "Meteorology and Atomic Energy – 1968" (Reference 5). That model is implemented through the definition of an effective gamma atmospheric dispersion factor $[X/Q^{\gamma}]$ (Reference 6) and the replacement of the undepleted X/Q in the infinite cloud dose equation by $[X/Q^{\gamma}]$.

The release point of effluents is also considered in the atmospheric dispersion calculation. The primary vent stack is treated as a "mixed-mode" release, as defined in Regulatory Guide 1.111. These effluents are considered to be part-time ground level / part-time elevated releases depending on the ratio of primary vent stack exit velocity relative to the speed of prevailing wind. All other release points (e.g., Turbine Building and Chemistry lab hoods) are considered ground-level releases. The beta air and gamma air dose calculations are consistent with the models presented in Regulatory Guide 1.109 (Reference 1). The values for the dose factors, DF_i^{γ} and DF_i^{β}, have been taken from Table B-1 in Regulatory Guide 1.109.

Table A presents the calculated maximum off-site gamma air and beta air doses for each calendar quarter and year. The calculated annual doses as a percent of the applicable regulatory limit are shown in Table C. The estimated quarterly and annual air doses resulting from noble gas effluents are well below all dose limit criteria.

IV. Method for Calculating the Critical Organ Dose Resulting from Iodines, Tritium and Particulates with T 1/2 Greater than 8 Days in Gaseous Releases

Regulatory Guide 1.109 dose models are applied in the calculation of the critical organ doses from iodines, tritium and particulate radionuclides released into the atmosphere during reporting period. Atmospheric dispersion and deposition factors (i.e., depleted X/Q and D/Q factors) calculated with concurrent meteorological data (i.e., meteorological data measurements taken during the time of the release) are used in the determination of gaseous pathway doses. The dispersion models are described in Section B.7.3.2 & .3 of the Seabrook ODCM.

Potential exposure pathways associated with gaseous effluent are (i) external irradiation from radioactivity deposited on the ground surface, (ii) inhalation, and (iii) ingestion of vegetables (both fresh leafy and stored), meat, and milk. Dose estimates were determined for the site boundary and for the locations of the nearest resident, vegetable garden, and milk animal in each of the sixteen principle compass directions. The locations of the nearest resident, vegetable garden and milk animal in each sector were identified by the 2002 Annual Land Use Census as required by ODCM Control C.9.2.1 (see Table F). Additionally, doses were calculated at the point of approximate maximum ground level air concentration of radioactive materials in gaseous effluent. Conservatism in the dose estimates was maintained by assuming that the vegetable garden pathway was active at each milk animal location. Though not required to be part of the land use census, meat animal (cattle) locations are included in the assessment when identified. Meat and milk animals were assumed to receive their entire intake from pasture during the second and third quarters. This is a conservative assumption because most dairy operations utilize supplemental feeding when animals are on pasture, or actually restrict animals to full time silage feeding throughout the entire year. Table E provides the reference sources for dose model parameter assumptions used in the dose assessment.

The maximum organ doses were determined by summing the contributions from all exposure pathways at each location, and sorting in descending order. Doses were calculated for the whole body, GI-LLI, bone, liver, kidney, thyroid, lung, and skin for adults, teenagers, children, and infants. The estimated quarterly and annual organ doses due to iodines, tritium and particulates at the location of the maximally exposed individual are reported in Table A.

The estimated organ doses from iodines, tritium and particulates in gaseous effluents are well below the 10CFR50, Appendix I dose criteria for the reporting period (See Table C for calculated dose as a percentage of annual limit).

V. Total Dose (40 CFR Part 190)

40 CFR 190 states that the annual dose equivalent should not exceed 25 mrem to the whole body, 75 mrem to the Thyroid, or 25 mrem to any other organ of any Member of the Public from all uranium fuel cycle sources. To show compliance with this standard, the maximum doses for both the liquid and gaseous pathways from Seabrook Station are added together with the whole body dose from noble gas releases and any direct radiation component attributed to plant fixed sources to the maximum receptor location. Since there are no other uranium fuel cycle facilities within five miles of Seabrook, no additional impacts from sources beyond Seabrook Station need be considered.

The sum of the maximum annual whole body doses to Members of the Public from all exposure pathways for liquid and gaseous effluents, plus the direct external dose from station fixed sources, was 1.82E-02 mrem to a hypothetical individual at or beyond the site boundary. The maximum organ dose (including the thyroid) to any age group from all exposure pathways including direct radiation was 2.31E-02 mrem.

Table B illustrates the total dose projections from all station sources to the maximum potential off-site individual for the year 2002 and demonstrates compliance with the EPA's environmental radiation standard for the uranium fuel cycle per 10 CFR Part 190 (See Table C for total dose as a percentage of annual limit).

VI. References

1. Regulatory Guide 1.109, Revision 1,"Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purposes of Evaluating Compliance with 10CFR Part 50, Appendix I", USNRC, October 1977.

2. Seabrook Station Offsite Dose Calculation Manual (ODCM), Revision 24.

3. Kocher, D.C., Dose-Rate Conversion Factors for Exposure to Photons and Electrons, Health Physics, Vol. 45, No. 3, Sept. 1983.

4. Regulatory Guide 1.111, Revision 1, "Method for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors", USNRC, July 1977.

5. Slade, D.H., "Meteorology and Atomic Energy – 1968", USAEC, July 1968.

6. Hamawi, J.N., "AEOLUS-2 A computer Code for the Determination of Continuous and Intermittent-Release Atmospheric Dispersion and Deposition of Nuclear Power Plant Effluents in Open-Terrain Sites, Coastal Sites, and Deep-River Valleys for the Assessment of Ensuing Doses and Finite-Cloud Gamma Radiation Exposures", Entech Engineering, Inc., March 1988.

Table A

Seabrook Station
2002 Annual Radioactive Effluent Release Report

Maximum[a] Off-Site Doses and Dose Commitments to Members of the Public

		Dose (mrem)[b]				
Release Type		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Year[c]
Liquid Effluents:						
Total Body Dose		3.20E-04 (1)	2.46E-04 (1)	6.15E-05 (1)	6.60E-05 (1)	6.94E-04
Organ Dose		4.63E-04 (2)	7.66E-04 (2)	1.85E-04 (2)	1.90E-04 (3)	1.60E-03
Airborne Effluents:						
Organ Dose from Iodines, Tritium, and Particulates		2.72E-03 (4)	1.05E-02 (5)	3.77E-03 (6)	3.90E-03 (7)	2.09E-02
Noble Gases	Beta Air (mrad)	4.62E-04 (9)	1.30E-03 (9)	8.16E-05 (11)	9.92E-08 (8)	1.84E-03
	Gamma Air (mrad)	1.38E-04 (9)	7.20E-04 (9)	3.72E-05 (10)	1.58E-07 (8)	8.95E-04
Doses (mrem) at Receptor Locations Inside Site Boundary[d]:						
Science and Nature Center (SW, 488m): Organ Dose (mrem)		1.33E-06 (d1)	5.60E-06 (d2)	2.52E-06 (d1)	3.02E-06 (d1)	1.25E-05
The "Rocks" (NE/ENE, 244m): Organ Dose (mrem)		1.50E-04 (d1)	2.32E-04 (d1)	2.14E-04 (d1)	2.36E-04 (d1)	8.32E-04
Direct Dose From Plant Operation[e]						0

Table A (continued)

Seabrook Station
2002 Annual Radioactive Effluent Release Report

Maximum[(a)] Off-Site Doses and Dose Commitments to Members of the Public

NOTES:

(a) "Maximum means the largest fraction of corresponding 10CFR50, Appendix I, dose design objective.

(b) The numbered footnotes indicate the age group, organ, and location (compass sector and distance from the primary vent in meters) of the dose receptor, where appropriate.

(1) Adult.
(2) GI-LLI of an adult.
(3) Bone of a child.
(4) Liver, kidney, lung, GI-LLI, thyroid, and whole body of a child, NNW 1009m.
(5) Thyroid, of a child, W 1315m.
(6) Thyroid, of a child, NW 1267m.
(7) Liver, kidney, lung, GI-LLI, thyroid, and whole body of a child, SW 1130m.
(8) E 2438m.
(9) N 914m.
(10) WSW 1022m.
(11) W 974m.

(c) "Maximum" dose for the year is the sum of the maximum doses for each quarter. This results in a conservative yearly dose estimate, but still well within the limits of 10CFR50.

(d) For each special receptor location, the whole body and organ doses calculated for the airborne effluent releases were adjusted by the occupancy factor provided in Seabrook's ODCM (i.e., 0.0014 for the Science and Nature Center and 0.0076 for the "Rocks"). It should also be noted that for 2002 actual occupancy factors were much lower (close to zero) since access to the site by the general public has been greatly restricted for security reasons following the terrorist attacks on America on 09/11/01. For conservatism, the previous factors as listed in the ODCM were applied for an estimate of upper bound doses and comparison with calculated impacts for years pre September 11, 2001. Where appropriate, the numbered footnotes indicate the organ and age group of the dose receptor:

(d1) Liver, kidney, lung, GI-LLI, thyroid, and whole body of a teen
(d2) Thyroid of a teen

(e) Only station sources are considered since there are no other facilities within five miles of Seabrook Station. 2002 data for the closest off-site environmental TLD locations in each sector (as listed in Table B.4-1 of Seabrook's ODCM) were compared to preoperation data from 1986-1988 for the same locations. No statistical difference which could be attributed to station sources was identified.

Table B

Seabrook Station
2002 Annual Radioactive Effluent Release Report

Total Dose to Maximum Off-Site Individual
(40CFR190)

Release Source	Total Body (mrem)	Maximum Organ[a] (mrem)
Liquids	6.94E-04	1.60E-03
Noble Gases	5.52E-04	5.52E-04
Gas Iodines, Tritium & Particulates	1.70E-02	2.09E-02
Direct Radiation	0.00E+00	0.00E+00
Annual Total	1.82E-02	2.31E-02

(a) Maximum organ includes consideration of the thyroid.

Table C

Seabrook Station
2002 Annual Radioactive Effluent Release Report

Calculated 2002 Maximum Doses Versus Applicable Limits

Receptor	Applicable ODCM Control	ODCM Annual Limit	Calculated Annual (2002) Dose	Percent of Limit
Offsite				
Liquid Effluents				
Whole Body Dose	C.6.2.1.b	3 mrem	6.94E-04 mrem	0.02%
Organ Dose	C.6.2.1.b	10 mrem	1.60E-03 mrem	0.02%
Airborne Effluents				
Organ Dose (iodines, tritium, and part.)	C.7.3.1.b	15 mrem	2.09E-02 mrem	0.14%
Gamma Air Dose (noble gases)	C.7.2.1.b	10 mrad	8.95E-04 mrad	0.009%
Beta Air Dose (noble gases)	C.7.2.1.b	20 mrad	1.84E-03 mrad	0.009%
All Plant Sources [a]				
Whole Body Dose	C.8.1.1	25 mrem	1.82E-02 mrem	0.07%
Organ Dose	C.8.1.1	25 mrem	2.31E-02 mrem	0.09%
Onsite (Science and Nature Center, 488m SW)				
Airborne Effluents				
Organ Dose (iodines, tritium, and part.)	C.7.3.1.b[b]	15 mrem	1.25E-05 mrem	0.0001%
Onsite (The "Rocks", 244m NE/ENE)				
Airborne Effluents				
Organ Dose (iodines, tritium, and part.)	C.7.3.1.b[b]	15 mrem	8.32E-04 mrem	0.006%

(a) The "all plant sources" doses are the sum of the whole body doses and maximum organ doses from liquid, noble gas, and iodines/tritium/particulate releases as well as direct radiation from fixed station sources.

(b) ODCM Part A, Section 10.2 states that the annual effluent report shall include an assessment of the radiation doses from radioactive liquids and gaseous effluents to members of the public due to their activities inside the site boundary during the report period. The referenced limits (C.7.2.1.b & C.7.3.1.b) are the acceptable doses from liquid and gaseous effluents to areas at and beyond the site boundary and are considered to be appropriate for comparison purposes.

Table D

Seabrook Station
2002 Annual Radioactive Effluent Release Report

Sources of the Values of Factors Used in Liquid Dose Equations

Factor	Definition	Source
U_{ap}	Usage factor	Table B.7-1, Station ODCM
M_p	Mixing ratio	Section B.7.1, Station ODCM (value=0.1 for aquatic foods and 0.025 for shoreline)
B_{ip}	Equilibrium bioaccumulation factor	Table A-1, Reg. Guide 1.109
D_{aipj}	Dose factor	Tables E-11 through E-14, R.G. 1.109
t_p	Nuclide transit time	Table E-15, Reg. Guide 1.109
K_c	Transfer coefficient from water to sediment	Reg. Guide 1.109
t_b	Period of activity buildup in sediment or soil	Table B.7-2, Station ODCM
W	Shoreline width factor	Table A-2, Reg. Guide 1.109 (value=0.5)

Table E

Seabrook Station
2002 Annual Radioactive Effluent Release Report

Sources of Values for the Factors Used in Dose Equations for Gaseous Releases

Factor	Definition	Source
t_b	Period of activity buildup in sediment or soil	Table B.7-2, Station ODCM
λ_i	Nuclide decay constant	Kocher (Reference 3)
DFG_{ij}	Ground plane dose factor	Table E-6, Reg. Guide 1.109
$[X/Q]^D$	Atmospheric dispersion factor	Calculated following Reg. Guide 1.111
R_a	Breathing rate	Table B.7-3, Station ODCM
DFA_{ija}	Inhalation dose factor	Tables E-7 through E-10, Reg. Guide 1.109
d_i	Nuclide deposition rate	Reg. Guide 1.109
P	Soil surface density	Table B.7-2, Station ODCM
t_e	Crop, leafy vegetable, or pasture grass exposure period	Table B.7-2, Station ODCM
t_h	Average time from crop harvest to consumption	Table B.7-2, Station ODCM
Y_v	Agricultural productivity by unit area	Table B.7-2, Station ODCM
r	Fraction of deposited activity retained on crops, leafy vegetables, or pasture grass	Table E-15, Reg. Guide 1.109
B_{iv}	Stable element transfer coefficient from soil to produce, leafy vegetable, or pasture grass	Table E-1, Reg. Guide 1.109
p	Fractional equilibrium ratio	Reg. Guide 1.109
H	Ambient absolute humidity	Table B.7-2, Station ODCM
F_m	Stable element transfer coefficient from feed to milk	Tables E-1 and E-2, Reg. Guide 1.109

Table E (continued)

Seabrook Station
2002 Annual Radioactive Effluent Release Report

Sources of Values for the Factors Used in Dose Equations for Gaseous Releases

Factor	Definition	Source
t_f	Average time from feed to milk to consumption	Reg. Guide 1.109
f_p	Fraction of the year that animals graze on pasture	Table B.7-2, Station ODCM
f_s	Fraction daily feed pasture grass	Table B.7-2, Station ODCM
F_f	Stable element transfer coefficient from feed to meat	Table E-1, Reg. Guide 1.109
t_s	Average time from meat animal slaughter to consumption	Table E-15, Reg. Guide 1.109
DFI_{ija}	Ingestion dose factor	Tables E-11 through E-14, R.G.1.109
U_a^v	Annual intake of produce	Table B.7-3, Station ODCM
U_a^m	Annual intake of milk	Table B.7-3, Station ODCM
U_a^F	Annual intake of meat	Table B.7-3, Station ODCM
U_a^L	Annual intake of leafy vegetables	Table B.7-3, Station ODCM
f_g	Ingestion rate fractions for garden produce	Reg. Guide 1.109
f_l	Ingestion rate fractions for garden leafy vegetables	Reg. Guide 1.109
λ_w	Rate constant for activity removal from plant and leaf surfaces by weathering	Table E-15, Reg. Guide 1.109
Q_F	Animal consumption rate	Table E-3, Reg. Guide 1.109

Table F

Seabrook Station
2002 Annual Radioactive Effluent Release Report

Receptor Locations* for Seabrook Station

Sector	Nearest Resident mile (km)	Nearest Garden mile (km)	Milk Animals within 5 Mile Radius mile (km)
N	2.69 (4.34)	2.78 (4.47)	---
NNE	1.89 (3.04)	1.95 (3.15)	---
NE	1.82 (2.92)	1.89 (3.04)	---
ENE	1.44 (2.31)	---	---
E	1.60 (2.58)	---	---
ESE	1.70 (2.73)	---	---
SE	1.46 (2.36)	---	---
SSE	2.13 (3.43)	---	---
S	0.75 (1.21)	0.86 (1.38)	---
SSW	0.69 (1.12)	0.88 (1.42)	---
SW	0.70 (1.13)	1.07 (1.73)	3.26 (5.24)
WSW	1.02 (1.64)	1.43 (2.31)	---
W	0.82 (1.32)	0.87 (1.40)	---
WNW	0.69 (1.11)	0.84 (1.35)	3.80 (6.12) 4.73 (7.61)
NW	0.79 (1.27)	0.79 (1.27)	4.30 (6.93)
NNW	0.63 (1.01)	0.73 (1.18)	3.30 (5.32)

* Locations based on 2002 Land Use Census.

ENCLOSURE 4 TO NYN-03041 / LIC-03045

Offsite Dose Calculation Manual

Revision 24

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PROGRAM MANUAL

Offsite Dose Calculation Manual

FOR INFORMATION ONLY

SORC Review: 02-074 Date: 12/18/02

Effective Date: 2-4-03

ODCM
Rev. 24

Manual Owner:
D. A. Robinson

ABSTRACT

The Offsite Dose Calculation Manual (ODCM) contains details to implement the requirements of Technical Specifications 6.7.6g and 6.7.6h.

The Offsite Dose Calculation Manual (ODCM) is divided into two parts: (1) the Radioactive Effluent Controls Program for both in-plant radiological effluent monitoring of liquids and gases, along with the Radiological Environmental Monitoring Program (REMP) (Part A); and (2) approved methods to determine effluent monitor setpoint values and estimates of doses and radionuclide concentrations occurring beyond the boundaries of Seabrook Station resulting from normal Station operation (Part B).

The sampling and analysis requirements of the Radioactive Effluent Controls Program, specified in Part A, provide the inputs for the models of Part B in order to calculate offsite doses and radionuclide concentrations necessary to determine compliance with the dose and concentration requirements of the Station Technical Specification 6.7.6g. The REMP required by Technical Specification 6.7.6h, and as specified within this manual, provides the means to determine that measurable concentrations of radioactive materials released as a result of the operation of Seabrook Station are not significantly higher than expected.

OFFSITE DOSE CALCULATION MANUAL
(ODCM)

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PART A
RADIOLOGICAL EFFLUENT CONTROL AND ENVIRONMENTAL MONITORING PROGRAMS

1.0 INTRODUCTION

The Offsite Dose Calculation Manual (ODCM) contains details to implement the Radioactive Effluent Controls and Environmental Monitoring Programs" of Technical Specifications 6.7.6g and 6.7.6h.

The purpose of this manual is to contain details for the implementation of the Radioactive Effluent Technical Requirement Program (RETRP) and the Radiological Environmental Monitoring Program (REMP). These programs are required by Technical Specifications 6.7.6g and 6.7.6h.

Part A of this manual defines specific concentrations, sampling regimes and frequencies for both the RETRP and the REMP. These activities are the defined surveillances for radiological releases. Part A also defines specific sampling locations for the RETRP. The information contained in Part A is used as input into the models that are used in Part B. The Part B models identify the calculational methods for determining radiation monitor setpoints, offsite doses and effluent concentrations of radionuclides. Part B also defines sampling locations for the REMP. The data resulting from the surveillance and monitoring programs described in Part A provide a means to confirm that concentrations of radioactive material released, as a result of routine Seabrook Station operations, do not contribute to effluent dose significantly different than as postulated in Part B.

2.0 RESPONSIBILITIES (PART A)

All changes to the ODCM shall be reviewed by the Station Operation Review Committee (SORC), approved by the Station Director, and documented per Administrative Control 6.13 of the Technical Specifications. The change process is controlled by the Applicability Determination Process as controlled by the 10 CFR 50.59 Resource Manual (5059RM). Changes made to Part A shall be submitted to the NRC for its information in the Annual Radioactive Effluent Release Report for the period in which the change(s) was made effective, pursuant to T.S. 6.13.

It shall be the responsibility of the Station Director to ensure that the ODCM is used in the performance of the Radioactive Effluent Control and Environmental Monitoring Program implementation requirements, as identified under Administrative Controls 6.7.6g and 6.7.6h of the Technical Specifications.

3.0 DEFINITIONS

The defined terms of this section appear in capitalized type and are applicable throughout these Controls. Terms used in these Controls and not defined herein have the same definition as listed in the Technical Specifications.

4.0 CONTROL AND APPLICABILITY

This section provides a summary listing of the Controls and Applicability requirements of the ODCM.

The RECP conforms with 10 CFR 50.36a for the control of radioactive effluents and for maintaining the doses to MEMBERS OF THE PUBLIC from radioactive effluents as low as reasonably achievable. The REMP provides for monitoring the radiation and radionuclides in the environs of the plant.

The specific implementation details for the RECP and REMP are located in the OFFSITE DOSE CALCULATION MANUAL (ODCM). Contained within the ODCM are the following CONTROLS:

C.5.1 - RADIOACTIVE EFFLUENT MONITORING INSTRUMENTATION – LIQUIDS

CONTROL - At All Times

The radioactive liquid effluent monitoring instrumentation channels shown in Table A.5.1-1 shall be OPERABLE with their Alarm/Trip Setpoints set to ensure that the limits of Control C.6.1.1 are not exceeded. The Alarm/Trip Setpoints of these channels shall be determined and adjusted in accordance with the methodology and parameters in the OFFSITE DOSE CALCULATION MANUAL (ODCM), Part B.

C.5.2 - RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

CONTROL- As Shown on ODCM Table A.5.2-1

The radioactive gaseous effluent monitoring instrumentation channels shown in Table A.5.2-1 shall be OPERABLE with their Alarm/Trip Setpoints set to ensure that the limits of Control C.7.1.1 are not exceeded. The Alarm/Trip Setpoints of these channels meeting Control C.7.1.1 shall be determined and adjusted in accordance with the methodology and parameters in the ODCM (Part B).

C.6.1.1 - RADIOACTIVE LIQUID EFFLUENTS – CONCENTRATION

CONTROL - At All Times

The concentration of radioactive material released in liquid effluents at the point of discharge from the multiport diffuser (see Technical Specifications Figure 5.1-3) shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} microCurie/ml total activity.

C.6.2.1 – DOSE

CONTROL – At All Times

The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each unit, to UNRESTRICTED AREAS (see Technical Specification Figure 5.1-3) shall be limited

- 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
- 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.

C.6.3.1 – LIQUID RADWASTE TREATMENT SYSTEM

CONTROL – At All Times

The Liquid Radwaste Treatment System shall be OPERABLE and appropriate portions of the system shall be used to reduce releases of radioactivity when the projected doses due to the liquid effluent to UNRESTRICTED AREAS (see Technical Specification Figure 5.1-3) would exceed 0.06 mrem to the whole body or 0.2 mrem to any organ in a 31-day period.

C.7.1.1 – RADIOACTIVE GASEOUS EFFLUENTS – DOSE RATE

CONTROL - At All Times

The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY (see Technical Specification Figure 5.1-1) shall be limited to the following:

- 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
- 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.

C.7.2.1 – DOSE – NOBLE GASES

CONTROL - At All Times

The air dose due to noble gases released in gaseous effluents to areas at and beyond the SITE BOUNDARY (see Technical Specification Figure 5.1-1) shall be limited to the following:

- 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
- 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.

C.7.3.1 – DOSE – IODINE-131, TRITIUM, AND RADIOACTIVE MATERIAL IN PARTICULATE FORM

CONTROL- At All Times

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 to areas at and beyond the SITE BOUNDARY (see Technical Specification Figure 5.1-1) shall be limited to the following:

- During any calendar quarter: Less than or equal to 7.5 mrems to any organ, and
- During any calendar year: Less than or equal to 15 mrems to any organ.

C.7.4.1 - GASEOUS RADWASTE TREATMENT SYSTEM

CONTROL – At All Times

The VENTILATION EXHAUST TREATMENT SYSTEM and the GASEOUS RADWASTE TREATMENT SYSTEM shall be OPERABLE and appropriate portions of these system shall be used to reduce releases of radioactivity when the projected doses in 31 days due to gaseous effluent releases to areas at and beyond the SITE BOUNDARY (see Technical Specification Figure 5.1-1) would exceed

- 0.2 mrad to air from gamma radiation, or
- 0.4 mrad to air from beta radiation, or
- 0.3 mrem to any organ of a MEMBER OF THE PUBLIC.

C.8.1.1 - TOTAL DOSE

CONTROL- At All Times

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 any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

C.9.1.1 - RADIOLOGICAL ENVIRONMENTAL MONITORING – MONITORING PROGRAM

CONTROL – At All Times

The Radiological Environmental Monitoring Program (REMP) shall be conducted as specified in Table A.9.1-1.

C.9.2.1 – LAND USE CENSUS

CONTROL - At All Times

A Land Use Census shall be conducted and shall identify within a distance of 8 km (5 miles) the location in each of the 16 meteorological sectors of the nearest milk animal, the nearest residence, and the nearest garden** of greater than 50 m^2 (500 ft^2) producing broad leaf vegetation.

C.9.3.1 – INTERLABORATORY COMPARISON PROGRAM

CONTROL - At All Times

In accordance with Technical Specification 6.7.6.h.3, analyses shall be performed on all radioactive materials supplied as part of an Interlaboratory Comparison Program, that has been approved by the Commission, that correspond to samples required by REMP.

**Broad leaf vegetation sampling of at least three different kinds of vegetation may be performed at the SITE BOUNDARY in each of two different direction sectors with the highest predicted relative deposition values (D/Qs) in lieu of the garden census. Specifications for broad leaf vegetation sampling in the REMP shall be followed, including analysis of control samples.

5.0 RADIOACTIVE EFFLUENT MONITORING INSTRUMENTATION

5.1 Liquids

CONTROLS

C.5.1 The radioactive liquid effluent monitoring instrumentation channels shown in Table A.5.1-1 shall be OPERABLE with their Alarm/Trip Setpoints set to ensure that the limits of Control C.6.1.1 are not exceeded. The Alarm/Trip Setpoints of these channels shall be determined and adjusted in accordance with the methodology and parameters in the OFFSITE DOSE CALCULATION MANUAL (ODCM), Part B.

APPLICABILITY: At all times.

ACTION:

a. With a radioactive liquid effluent monitoring instrumentation channel Alarm/Trip Setpoint less conservative than required by the above specification, immediately suspend the release of radioactive liquid effluents monitored by the affected channel, or declare the channel inoperable.

b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table A.5.1-1. Restore the inoperable instrumentation to OPERABLE status within 30 days and, if unsuccessful, explain in the next Annual Radioactive Effluent Release Report pursuant to Technical Specification 6.8.1.4 and Part A, Section 10.2, of the ODCM, why this inoperability was not corrected in a timely manner.

SURVEILLANCE REQUIREMENTS

S.5.1 Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL OPERATIONAL TEST at the frequencies shown in Table A.5.1-2.

BASES

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

Table A.5.1-2 Item 3a of Control C.5.1 requires that a Channel Operational Test be performed on the radioactivity monitors (RM-R-6515 and RM-R-6516) for the PCCW System. This channel operational test is a digital channel operational test and requires that it shall demonstrate automatic isolation of the pathway and control room alarm annunciation.

For Seabrook Station, these two radioactivity monitoring channels provide control room annunciation, but do not provide automatic isolation of the release pathway. This particular item was discussed in detail with the NRC staff reviewers. For this particular reason, the words "But Not Termination of Release" were added to Item 3 of Table A.5.1-2. The purpose of adding the above words to Item 3 was to preclude the addition of another Table Notation to Table A.5.1-2. Therefore, the channel operational test for these monitors only requires that they provide control room alarm annunciation.

The CHANNEL CHECK for Flow Rate Measurement Devices (Table A.5.1-2, items 2.a. and 2.b.) is required "at least once per 24 hours on **days when continuous, periodic, or batch releases are made.**" Additionally, ACTION 31 of Table A.5.1-1 is only applicable during actual releases.

Based on the above requirements, these instruments are only required to be OPERABLE during actual releases. Therefore, the CHANNEL CHECK is only required during periods when continuous, periodic, or batch releases are being made.

The Primary Component Cooling Water (PCCW) System is monitored by radiation monitors, which are required by Technical Specifications 3.3.3.1 and C.5.1 to be OPERABLE, or sampling of the PCCW and Service Water (SW) Systems is required. Clarification of this requirement needs to be made for certain PCCW System conditions. Below is a list of 3 conditions and their corresponding requirements.

1) If the PCCW System is shut down but not drained, grab samples shall be taken of PCCW and SW, as required in Technical Specification Table 3.3-6, Items 6a and 6b (Action 28).

2) During transition times when the PCCW system is in the process of being drained, grab samples, as required by Technical Specification Table 3.3-6, shall be taken until such time as sampling of PCCW is no longer possible. At this time neither PCCW nor SW need to be sampled. During transition times when the PCCW system is being filled, the taking of grab samples shall commence as soon as physically possible and continue in accordance with the requirements of Technical Specifications 3.3.3.1 and C.5.1 until PCCW is in service, the pumps are operating, and monitors are operable.

3) When PCCW is drained, there are no sampling requirements.

The above statements are consistent with the Technical Specification definition of OPERABILITY and with the Bases for Technical Specification 3.3.3.1.

The following actions are required when the Service Water side of the Primary Component Cooling Water (PCCW) Heat Exchanger is drained and grab samples of the Service Water System are required:

a. Grab samples from the Service Water System will be obtained at the frequencies specified in Technical Specification 3.3.3.1 and C.5.1 as the Service Water System is being drained until obtaining these samples is not physically possible.

b. Grab samples are not required once the Service Water System is drained such that it is not physically possible to obtain the samples.

c. When refilling the Service Water System, grab samples shall resume as soon as physically possible, at the intervals specified in the aforementioned sources, and continue until the PCCW radiation monitors (1-RM-6515 and 1-RM-6516) are OPERABLE.

Sampling of the PCCW system with the Service Water system drained and the PCCW system in operation shall continue per the requirements of Technical Specification 3.3.3.1 and this Control.

The purpose of the plant radiation monitors is to sense radiation levels in selected plant systems and locations and determine whether or not predetermined limits are being exceeded. In the case of the Primary Component Cooling Water (PCCW) loops, the radiation monitors (1-RM-6515 and 1-RM-6516) sense radiation in the PCCW system which could leak into the Service Water System and be discharged to the environment via the multiport diffuser. Per Control C.6.1.1, the concentration of radioactive material released in liquid effluents at the point of discharge from the multiport diffuser must be within specified limits. This limitation provides assurance that the levels of radioactive materials in unrestricted areas will not pose a threat to the health and safety of the public.

Based on the importance of maintaining radioactive effluent releases within limits that guarantee the health and safety of the public will not be at risk, the PCCW radiation monitors are required to be in operation at all times. When a radiation monitor is inoperable, grab samples from the PCCW and Service Water systems must be obtained and analyzed as a compensatory measure in accordance with Technical Specification 3.3.3.1, Table 3.3-6 Action 28 and this Control. If the service water system is drained, there is no potential for inadvertent radioactive liquid effluent release through the service water system to the environment via the multiport diffuser. Thus, when the system is drained there is no need to obtain the grab sample. However, when the system is being filled, grab samples must be obtained as soon as possible to ensure that the water discharged to the environment is in compliance with Control C.6.1.1.

The purpose of the PCCW monitors is to detect radioactivity indicative of a leak from the Reactor Coolant System or from one of the other radioactive systems which exchange with the PCCW System. These monitors are required to be operable at all times. Grab samples of PCCW are required when the PCCW monitors are not operable. Since the purpose of obtaining the PCCW samples is to provide an indication of a leak of radioactive liquid into the PCCW system, draining of the Service Water system does not remove the reason for obtaining the PCCW grab samples. These samples shall be obtained as specified in Technical Specification 3.3.3.1 and this Control. This determination is consistent with the Bases for Technical Specification 3.3.3.1.

The temporary lowering of an RDMS channel setpoint, by RDMS data base manipulation to verify alarm/trip functions, does not prevent the channel from continuously monitoring radiation levels (except WRGM). Additionally, when the setpoint is lowered below background radiation levels the associated trip functions will actuate equipment in their required operating mode as if a high radiation condition exists. The channel remains OPERABLE because monitoring and associated trip functions are not inhibited. Refer to TS-142 for further details.

When the SGBD demineralizers are being rinsed to the ocean using SGBD water, the SGBD flash tank radiation monitor (RM-6519) may become inoperable in this alignment from decreased backpressure to run the monitor sample pump. If this happens, the sampling requirements of Table A.5.1-1 ACTION 30 must be performed.

RM-6509, although in the flowpath of the SGBD demineralizer rinse, cannot perform the function of RM-6519 because it cannot achieve the same sensitivity to radiation. However, RM-6509 shall have its setpoints established per plant procedures since the discharge flow path is through the SGBD demineralizers (where a potential to acquire radioactivity exists), but after RM-6519.

If RM-6509 is inoperable, then in addition to the periodic sampling requirements of Table A.5.1-1 ACTION 30 for RM-6519, the batch sample and lineup verification of ACTION 29 would also have to be complied with, for RM-6509.

It should be noted that, during a SGBD demineralizer rinse to the discharge transition structure with SB liquid, SB-FE-1918 is not in the flow path. It is acceptable to use a flow monitoring device in the final flow path (such as WL-FIT-1458) so that Table A.5.1-1 ACTION 31 does <u>NOT</u> have to be entered.

The Note which corresponds to Table A.5.1-1 "**" states that pump performance curves generated in place "should" be used to estimate flow. Hence, there is no requirement to use the pump curves as described in these tables.

TABLE A.5.1-1

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT		MINIMUM CHANNELS OPERABLE	ACTION
1.	Radioactivity Monitors Providing Alarm and Automatic Termination of Release		
	a. Liquid Radwaste Test Tank Discharge	1	29
	b. Steam Generator Blowdown Flash Tank Drain	1*	30
	c. Turbine Building Sump Effluent Line	1	30
2.	Flow Rate Measurement Devices		
	a. Liquid Radwaste Test Tank Discharge	1	31
	b. Steam Generator Blowdown Flash Tank Drain	1*	31
	c. Circulating Water Discharge	1**	N.A.
3.	Radioactivity Monitors Providing Alarm but Not Termination of Release		
	a. Primary Component Cooling Water System (in lieu of service water monitors)	1	32
4.	Rate of Change Monitor		
	a. Primary Component Cooling Water System Head Tank (in lieu of service water monitors)	1	33

*Only applicable when steam generator blowdown is directed to the discharge transition structure without intermediate collection. The required radiation monitoring channel is RM-6519. The flow path must include a flow indicator which can be used to provide total flow discharged during period of interest.

**Pump performance curves generated in place should be used to estimate flow.

TABLE A.5.1-1

(Continued)

ACTION STATEMENTS

ACTION 29 - With the number of channels OPERABLE less than the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided that prior to initiating a release

a. At least two independent samples are analyzed in accordance with Surveillance S.6.1.1, and

b. At least two technically qualified members of the station staff independently verify the release rate calculations and discharge line valving.

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 30 - With the number of channels OPERABLE less than the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided grab samples are analyzed for radioactivity at a lower limit of detection of no more than 10^{-7} microCurie/ml

a. At least once per 12 hours when the specific activity of the secondary coolant is greater than 0.01 microCurie/gram DOSE EQUIVALENT I-131, or

b. At least once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 microCurie/gram DOSE EQUIVALENT I-131.

ACTION 31 - With the number of channels OPERABLE less than the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours during actual releases. Pump performance curves generated in place may be used to estimate flow.

ACTION 32 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, collect grab samples daily from the Primary Component Cooling Water System and the Service Water System and analyze the radioactivity until the inoperable channel(s) is restored to OPERABLE status.

ACTION 33 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the radioactivity level is determined at least once per 12 hours during actual releases.

TABLE A.5.1-2

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL OPERATIONAL TEST
1. Radioactivity Monitors Providing Alarm and Automatic Termination of Release				
a. Liquid Radwaste Test Tank Discharge	D	P	R(2)	P(1)
b. Steam Generator Blowdown Flash Tank Drain	D	M	R(2)	Q(1)
c. Turbine Building Sumps Effluent Line	D	M	R(2)	Q(1)
2. Flow Rate Measurement Devices				
a. Liquid Radwaste Test Tank Discharge*	D(3)	N.A.	R	N.A.
b. Steam Generator Blowdown Flash Tank Drain***	D(3)	N.A.	R	N.A.
c. Circulating Water Discharge	**	N.A.	N.A.	N.A.
3. Radioactivity Monitor Providing Alarm but Not Termination of Release				
a. Primary Component Cooling Water System (in lieu of service water monitors)	D	M	R(2)	Q(1)
4. Rate of Change Monitor				
a. Primary Component Cooling Water System (in lieu of service water monitors)	D(4)	N.A.	R	N.A

*Isolation of the flow path is accomplished by the Waste Test Tank Discharge Pump Trip Circuitry.

**Pump curves may be used to estimate flow.

***Applies to the flow indicator used in the discharge path when steam generator blowdown is directed to the discharge transition structure without intermediate collection.

TABLE A.5.1-2
(Continued)

TABLE NOTATIONS

(1) The DIGITAL CHANNEL OPERATIONAL TEST shall also demonstrate that automatic isolation of this pathway and Control Room alarm annunciation occurs if the instrument indicates measured levels above the normal or Surveillance test Alarm/Trip Setpoint.

(2) The initial channel calibration for radioactivity measurement instrumentation shall include the use of a known (traceable to National Institute for Standards and Technology) liquid radioactive source positioned in a reproducible geometry with respect to the sensor. These standards shall permit calibrating the system over its normal operating range of energy and rate. For subsequent channel calibrations, sources that have been related to the initial calibration shall be used.

(3) CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous, periodic, or batch releases are made.

(4) CHANNEL CHECK shall consist of verifying indication of tank level during periods of release. CHANNEL CHECK shall be made at least once per 24 hours.

5.2 Radioactive Gaseous Effluent Monitoring Instrumentation

CONTROLS

C.5.2 The radioactive gaseous effluent monitoring instrumentation channels shown in Table A.5.2-1 shall be OPERABLE with their Alarm/Trip Setpoints set to ensure that the limits of Control C.7.1.1 are not exceeded. The Alarm/Trip Setpoints of these channels meeting Control C.7.1.1 shall be determined and adjusted in accordance with the methodology and parameters in the ODCM (Part B).

APPLICABILITY: As shown in Table A.5.2-1.

ACTION:

a. With a radioactive gaseous effluent monitoring instrumentation channel Alarm/Trip Setpoint less conservative than required by the above specification, immediately suspend the release of radioactive gaseous effluents monitored by the affected channel, or declare the channel inoperable.

b. With the number of OPERABLE radioactive gaseous effluent monitoring instrumentation channels less than the Minimum Channels OPERABLE, take the ACTION shown in Table A.5.2-1. Restore the inoperable instrumentation to OPERABLE status within 30 days or, if unsuccessful, explain in the next Annual Radioactive Effluent Release Report pursuant to Technical Specification 6.8.1.4 and Part A, Section 10.2, of the ODCM, why this inoperability was not corrected in a timely manner.

SURVEILLANCE REQUIREMENTS

S.5.2 Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL OPERATIONAL TEST at the frequencies shown in Table A.5.2-2.

BASES

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM (Part B) to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50. The sensitivity of any noble gas activity monitors used to show compliance with the gaseous effluent release requirements of Control C.7.2.1 shall be such that concentrations as low as 1×10^{-6} µCi/cc are measurable.

The main condenser air evacuation radiation monitor, RM-6505, is included with the Turbine Gland Seal Condenser Exhaust in Tables A.5.2-1 and A.5.2-2. Table A.5.2-1 defines the minimum channels operable and the required actions for the radioactive gaseous effluent monitoring instrumentation. Table A.5.2-2 lists the surveillance requirements for this instrumentation.

It is recommended that the out-of-service time for RM-6505 be tracked for reporting per C.5.2. (Reference ACR 96-197).

The Plant Vent Wide Range Gas Monitor (WRGM) design includes three ranges of noble gas monitors and two ranges of iodine and particulate sampling filters. The noble gas monitor, the equipment necessary to provide flow through three ranges of the noble gas monitors, and the iodine and particulate sample filters all affect the operability of the WRGM. The various combinations of out-of-service components are addressed in this clarification.

The WRGM noble gas activity monitor has three overlapping detector ranges: low, mid, and high.

UFSAR Table 12.3-15 lists the following ranges for the WRGM:

Low Range 10^{-7} - 10^{-1} µCi/cc
Mid Range 10^{-3} - 10^{3}
High Range 10^{-1} - 10^{5}

The minimum number of operable channels for the noble gas activity monitor, the flow rate monitors and the iodine sampler and particulate sampler is one, respectively.

The Controls do not list the specific WRGM noble gas activity monitor, the iodine/particulate sampler or the flow rate monitor channels separately by an instrumentation identification tag number.

Heat tracing of the sample lines, from the plant vent to the WRGM, is not listed as a specific requirement for WRGM operability. However, these circuits are necessary to ensure that the particulate and iodine concentration of the sample reaching the WRGM is representative of the effluent. The purpose of heat tracing is to ensure that the sample lines are free of moisture due to condensation. The low temperature alarm setpoint is variable based on outside ambient air temperature, and ensures that the sample line tubing metal temperature is high enough to prevent the moisture in the air from condensing inside of the sample line. The ability to detect of noble gases is not affected by the operational status of the heat tracing circuits.

The heat tracing on the sample lines within the PAB (CP 433, circuit 55) is not required for WRGM operation. (Engineering Evaluation, SS-EV-960017)

The following equipment normally defines an operational WRGM:

<u>During routine releases,</u>

-Sample flow through one of the particulate and iodine (P&I) filters F-156-1,2,3 and channel 1 (low range) noble gas (NG) detectors using pump P-240-2, and

-Sample flow through P&I filters F-156-7,8 using pump RM-P-391.

or in the event the noble gas activity is in the mid/high range,

-Sample flow through one of the particulate/iodine (P&I) filters F-156-4,5,6 and channels 2 or 3 (mid/high range) NG detectors using pump P-240-1, and

-Sample flow bypassing P&I filters F-156-7,8 using pump RM-P-391.

At all times,

-Heat tracing (HT) on the sample lines from the plant vent to the WRGM.

Note: Dewpoint measurements may be used if heat tracing is out of service. (See the following table)

-Vent stack flow rate monitor.

-WRGM sample flow rate for the channel(s) in service.

The table below lists the action required in the event that a WRGM component is out of service.

Out of Service Component	Action
Low range NG detector	Enter Action 33. Perform grab sampling as required.
High range NG detector	Enter Action 33. The actions required by Action 33 are satisfied provided the Low range NG detector provides continuous indication of the effluent concentrations, grab sampling not required. In the unlikely event that elevated effluent concentrations above the capability of the low range detector are present, then grab sampling or backup monitoring will/may be required.
Mid range NG detector	No action required, detection capability met by the overlapping ranges of the low and high NG detectors. (May need to ensure that the high range pump [RM-P-240-1] starts on increasing activity.)
RM-P-391	Enter Action 35. The mid and high range particulate and iodine sampling capability is lost. If a low range P&I filter F-156-1,2 or 3 is in service then no further action is required. If the low range P&I filters are out of service then comply with Action 35 within one hour.
P-240-1 (High range pump)	Enter Action 33 and 35. Action 33 is satisfied provided the low range NG detector provides continuous indication of the effluent concentrations, grab sampling is not required. Action 35 is satisfied if P-240-2 , and filters F-156-1,-2, or -3 are in service. If these P&I filters are out of service and the NG activity is in the low range, then ensure compliance with Action 35 within one hour of identifying the out of service condition. In the unlikely event that elevated effluent concentrations above the capability of the low range detector are present, then, with P-391 operating, install a portable sample pump across valves V28 and V29 to facilitate P&I grab sampling using filters F-156-4,-5, or -6, and noble gas sampling using the medium and high range detectors.
P-240-2 (Low range pump)	Enter Action 33 and 35. Action 33 is satisfied by performing grab samples. Action 35 is satisfied by ensuring the operation of P-391 with filters F-156-7 & 8 in service within one hour of identifying the out-of-service condition.

HT circuit: CP-434 Ckt. 28. (Sample line temperature less than setpoint.)	Enter Action 36. Action 36 is satisfied and the WRGM may remain OPERABLE with CP-434 Ckt 28 out of service provided that CP-426 Ckt. 46 is energized within 1 hr of the out-of-service condition.
Flow rate monitor and/or sampler flow rate monitor.	Comply with Action 32.

Action Statement 35 provides no guidance with regard to time required to initiate auxiliary sampling upon failure of a monitor. A finite time is required to take the appropriate actions to initiate auxiliary sampling. An interval of 60 minutes is a reasonable period of time in which to accomplish these actions provided that no activity occurs during this period which could result in an increase in radiation release levels.

Since the intent of Action 35 is to allow continued release of gaseous effluents provided an alternate means of continuous monitoring/collection capability is on-going during the release of radioactive gaseous effluents, the 60 minute time frame for auxiliary sampling to be established is still a reasonable period of time to complete the necessary manual actions to establish auxiliary sampling. If auxiliary sampling cannot be established within 60 minutes then the initial action of immediately suspending the release of radioactive gaseous effluents should be done, as specified in Action a. of C.5.2. It should be noted that for lack of specified criteria the 60 minute time period is solely based on prudent engineering judgment for completion of manual actions in order to satisfy the intent of Action 35. Operation beyond 60 minutes without auxiliary sampling service would need to be justified by engineering calculation to ensure continued compliance with 10 CFR Part 20 limits.

On those occasions when a radiation monitor or any system/component must be rendered inoperable to perform a surveillance test, the Station Management Manual (SSMM) policy regarding "the use of ACTION requirements to perform maintenance or a test" applies.

When a surveillance test must be performed on the WRGM, rendering it inoperable, Action 35 cannot be fully satisfied because of the nature of testing is incompatible with the Action 35 required installation of auxiliary sampling equipment. However, because the performance of the WRGM surveillance renders it inoperable for only a short period of time (e.g., less than one hour), it is reasonable to allow the surveillance test to be performed without the installation of the auxiliary sampling equipment. It should be noted that neither C.5.2 Action a. nor Action b. requires the immediate establishment of auxiliary sampling. However, if there is concern that the results of surveillance testing activities will identify the instrumentation as inoperable then it would be prudent to set up the auxiliary sampling equipment prior to surveillance testing. The prudent action would prevent the potential situation of continued release of gaseous effluents beyond 60 minutes without continuous monitoring/collection capability.

The current procedural method of collecting the grab sample from the plant vent release pathway requires the shutdown of the compensatory sampling equipment pump (for pressure equilibrium purposes) whenever a grab sample is to be withdrawn into the sample bottle. Shutting down the pump raises the question as to whether this action contradicts the "continuous collection" requirement of Action 35.

Action 35 allow effluent release to continue provided samples are continuously collected (as required in Table A.7.1-1) with auxiliary equipment whenever the number of channels OPERABLE is less than the Minimum Channels OPERABLE requirement. Table A.7.1-1 requires that the sampling frequency be continuous for iodine and particulate and a monthly grab sample for noble gasses (Kr and Xe). The ODCM also requires that the ratio of the sample flow rate to the sampled stream flow rate be known/determined for the time period covered by each dose or dose rate calculation made in accordance with C.7.1.1, C.7.2.1, and C.7.3.1 (i.e., weekly and/or monthly).

It must be noted that Action 35 pertains to the iodine and particulate samplers. For noble gas collection, Action 33 is applicable which requires grab samples be taken once per 12 hours and analyzed for radioactivity within 24 hours. Action 33 does not specify that auxiliary sampling for noble gas must be continuous; therefore, the concern for "continuous" monitoring/collection is not applicable for auxiliary sampling of noble gas.

Whenever the station is operating under the auspices of Action 35 the process of collecting grab samples by the auxiliary sampling method necessitates, on occasions, the temporary disablement of permanent and/or temporary equipment (e.g., installation, and disconnection of auxiliary sampling equipment, pressure equalization, etc.) in order to achieve and comply with the requirements of Action 35. Therefore, actions required (e.g. temporarily shutting down the sample pump in order to install / remove / equalize sample bottles, thus interrupting continuous flow) to obtain a grab sample are not considered actions that are contrary in meeting the intent of Action 35.

The temporary lowering of an RDMS channel setpoint, by RDMS data base manipulation to verify alarm/trip functions, does not prevent the channel from continuously monitoring radiation levels (except WRGM). Additionally, when the setpoint is lowered below background radiation levels the associated trip functions will actuate equipment in their required operating mode as if a high radiation condition exists. The channel remains OPERABLE because monitoring and associated trip functions are not inhibited. Refer to TS-142 for further details. Therefore, during performance of a RDMS channel DCOT, the LCO remains satisfied. Entering an ACTION statement is not appropriate nor required (except for WRGM DCOT). However, because the channel is in alarm status, increased operator vigilance is required to note any increase in radiation levels during the DCOT surveillance period and to take remedial actions if required.

C.5.2 ACTION Statement #33 is applied if RM-6504 is inoperable. The intent of the last sentence is that RM-6503 may be used instead of taking a grab sample. It is not intended that RM-6503 be used in place of RM-6504 and ACTION Statement #33 not entered.

RM-6504 monitors the radiation level of the gas stream at the outlet of the waste gas compressors. If a high radiation level is detected, RM-6504 automatically closes WG-FV-1602. The closing of WG-FV-1602 isolates a potential radiological release path to the environment. RM-6503, located at the inlet to the waste gas compressor, provides alarm and monitoring functions only. It does not have the ability to terminate a radiological release. Therefore, it cannot be used as a substitute for RM-6504.

C.5.2 ACTION b. permits operations to continue for up to 30 days with an inoperable instrument channel. If the inoperable instrument is not returned to OPERABLE status within this time, a report must be submitted explaining why the inoperability was not corrected in a timely manner. If RM6503 were considered a alternate for RM-6504 then operations could continue indefinitely without the ability to automatically terminate a radiological release. This is clearly not the intent of C.5.2 ACTION Statement #33.

Table A.5.2-1, Radioactive Gaseous Effluent Monitoring Instrumentation, specifically lists RM-6504 as the instrument required to satisfy the Limiting Condition for operation. This table also states that the monitor provide the functions of alarm and automatic termination of release.

TABLE A.5.2-1

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT			MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
1.	(Not Used)				
2.	PLANT VENT-WIDE RANGE GAS MONITOR				
	a.	Noble Gas Activity Monitor	1	*	33
	b.	Iodine Sampler	1	*	35
	c.	Particulate Sampler	1	*	35
	d.	Flow Rate Monitor	1	*	32
	e.	Sampler Flow Rate Monitor	1	*	32, 35
	f.	Sample Line Temperature	1	*	36
3.	GASEOUS WASTE PROCESSING SYSTEM (Providing Alarm and Automatic Termination of Release - RM-6504)				
	a.	Noble Gas Activity Monitor (Process)	1	*	33
4.	TURBINE GLAND SEAL CONDENSER EXHAUST				
	a.	Iodine Sampler	1	***	35
	b.	Particulate Sampler	1	***	35
	c.	Sampler Flow Rate Indicator		***	32, 35
	d.	Noble Gas Activity Monitor (RM 6505)	1	***	34

* At all times.

** (Not Used.)

*** When the gland seal exhauster is in operation.

TABLE A.5.2-1
(Continued)

ACTION STATEMENTS

ACTION 32 - With the number of channels OPERABLE less than the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours.

ACTION 33 - With the number of channels OPERABLE less than the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided grab samples are taken at least once per 12 hours and these samples are analyzed for radioactivity within 24 hours. For RM-6504, RM-6503 may be used instead of taking grab samples (see Bases for reporting requirements).

ACTION 34 - With RM-6505 INOPERABLE and the gland seal exhauster in operation, effluent releases via the turbine gland seal condenser exhaust may continue provided grab samples from condenser air evacuation pump effluent are taken at least once per 12 hours, and analyzed for radioactivity within 24 hours.

ACTION 35 - With the number of channels OPERABLE less than the Minimum Channels OPERABLE requirement, effluent releases via the affected pathway may continue provided samples are continuously collected with auxiliary sampling equipment as required in this document.

Auxiliary sampling must be initiated within 60 minutes. Additionally, the auxiliary sampling equipment need not be installed during surveillance activities provided the surveillance testing is completed in less than one hour. Actions required (e.g., temporarily shutting down the sample pump in order to install / remove / equalize sample bottles, thus interrupting continuous flow) to obtain a grab sample are not considered actions that are contrary in meeting the intent of this Action.

Auxiliary sample equipment includes sample flow monitoring to provide information used in the sample analysis.

ACTION 36 - If, for any reason, the sample line temperature cannot be maintained greater than 20° above outside ambient air temperature, the WRGM may remain OPERABLE provided dewpoint measurements are obtained every 12 hours verifying that conditions do not exist for condensation in the sample line with the inservice operating sample pump. (CX0901.38)

TABLE A.5.2-2

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL OPERATIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
1 (Not Used)					
2. PLANT VENT-WIDE RANGE GAS MONITOR					
a. Noble Gas Activity Monitor	D	M	R(3)	Q(2)	*
b. Iodine Sampler	W	N.A	N.A.	N.A.	*
c. Particulate Sampler	W	N.A.	N.A.	N.A.	*
d. Flow Rate Monitor	D	N.A.	R	Q****	*
e. Sampler Flow Rate Monitor	D	N.A.	R	Q****	*
f. Sample Line Temperature	N.A.	N.A.	R	N.A.	*
3. GASEOUS WASTE PROCESSING SYSTEM (Providing Alarm and Automatic Termination of Release)					
a. Noble Gas Activity Monitor (Process)	D	N.A.	R(5)	Q(1)	*
4. TURBINE GLAND SEAL CONDENSER EXHAUST					
a. Iodine Sampler	W	N.A.	N.A.	N.A.	***
b. Particulate Sampler	W	N.A.	N.A.	N.A.	***
c. Sampler Flow Rate Indicator	D	N.A.	N.A.	N.A.	***
d. Noble Gas Activity Monitor (RM 6505)	D	M	R(3)	Q(2)	***

TABLE A.5.2-2
(Continued)

TABLE NOTATIONS

* At all times.

** (Not Used.)

*** When the gland seal exhauster is in operation.

**** The CHANNEL OPERATIONAL TEST for the flow rate monitor shall consist of a verification that the Radiation Data Management System (RDMS) indicated flow is consistent with the operational status of the plant.

(1) The DIGITAL CHANNEL OPERATIONAL TEST shall also demonstrate that automatic isolation of this pathway and Control Room alarm annunciation occurs if the instrument indicates measured levels above the normal or Surveillance test Alarm/Trip Setpoint.

(2) The DIGITAL CHANNEL OPERATIONAL TEST shall also demonstrate that Control Room alarm annunciation occurs if the instrument indicates measured levels above the normal or Surveillance test Alarm Setpoint.

(3) The initial channel calibration for radioactivity measurement instrumentation shall include the use of a known (traceable to National Institute for Standards and Technology) radioactive source positioned in a reproducible geometry with respect to the sensor. These standards should permit calibrating the system over its normal operating range of rate capabilities. For subsequent channel calibrations, sources that have been related to the initial calibration shall be used.

(4) (Not Used).

(5) The CHANNEL CALIBRATION shall be performed using sources of various activities covering the measurement range of the monitor to verify that the response is linear. Sources shall be used to verify the monitor response only for the intended energy range.

6.0 RADIOACTIVE LIQUID EFFLUENTS

6.1 Concentration

CONTROLS

C.6.1.1 The concentration of radioactive material released in liquid effluents at the point of discharge from the multiport diffuser (see Technical Specifications Figure 5.1-3) shall be limited to the concentrations specified in 10 CFR Part 20, Appendix B, Table II, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} microCurie/ml total activity.

APPLICABILITY: At all times.

ACTION:

With the concentration of radioactive material released in liquid effluents at the point of discharge from the multiport diffuser exceeding the above limits, restore the concentration to within the above limits within 15 minutes.

SURVEILLANCE REQUIREMENTS

S.6.1.1 Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program specified in Table A.6.1-1.

S.6.1.2 The results of the radioactivity analyses shall be used in accordance with the methodology and parameters in Part B of the ODCM to assure that the concentrations at the point of release are maintained within the limits of Control C.6.1.1.

BASES

This Control is provided to ensure that the concentration of radioactive materials released in liquid waste effluents at the point of discharge from the multipart diffuser will be less than the concentration levels specified in 10 CFR Part 20, Appendix B to 20, Table II, Column 2 (most restrictive). This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC, and (2) the limits of Appendix I, 10 CFR Part 20.106(e) to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

Controls C.6.1.1 and C.5.1 provide controls to ensure that the concentration of radioactive materials released in liquid waste effluents at the point of discharge from the multiport diffuser will be less than the concentration levels specified in 10CFR20, Appendix B, Table II, Column 2. As no LLD is specified for the compensatory samples taken for an inoperable PCCW Head Tank Rate of Change Monitor, the LLD for these samples must ensure that these limits are met.

Although the periodic Service Water System sample is counted to an LLD of $5x10^{-7}\mu Ci/cc$, the compensatory samples for inoperable SGBD Flash Tank and Turbine Building Sump Monitors are required to be counted to an LLD of $1x10^{-7}\mu Ci/cc$. This more restrictive limit will ensure that the limits of 10CFR20 are met during periods of PCCW Head Tank Rate of Change Monitor inoperability, thereby ensuring compliance with the requirements of the respective Controls.

Counting the required grab samples to an LLD of $1x10^{-7}\mu Ci/cc$ is therefore an acceptable method of complying with these requirements; it is not necessary to meet the LLD of $1x10^{-8}\mu Ci/cc$ specified as the equivalent sensitivity of the PCCW Head Tank Rate of Change Monitor.

For controls associated with the release of liquid and gaseous effluents, the method currently in use for controlling releases to within the "old" 10CFR20.106, Appendix B concentration MPC limits based on "instantaneous" concentration values is suitable for demonstrating conformance to the requirements of the "new" 10CFR Part 20, Appendix B ECL concentration limits. Controlling liquid and gaseous effluents to within the MPC values based on an instantaneous release rate (i.e., no time averaging of effluent concentrations) is considered to be more conservative than the requirements of the new Part 20 which have limits stated as effluent concentrations averaged over a year. In other words, if discharged liquid and gaseous effluents remain within instantaneous concentration limits as required in the Controls during the times that discharge actually take place, then, we are confident that the annual average limits associated with the new Part 20 ECL values will also be met. This position is based on an NRC issued letter, dated June 30, 1993, from Thomas E. Murley, then Director, Office of Nuclear Reactor Regulation, to Thomas E. Tipton of NEI, formally NUMARC, in which the Nuclear Regulatory Commission responded to an industry inquiry on promulgation of a new Part 20. In the letter the Nuclear Regulatory Commission stated:

"After careful review of your position and other relevant factors, we have determined that it is acceptable to the staff for licensees to retain their existing level of effluent control as implementing the ALARA requirement after January 1, 1994, without submitting individual requests for amending their technical specifications to comply with new 10 CFR 20.1101(b)."

The letter goes on to say, "... we are preparing a Generic Letter to provide model Technical Specification wording to ensure conformance with the revised Part 20 requirements." and, "The model changes for Technical Specifications that will be in the Generic Letter are intended to eliminate possible confusion or improper implementation of revised Part 20 requirements."

Since then, the NRC has canceled its plan to issue a Generic Letter so as to devote more resources to conversion reviews and additional reviews to the Improved Standard Technical Specifications (ITS). Seabrook Station will continue to comply to the requirements of "old" Part 20, i.e., 10 CFR 20.1 - 20.601, and its Appendices for release of radioactive liquid and gaseous effluents. All other effluent controls must abide by the requirements of "new" Part 20.

TABLE A.6.1-1
RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (1) (μCi/ml)
A. Liquid Radwaste Test Tanks	P Each Batch	P Each Batch	Principal Gamma Emitters(3)	5×10^{-7}
			I-131	1×10^{-6}
(Batch Release)(2)	P One Batch/M	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
	P Each Batch	M(4) Composite	H-3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	P Each Batch	Q(4) Composite	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}
B. Turbine Building Sump Effluent(8)	W Grab Sample	W	Principal Gamma Emitters(3)	5×10^{-7}
			I-131	1×10^{-6}
(Continuous Release)(5)	W Grab Sample	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}

TABLE A.6.1-1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

(Continued)

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (1) (μCi/ml)
B. (Continued)	W Grab Sample	M	H-3	$1x10^{-5}$
			Gross Alpha	$1x10^{-7}$
	W Grab Sample	Q (9)	Sr-89, Sr-90	$5x10^{-8}$
			Fe-55	$1X10^{-6}$
C. Steam Generator Blowdown Flash Tank(6)(8)	W Grab Sample	W	Principal Gamma Emitters(3)	$5x10^{-7}$
			I-131	$1x10^{-6}$
(Continuous Release)(5)	W Grab Sample	M	Dissolved and Entrained Gases (Gamma Emitters)	$1x10^{-5}$
	W Grab Sample	M	H-3	$1x10^{-5}$
			Gross Alpha	$1x10^{-7}$
	W Grab Sample	Q(9)	Sr-89, Sr-90	$5x10^{-8}$
			Fe-55	$1x10^{-6}$

TABLE A.6.1-1
RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM
(Continued)

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (1) (µCi/ml)
D. Service Water(7)	W Grab Sample	W	Principal Gamma Emitters(3)	$5x10^{-7}$
			I-131	$1x10^{-6}$
	W Grab Sample	M	Dissolved and Entrained Gases (Gamma Emitters)	$1x10^{-5}$
	W Grab Sample	M	H-3	$1x10^{-5}$
			Gross Alpha	$1x10^{-7}$
	W Grab Sample	Q	Sr-89, Sr-90	$5x10^{-8}$
			Fe-55	$1x10^{-6}$

P - Prior to Discharge
W - Weekly
M - Monthly
Q - Quarterly

TABLE A.6.1-1
RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM
(Continued)

Notations

(1) The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, 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:

$$LLD = \frac{4.66\, S_b}{E \times V \times 2.22 \times 10^6 \times Y \times \exp(-\lambda \Delta t)}$$

Where:

LLD = the "a priori" lower limit of detection (microcurie per unit mass or volume),

4.66 = a constant derived from the K_{alpha} and K_{beta} values for the 95% confidence level;

S_b = the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (counts per minute),

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 microcurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (s^{-1}), and

Δt = the elapsed time between the midpoint of sample collection and the time of counting(s).

Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD 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.

(2) A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed to assure representative sampling.

TABLE A.6.1-1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

(Continued)

Notations

(Continued)

(3) The principal gamma emitters for which the LLD specification applies include the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radioactive Effluent Release Report in accordance with Technical Specification 6.8.1.4. Isotopes which are not detected should be reported as "not detected." Values determined to be below detectable levels are not used in dose calculations.

(4) A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen that is representative of the liquids released.

(5) A continuous release is the discharge of liquid wastes of a nondiscrete volume, e.g., from a volume of a system that has an input flow during the continuous release.

(6) Sampling and analysis is only required when Steam Generator Blowdown is directed to the discharge transition structure.

(7) Principal gamma emitters shall be analyzed weekly in Service Water. Sample and analysis requirements for dissolved and entrained gases, tritium, gross alpha, strontium 89 and 90, and Iron 55 shall only be required when analysis for principal gamma emitters exceeds the LLD.

The following are additional sampling and analysis requirements:

a. PCCW sampled and analyzed weekly for principal gamma emitters.

b. Sample Service Water System (SWS) daily for principal gamma emitters whenever primary component cooling water (PCCW) activity exceeds $1x10^{-3}$ µC/cc.

c. With the PCCW System radiation monitor inoperable, sample PCCW and SWS daily for principal gamma emitters.

d. With a confirmed PCCW/SWS leak and PCCW activity in excess of $1x10^{-4}$ µC/cc, sample SWS every 12 hours for principal gamma emitters.

e. The setpoint on the PCCW head tank liquid rate-of-change alarm will be set to ensure that its sensitivity to detect a PCCW/SWS leak is equal to or greater than that of an SWS radiation monitor, located in the unit's combined SWS discharge, with an LLD of $1x10^{-8}$ µC/cc. If this sensitivity cannot be achieved, the SWS will be sampled once every 12 hours.

TABLE A.6.1-1

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

(Continued)

Notations

(Continued)

(8) If the Turbine Building Sump (Steam Generator Blowdown Flash Tank) isolate due to high concentration of radioactivity, that liquid stream will be sampled and analyzed for Iodine-131 and principal gamma emitters prior to release.

(9) Quarterly composite analysis requirements shall only be required when analysis for principal gamma emitters indicate positive radioactivity.

6.2 Dose

CONTROLS

C.6.2.1 The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each unit, to UNRESTRICTED AREAS (see Technical Specification Figure 5.1-3) shall be limited

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

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

APPLICABILITY: At all times.

ACTION:

With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.8.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

SURVEILLANCE REQUIREMENTS

S.6.2.1 Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with the methodology and parameters in Part B of the ODCM at least once per 31 days.

BASES

This Control is provided to implement the requirements of Sections II.A, III.A, and IV.A of Appendix I to 10 CFR Part 50. The Control implements the guides set forth in Section II.A of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents to UNRESTRICTED AREAS will be kept as low as is reasonably achievable. The dose calculation methodology and parameters in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

6.3 Liquid Radwaste Treatment System

CONTROLS

C.6.3.1 The Liquid Radwaste Treatment System shall be OPERABLE and appropriate portions of the system shall be used to reduce releases of radioactivity when the projected doses due to the liquid effluent to UNRESTRICTED AREAS (see Technical Specification Figure 5.1-3) would exceed 0.06 mrem to the whole body or 0.2 mrem to any organ in a 31-day period.

APPLICABILITY: At all times.

ACTION:

With radioactive liquid waste being discharged without treatment and in excess of the above limits and any portion of the Liquid Radwaste Treatment System which could reduce the radioactive liquid waste discharged not in operation, prepare and submit to the Commission within 30 days, pursuant to Specification 6.8.2, a Special Report that includes the following information:

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

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

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

SURVEILLANCE REQUIREMENTS

S.6.3.1 Doses due to liquid releases from each unit to UNRESTRICTED AREAS shall be projected at least once per 31 days in accordance with the methodology and parameters in Part B of the ODCM when Liquid Radwaste Treatment Systems are not being fully utilized.

S.6.3.2 The installed Liquid Radwaste Treatment System shall be considered OPERABLE by meeting Controls C.6.1.1 and C.6.2.1.

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

7.0 RADIOACTIVE GASEOUS EFFLUENTS

7.1 Dose Rate

CONTROLS

C.7.1.1 The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY (see Technical Specification Figure 5.1-1) 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.

APPLICABILITY: At all times.

ACTION:

With the dose rate(s) exceeding the above limits, decrease the release rate within 15 minutes to within the above limit(s).

SURVEILLANCE REQUIREMENTS

S.7.1.1 The dose rate due to noble gases in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in Part B of the ODCM.

S.7.1.2 The dose rate due to Iodine-131, Iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in the ODCM by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table A.7.1-1.

BASES

This Control is provided to ensure that the dose at any time at and beyond the SITE BOUNDARY from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 to UNRESTRICTED AREAS. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table II, Column I. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC in an UNRESTRICTED AREA, either within or outside the SITE BOUNDARY, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 (10 CFR Part 20.106[b]). For MEMBERS OF THE PUBLIC who may at times be within the SITE BOUNDARY, the occupancy of the MEMBER OF THE PUBLIC will usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. Examples of calculations for such MEMBERS OF THE PUBLIC, with the appropriate occupancy factors, shall be given in the ODCM. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY to less than or equal to 500 mrems/year to the whole body or to less than or equal to 3000 mrems/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrems/year.

TABLE A.7.1-1
RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection(1) (LLD) (μCi/cc)
1. Plant Vent	M(3)(4) Grab Sample	M	Principal Gamma Emitters(2)	$1x10^{-4}$
			H-3	$1x10^{-6}$
	Continuous(5)	W(6) Charcoal Sample	I-131	$1x10^{-12}$
	Continuous(5)	W(6) Particulate Sample	Principal Gamma Emitters(2)	$1x10^{-11}$
	Continuous(5)	M Composite Particulate Sample	Gross Alpha	$1x10^{-11}$
	Continuous(5)	Q Composite Particulate Sample	Sr-89, Sr-90	$1x10^{-11}$
2. Condenser Air Removal Exhaust	M(7) Grab Sample	M(7) Noble Gases	Principal Gamma Emitters(2)	$1x10^{-4}$
			H-3	$1x10^{-6}$

TABLE A.7.1-1
RADIOACTIVE GASEOUS WASTE SAMPLING
AND ANALYSIS PROGRAM
(Continued)

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection(1) (LLD) (μCi/cc)
3. Gland Steam Packing Exhauster	Continuous	W Particulate Sample	Principal Gamma Emitters(2)	$1x10^{-11}$
	Continuous	W Charcoal Sample	I-131	$1x10^{-12}$
	Continuous	M Composite Particulate Sample	Gross Alpha	$1x10^{-11}$
	Continuous	Q Composite Particulate Sample(8)	Sr-89, Sr-90	$1x10^{-11}$
4. Containment Purge	P(3) Each Purge Grab Sample	P Each Purge	Principal Gamma Emitters(2)	$1x10^{-4}$
			H-3 (oxide)	$1x10^{-6}$

TABLE A.7.1-1

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

(Continued)

Notations

(1) The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, 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:

$$LLD = \frac{4.66 S_b}{E \times V \times 2.22 \times 10^6 \times Y \times \exp(-\lambda \Delta t)}$$

Where:

LLD = the "a priori" lower limit of detection (microcurie per unit mass or volume),

4.66 = a constant derived from the K_{alpha} and K_{beta} values for the 95% confidence level;

S_b = the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (counts per minute),

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 microcurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (s^{-1}), and

Δt = the elapsed time between the midpoint of sample collection and the time of counting(s).

Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD 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.

TABLE A.7.1-1
RADIOACTIVE GASEOUS WASTE SAMPLING
AND ANALYSIS PROGRAM
(Continued)

Notations
(Continued)

(2) The principal gamma emitters for which the LLD specification applies include the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 in noble gas releases and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, I-131, Cs-134, Cs-137, Ce-141 and Ce-144 in iodine and particulate releases. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radioactive Effluent Release Report in accordance with Technical Specification 6.8.1.4 and Part A, Section 10.2 of the ODCM. Isotopes which are not detected should be reported as "not detected." Values determined to be below detectable levels are not used in dose calculations.

(3) Sampling and analysis shall also be performed following shutdown, startup, or a THERMAL POWER change exceeding 15 percent of RATED THERMAL POWER within a one hour period unless; 1) analysis shows that the DOSE EQUIVALENT I-131 concentrations in the primary coolant has not increased more than a factor of 3; 2) the noble gas activity monitor for the plant vent has not increased by more than a factor of 3. For containment purge, requirements apply only when purge is in operation.

(4) Tritium grab samples shall be taken at least once per 24 hours when the refueling canal is flooded.

(5) The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Controls C.7.1.1, C.7.2.1, and C.7.3.1.

(6) Samples shall be changed at least once per seven (7) days and analyses shall be completed within 48 hours after changing, or after removal from sampler. Sampling shall also be performed at least once per 24 hours for at least seven (7) days following each shutdown, startup, or THERMAL POWER change exceeding 15 percent of RATED THERMAL POWER within a one-hour period and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement does not apply if 1) analysis shows that the DOSE EQUIVALENT I-131 concentration in the reactor coolant has not increased more than a factor of 3; and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.

(7) Samples shall be taken prior to start-up of condenser air removal system when there have been indications of a primary to secondary leak.

(8) Quarterly composite analysis requirements shall only be required when analysis for principal gamma emitters indicate positive radioactivity.

7.2 Dose - Noble Gases

CONTROLS

C.7.2.1 The air dose due to noble gases released in gaseous effluents to areas at and beyond the SITE BOUNDARY (see Technical Specification Figure 5.1-1) 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.

APPLICABILITY: At all times.

ACTION:

With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.8.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

SURVEILLANCE REQUIREMENTS

S.7.2.1 Cumulative dose contributions for the current calendar quarter and current calendar year for noble gases shall be determined in accordance with the methodology and parameters in Part B of the ODCM at least once per 31 days.

BASES

This Control is provided to implement the requirements of Sections II.B, III.A, and IV.A of Appendix I to 10 CFR Part 50. The Control implements the guides set forth in Section I.B of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I at the SITE BOUNDARY that the releases of radioactive material in gaseous effluents to UNRESTRICTED AREAS will be kept as low as reasonably achievable. The Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The dose calculation methodology and parameters established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977, and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1, July 1977. The ODCM equations provided for determining the air doses at and beyond the SITE BOUNDARY are based upon the historical average atmospheric conditions.

7.3 Dose - Iodine-131, Iodine-133, Tritium, and Radioactive Material in Particulate Form

CONTROLS

C.7.3.1 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 to areas at and beyond the SITE BOUNDARY (see Technical Specification Figure 5.1-1) shall be limited to the following:

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

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

APPLICABILITY: At all times.

ACTION:

With the calculated dose from the release of Iodine-131, Iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.8.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

SURVEILLANCE REQUIREMENTS

S.7.3.1 Cumulative dose contributions for the current calendar quarter and current calendar year for Iodine-131, Iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days shall be determined in accordance with the methodology and parameters in Part B of the ODCM at least once per 31 days.

BASES

This Control is provided to implement the requirements of Sections II.C, III.A, and IV.A of Appendix I to 10 CFR Part 50. The Controls are the guides set forth in Section II.C of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents at the SITE BOUNDARY will be kept as low as reasonably achievable. The ODCM calculation methods specified in the Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methodology and parameters for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977, and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1, July 1977. These equations also provide for determining the actual doses based upon the historical Iodine-133, tritium, and radionuclides in particulate form with half-lives greater than 8 days are dependent upon the existing radionuclide pathways to man in the areas at and beyond the SITE BOUNDARY. The pathways that were examined in the development of the calculations were

(1) individual inhalation of airborne radionuclides,

(2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man,

(3) deposition of radionuclides onto grassy areas where milk animals and meat-producing animals graze followed by human consumption of that milk and meat, and

(4) deposition of radionuclides on the ground followed by subsequent human exposure.

7.4 Gaseous Radwaste Treatment System

CONTROLS

C.7.4.1 The VENTILATION EXHAUST TREATMENT SYSTEM and the GASEOUS RADWASTE TREATMENT SYSTEM shall be OPERABLE and appropriate portions of these system shall be used to reduce releases of radioactivity when the projected doses in 31 days due to gaseous effluent releases to areas at and beyond the SITE BOUNDARY (see Technical Specification Figure 5.1-1) would exceed

a. 0.2 mrad to air from gamma radiation, or

b. 0.4 mrad to air from beta radiation, or

c. 0.3 mrem to any organ of a MEMBER OF THE PUBLIC.

APPLICABILITY: At all times.

ACTION:

With radioactive gaseous waste being discharged without treatment and in excess of the above limits, prepare and submit to the Commission within 30 days, pursuant to Specification 6.8.2, a Special Report that includes the following information:

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

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

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

SURVEILLANCE REQUIREMENTS

S.7.4.1 Doses due to gaseous releases from each unit to areas at and beyond the SITE BOUNDARY shall be projected at least once per 31 days in accordance with the methodology and parameters in Part B of the ODCM when Gaseous Radwaste Treatment Systems are not being fully utilized.

S.7.4.2 The installed VENTILATION EXHAUST TREATMENT SYSTEM and GASEOUS RADWASTE TREATMENT SYSTEM shall be considered OPERABLE by meeting Controls C.7.1.1, and C.7.2.1, or C.7.3.1.

BASES

The OPERABILITY of the GASEOUS RADWASTE TREATMENT SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM ensures that the systems will be available for use whenever gaseous effluents require treatment prior to release to the environment. The requirement that the appropriate portions of these systems be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept as low as is reasonably achievable. This Control implements the requirements of 10 CFR 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Sections II.B and II.C of Appendix I to 10 CFR Part 50, for gaseous effluents.

8.0 TOTAL DOSE

CONTROL

C.8.1.1 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 any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

APPLICABILITY: At all times.

ACTION:

With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Controls C.6.2.1.a, C.6.2.1.b, C.7.2.1.a, C.7.2.1.b, C.7.3.1.a, or C.7.3.1.b, calculations shall be made including direct radiation contributions from the units and from outside storage tanks to determine whether the above limits of Control C.8.1.1 have been exceeded. If such is the case, prepare and submit to the Commission within 30 days, pursuant to Technical Specification 6.8.2, a Special Report that defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the above limits and includes the schedule for achieving conformance with the above limits. This Special Report, as defined in 10 CFR 20.405(c), shall include an analysis that 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. It shall also describe 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 above limits, and if the release condition resulting in violation of 40 CFR Part 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR Part 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

SURVEILLANCE REQUIREMENTS

S.8.1.1 Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with Surveillance Requirement S.6.2.1, S.7.2.1, and S.7.3.1, and in accordance with the methodology and parameters in Part B of the ODCM.

S.8.1.2 Cumulative dose contributions from direct radiation from the units and from radwaste storage tanks shall be determined in accordance with the methodology and parameters in Part B of the ODCM. This requirement is applicable only under conditions set forth in ACTION a. of Control C.8.1.1.

BASES

This Control is provided to meet the dose limitations of 40 CFR Part 190 that have been incorporated into 10 CFR Part 20 by 46FR18525. The specification requires the preparation and submittal of a Special Report whenever the calculated doses due to releases of radioactivity and to radiation from uranium fuel cycle sources exceed 25 mrems to the whole body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems. For sites containing up to four reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR Part 190 if the individual reactors remain within twice the dose design objectives of Appendix I, and if direct radiation doses from the units (including outside storage tanks, etc.) are kept small. The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR Part 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 nuclear fuel cycle facilities at the same site are within a radius of 8 km must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40 CFR 190.11 and 10 CFR 20.405c, is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR Part 190, and does not apply in any way to the other requirements for dose limitation of 10 CFR Part 20, as addressed in Controls C.6.1.1 and C.7.1.1. An individual is not considered a MEMBER OF THE PUBLIC during any period in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

9.0 RADIOLOGICAL ENVIRONMENTAL MONITORING

9.1 Monitoring Program

CONTROL

C.9.1.1 The Radiological Environmental Monitoring Program (REMP) shall be conducted as specified in Table A.9.1-1.

APPLICABILITY: At all times.

ACTION:

a. With the REMP not being conducted as specified in Table A.9.1-1, prepare and submit to the Commission, in the Annual Radiological Environmental Operating Report required by Technical Specification 6.8.1.3 and Part A, Section 10.1 of the ODCM, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

b. With the level of radioactivity as the result of plant effluents in an environmental sampling medium at a specified location exceeding the reporting levels of Table A.9.1-3 when averaged over any calendar quarter, prepare and submit to the Commission within 30 days from receipt of the laboratory analyses, pursuant to Technical Specification 6.8.2, a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions 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 Control C.6.2.1, C.7.2.1, or C.7.3.1. When more than one of the radionuclides in the REMP are detected in the sampling medium, this report shall be submitted if

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting level (2)}} + \ldots \geq 1.0$$

When radionuclides other than those listed in the REMP are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose* to a MEMBER OF THE PUBLIC from all radionuclides is equal to or greater than the calendar year limits of Control C.6.2.1, C.7.2.1, or C.7.3.1. This 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 reported and described in the Annual Radiological Environmental Operating Report required by Technical Specification 6.8.1.3 and Part A, Section 10.1 of the ODCM.

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*The methodology and parameters used to estimate the potential annual dose to a MEMBER OF THE PUBLIC shall be indicated in this report.

ACTION: (Continued)

With milk or fresh leafy vegetable samples unavailable from one or more of the sample locations required by the REMP, identify specific locations for obtaining replacement samples and add them within 30 days to the REMP given in the ODCM. The specific locations from which samples were unavailable may then be deleted from the monitoring program. Pursuant to Technical Specification 6.13, and Part A, Section 10.2, of the ODCM, submit in the next Annual Radioactive Effluent Release Report documentation for a change in the ODCM including a revised figure(s) and table for the ODCM reflecting the new location(s) with supporting information identifying the cause of the unavailability of samples and justifying the selection of the new locations(s) for obtaining samples.

SURVEILLANCE REQUIREMENTS

S.9.1.1 The radiological environmental monitoring samples shall be collected pursuant to Table A.9.1-1 from the specific locations given in the table and figure(s) in Part B of the ODCM, and shall be analyzed pursuant to the requirements of Table A.9.1-1 and the detection capabilities required by Table A.9.1-2.

BASES

The REMP required by this Control provides representative measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from the plant operation. This monitoring program implements Section IV.B.2 of Appendix I to 10 CFR Part 50, and thereby supplements the REMP by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and the modeling of the environmental exposure pathways. Guidance for this monitoring program is provided by the Radiological Assessment Branch Technical Position on Environmental Monitoring, Revision 1, November 1979. The initially specified monitoring program will be effective for at least the first 3 years of commercial operation. Following this period, program changes may be initiated based on operational experience.

Detailed discussion of the LLD and other detection limits can be found in Currie, L.A., "Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements," NUREG/CR-4007 (September 1984).

TABLE A.9.1-1
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Representative Samples and Sample Locations[a]	Sampling and Collection Frequency	Type and Frequency of Analysis
1. DIRECT RADIATION[b]	40 routine monitoring stations with two or more dosimeters 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, generally in the 6 to 8-km range from the site; The balance of the stations to be placed in special interest areas such as population centers, nearby residences, schools, and control locations.	Quarterly.	Gamma dose quarterly.
2. AIRBORNE Radioiodine and Particulates	Samples from five locations[d]: Three samples from close to the three SITE BOUNDARY locations, in different sectors, of high calculated long-term average ground-level D/Q. One sample from the vicinity of a community having the highest calculated long-term average ground-level D/Q.	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[c]; Gamma isotopic analysis[e] of composite (by location) quarterly.

TABLE A.9.1-1
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
(Continued)

Exposure Pathway and/or Sample	Number of Representative Samples and Sample Locations[a]	Sampling and Collection Frequency	Type and Frequency of Analysis
2. (Continued)	One sample from a control location, as for example 15-30 km distant and in the least prevalent wind direction.		
3. WATERBORNE			
a. Surface	One sample in the discharge area. One sample from a control location.	Monthly grab sample.	Gamma isotopic analysis[e] monthly. Composite for tritium analysis quarterly.
b. Sediment from shoreline	One sample from area with existing or potential recreational value.	Semiannually.	Gamma isotopic analysis[e] semiannually.
c. Subsurface water	One sample beneath plant structures at PAB	Quarterly	Gamma isotopic and tritium.
4. INGESTION			
a. Milk	Samples from milking animals in three locations within 5 km distance having the highest dose potential. If there are none, then, one sample from milking animals in each of three areas between 5 to 8 km distant where doses are calculated to be greater than 1 mrem per yr.[f] One sample from milking animals at a control location, as for example, 15-30 km distant and in the least prevalent wind direction.	Semimonthly when milking animals are on pasture, monthly at other times.	Gamma isotopic[e] and I-131 analysis on each sample.

TABLE A.9.1-1

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

(Continued)

Exposure Pathway and/or Sample	Number of Representative Samples and Sample Locations[a]	Sampling and Collection Frequency	Type and Frequency of Analysis
4. (Continued) b. Fish and Invertebrates	One sample of each of three commercially and recreationally important species in vicinity of plant discharge area. One sample of similar species in areas not influenced by plant discharge.	Sample in season, or semiannually if they are not seasonal.	Gamma isotopic analysis[e] on edible portions.
c. Food Products	Samples of three (if practical) different kinds of broad leaf vegetation[g] grown nearest each of two different off-site locations of highest predicted long-term average ground-level D/Q if milk sampling is not performed.	Monthly, when available.	Gamma isotopic[e] and I-131 analysis.
	One sample of each of the similar broad leaf vegetation[g] grown at a control location, as for example 15-30 km distant in the least prevalent wind direction, if milk sampling is not performed.	Monthly, when available.	Gamma isotopic[e] and I-131 analysis.

TABLE A.9.1-1
RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
(Continued)

Table Notations

a. Specific parameters of distance and direction sector from the centerline of the Unit 1 reactor, and additional description where pertinent, shall be provided for each and every sample location in Table B.4-1 in the ODCM, Part B. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to circumstances such as hazardous conditions, seasonal unavailability and malfunction of automatic sampling equipment. If specimens are unobtainable due to sampling equipment malfunction, effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report as specified in Part A, Section 10.1. It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the Radiological Environmental Monitoring Program. Identify the cause of the unavailability of samples for that pathway and identify the new location(s), if available, for obtaining replacement samples in the next Semiannual Radioactive Effluent Release Report as specified in Part A, Section 10.2 and also include in the report a revised figure(s) and table for the ODCM reflecting the new location(s).

b. A thermoluminescent dosimeter (TLD) is considered to be one phosphor; two or more phosphors in a packet are considered as two or more dosimeters.

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

d. Optimal air sampling locations are based not only on D/Q but on factors such as population in the area, year-round access to the site, and availability of power.

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

f. The dose shall be calculated for the maximum organ and age group, using the methodology and parameters in the ODCM, Part B.

g. If broad leaf vegetation is unavailable, other vegetation will be sampled.

TABLE A.9.1-2

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS[a,f,g]

Lower Limit of Detection (LLD)[b]

Analysis	Water (pCi/kg)	Airborne Particulate or Gas (pCi/kg, wet)	Fish and Invertebrates (pCi/kg, wet)	Milk (pCi/kg)	Food Products (pCi/kg, wet)	Sediment (pCi/kg, dry)
Gross Beta	4	0.01				
H-3	3,000					
Mn-54	15		130			
Fe-59	30		260			
Co-58, 60	15		130			
Zn-65	30		260			
Zr-Nb-95	15[c]					
I-131	15	0.07		1	60[e]	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-La-140	15[c,d]			15[c,d]		

TABLE A.9.1-2
DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS
(Continued)

Table Notations

a. This list does not mean that only these nuclides are to be considered. Other peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radiological Environmental Operating Report.

b. The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive material in a sample that will yield a net count, above system background, that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system, which may include radiochemical separation:

$$LLD = \frac{4.66\,Sb}{E x V x\ 2.22\ x 10^6\ x\ Y x \exp(-\lambda \Delta t)}$$

Where:

LLD is the "a priori" lower limit of detection as defined above, as picocuries per unit mass or volume;

4.66 is a constant derived from the K_{alpha} and K_{beta} values for the 95% confidence level;

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, as counts per minute;

E is the counting efficiency, as counts per disintegration;

V is the sample size in units of mass or volume;

2.22 is the number of disintegrations per minute per picocurie;

Y is the fractional radiochemical yield, when applicable;

λ is the radioactive decay constant for the particular radionuclide as per second; and

Δ t for environmental samples is the elapsed time between sample collection and time of counting, as seconds.

Typical values of E, V, Y, and Δ t should be used in the calculation.

In calculating the LLD for a radionuclide determined by gamma ray spectrometry, the background shall include the typical contributions of other radionuclides normally present in the samples (e.g., Potassium-40 in milk samples).

TABLE A.9.1-2

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS

(Continued)

Table Notations

(Continued)

It should be recognized that the LLD 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. This does not preclude the calculation of an a posteriori LLD for a particular measurement based upon the actual parameters for the sample in question and appropriate decay correction parameters such as decay while sampling and during analysis. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidable small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors shall be identified and described in the Annual Radiological Environmental Operating Report per Part A, Secion 10.1.

c. Parent only.

d. The Ba-140 LLD and concentration can be determined by the analysis of its short-lived daughter product La-140 subsequent to an eight-day period following collection. The calculation shall be predicated on the normal ingrowth equations for a parent-daughter situation and the assumption that any unsupported La-140 in the sample would have decayed to an insignificant amount (at least 3.6% of its original value). The ingrowth equations will assume that the supported La-140 activity at the time of collection is zero.

e. Broad leaf vegetation only.

f. If the measured concentration minus the three standard deviation uncertainty is found to exceed the specified LLD, the sample does not have to be analyzed to meet the specified LLD.

g. Required detection capabilities for thermoluminescent dosimeters used for environmental measurements shall be in accordance with recommendations of Regulatory Guide 4.13, Revision 1, July 1977.

TABLE A.9.1-3

REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Analysis	Water (pCi/kg)	Airborne Particulate or Gas (pCi/kg, wet)	Fish and Invertebrates (pCi/kg, wet)	Milk (pCi/kg)	Food Products (pCi/kg, wet)
H-3	30,000***				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-Nb-95	400*				
I-131	100	0.9		3	100**
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140	200*			300*	

* Parent only.
** Broad leaf vegetation only.
***Plant dewatering reporting level = 20,000 pCi/kg (2E-05 μCi/ml)

9.2 Land Use Census

CONTROL

C.9.2.1 A Land Use Census shall be conducted and shall identify within a distance of 8 km (5 miles) the location in each of the 16 meteorological sectors of the nearest milk animal, the nearest residence, and the nearest garden** of greater than 50 m^2 (500 ft^2) producing broad leaf vegetation.

APPLICABILITY: At all times.

ACTION

a. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment greater than the values currently being calculated in Surveillance S.7.3.1 pursuant to Technical Specification 6.8.1.4 and Part A, Section 10.2, of the ODCM, identify the new location(s) in the next Annual Radioactive Effluent Release Report.

b. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment (via the same exposure pathway) 20% greater than at a location from which samples are currently being obtained in accordance with Control C.9.1.1, add the new location(s) within 30 days to the REMP given in the ODCM, if permission from the owner to collect samples can be obtained and sufficient sample volume is available. The sampling location(s), excluding the Control station location, having the lowest calculated dose or dose commitment(s), via the same exposure pathway, may be deleted from this monitoring program after October 31 of the year in which this Land Use Census was conducted. Pursuant to Technical Specification 6.13 and Part A, Section 10.2 of the ODCM, submit in the next Annual Radioactive Effluent Release Report documentation for a change in the ODCM including a revised figure(s) and table(s) for the ODCM reflecting the new location(s) with information supporting the change in sampling locations.

SURVEILLANCE REQUIREMENTS

S.9.2.1 The Land Use Census shall be conducted during the growing season at least once per 12 months using a method such as by a door-to-door survey, aerial survey, or by consulting local agriculture authorities, as described in the ODCM. The results of the Land Use Census shall be included in the Annual Radiological Environmental Operating Report pursuant to Part A, Section 10.1 of the ODCM.

**Broad leaf vegetation sampling of at least three different kinds of vegetation may be performed at the SITE BOUNDARY in each of two different direction sectors with the highest predicted relative deposition values (D/Qs) in lieu of the garden census. Specifications for broad leaf vegetation sampling in the REMP shall be followed, including analysis of control samples.

This specification is provided to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the REMP given in the ODCM are made if required by the results of this census. Information from methods such as the door-to-door survey, from aerial survey, of from consulting with local agricultural authorities shall be used. 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 50 m^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/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were made: (1) 20% of the garden was used for growing broad-leaf vegetation (i.e., similar to lettuce and cabbage), and (2) there was a vegetation yield of 2 kg/m^2.

9.3 Interlaboratory Comparison Program

CONTROL

C.9.3.1 In accordance with Technical Specification 6.7.6h.3, analyses shall be performed on all radioactive materials supplied as part of an Interlaboratory Comparison Program, that has been approved by the Commission, that correspond to samples required by REMP.

APPLICABILITY: At all times.

ACTION:

With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report pursuant to Part A, Section 10.1 of the ODCM.

SURVEILLANCE REQUIREMENTS

S.9.3.1 The Interlaboratory Comparison Program shall be identified in Part B of the ODCM. A summary of the results obtained as part of the above required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report pursuant to Part A, Section 10.1 of the ODCM.

BASES

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 valid for the purposes of Section IV.B.2 of Appendix I to 10 CFR Part 50.

10.0 REPORTS

10.1 Annual Radiological Environmental Operating Report

Routine Annual Radiological Environmental Operating Reports covering the operation of the station during the previous calendar year shall be submitted prior to May 1 of each year pursuant to Technical Specification 6.8.1.3.

The Annual Radiological Environmental Operating Reports shall include summaries, interpretations, and an analysis of trends of the results of the radiological environmental Surveillance activities for the report period, including a comparison with preoperational studies, with operational Controls, as appropriate, and with previous environmental Surveillance reports, and an assessment of the observed impacts of the plant operation on the environment. The reports shall also include the results of the Land Use Census required by Control C.9.2.1.

The Annual Radiological Environmental Operating Reports shall include the results of analysis of all radiological environmental samples and of all environmental radiation measurements taken during the period pursuant to the locations specified in the table and figures in Part B of the ODCM, as well as summarized and tabulated results of these analyses and measurements in the format of the table in the Radiological Assessment Branch Technical Position, Revision 1, November 1979. In the event that some individual 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 reports shall also include the following: a summary description of the Radiological Environmental Monitoring Program; at least two legible maps**** covering all sampling locations keyed to a table giving distances and directions from the centerline of one reactor; the results of licensee participation in the Interlaboratory Comparison Program and the corrective action taken if the specified program is not being performed as required by Control C.9.3.1; reason for not conducting the Radiological Environmental Monitoring Program as required by Control C.9.1.1, and discussion of all deviations from the sampling schedule; discussion of environmental sample measurements that exceed the reporting levels but are not the result of plant effluents, pursuant to ACTION b. of Control C.9.1.1; and discussion of all analyses in which the LLD required was not achievable.

****One map shall cover locations near the SITE BOUNDARY; the more distant locations shall be covered by one or more additional maps.

10.2 Annual Radioactive Effluent Release Report

A routine Annual Radioactive Effluent Release Report covering the operation of the station during the previous calendar year of operation shall be submitted by May 1 of each year, pursuant to Technical Specification 6.8.1.4.

The Annual Radioactive Effluent Release Reports shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the station as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," Revision 1, June 1974, with data summarized on a quarterly basis following the format of Appendix B thereof. For solid wastes, the format for Table 3 in Appendix B shall be supplemented with three additional categories: class of solid wastes (as defined by 10 CFR Part 61), type of container (e.g., LSA, Type A, Type B, Large Quantity) and SOLIDIFICATION agent or absorbent (e.g., cement).

The Annual 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 on magnetic tape of wind speed, wind direction, atmospheric stability, and precipitation (if measured), or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability.***** This same report shall include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the unit or station during the previous calendar year. This same 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 Technical Specification (Figure 5.1-3) during the report period. All assumptions used in making these assessments, i.e., specific activity, exposure time, and location, shall be included in these reports. 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. The assessment of radiation doses shall be performed in accordance with the methodology and parameters in the OFFSITE DOSE CALCULATION MANUAL (ODCM).

The Annual Radioactive Effluent Release 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 Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operation." Acceptable methods for calculating the dose contribution from liquid and gaseous effluents are given in Regulatory Guide 1.109, Rev. 1, October 1977.

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

The Annual Radioactive Effluent Release Report shall include a list and description of unplanned releases from the site to UNRESTRICTED AREAS of radioactive materials in gaseous and liquid effluents made during the reporting period.

The Annual Radioactive Effluent Release Report shall include any changes made during the reporting period to the PROCESS CONTROL PROGRAM and the ODCM, pursuant to Technical Specifications 6.12 and 6.13, respectively, as well as any major change to Liquid, Gaseous, or Solid Radwaste Treatment Systems pursuant to Control 11.0. It shall also include a listing of new locations for dose calculations and/or environmental monitoring identified by the Land Use Census pursuant to Control C.9.2.

The Annual Radioactive Effluent Release Report shall also include the following: an explanation as to why the inoperability of liquid or gaseous effluent monitoring instrumentation was not corrected within the time specified in Control C.5.1 or C.5.2, respectively; and description of the events leading to liquid holdup tanks or gas storage tanks exceeding the limits of Technical Specification 3.11.1.4.

SEABROOK STATION ODCM

PART B

RADIOLOGICAL CALCULATIONAL METHODS AND PARAMETERS

1.0 INTRODUCTION

The Offsite Dose Calculation Manual (ODCM) contains details to implement Radioactive Effluent Controls and Environmental Monitoring Program as required by Technical Specifications 6.7.6g and 6.7.6h.

Part B of the ODCM provides formal and approved methods for the calculation of off-site concentration, off-site doses and effluent monitor setpoints, and indicates the locations of environmental monitoring stations in order to comply with the Seabrook Station Radioactive Effluent Controls Program (RECP), and Radiological Environmental Monitoring Program (REMP) detailed in Part A of the manual. The ODCM forms the basis for station procedures which document the off-site doses due to station operation which are used to show compliance with the numerical guides for design objectives of Section II of Appendix I to 10CFR Part 50. The methods contained herein follow accepted NRC guidance, unless otherwise noted in the text.

The references to 10 CFR Part 20 in Part B of the ODCM refer to revisions of 10 CFR Part 20 published prior to 1 January 1993. The decision to continue the use of the "old" version of 10 CFR Part 20 is based on an NRC letter dated June 30, 1993, from Thomas E. Murley to Thomas E. Tipton. For the convenience of the plant staff a copy of 10 CFR Part 20 (Rev. 1 January 1992) has been included in Appendix B.

1.1 Responsibilities for Part B

All changes to the ODCM shall be reviewed by the Station Operation Review Committee (SORC), approved by the Station Director, and documented in accordance with Technical Specification 6.13. The change process is controlled by the Applicability Determination Process as controlled by the 10 CFR 50.59 Resource Manual (5059RM). Changes made to Part B shall be submitted to the Commission for their information in the Annual Radioactive Effluent Release Report for the period in which the change(s) was made effective.

It shall be the responsibility of the Station Director to ensure that the ODCM is used in the performance of surveillance requirements and administrative controls in accordance with Technical Specifications 6.7.6g and 6.7.6h, and Effluent Control Program and Radiological Environmental Monitoring Program detailed in Part A of the manual.

In addition to off-site dose calculations for the demonstration of compliance with Technical Specification dose limits at and beyond the site boundary, 10CFR20.1302 requires that compliance with the dose limits for individual members of the public (100 mrem/yr total effective dose equivalent) be demonstrated in controlled areas on-site. Demonstration of compliance with the dose limits to members of the public in controlled areas is implemented per Health Physics Department Procedures, and is outside the scope of the ODCM. However, calculations performed in accordance with the ODCM can be used as one indicator of the need to perform an assessment of exposure to members of the public within the site boundary. Since external direct exposure pathways are already subject to routine exposure rate surveys and measurements, only the inhalation pathway need be assessed. The accumulated critical organ dose at the site boundary, as calculated per ODCM Part B Sections 3.9 and 3.11, can be used as an indicator of when additional assessments of on-site exposure to members of the public is advisable (see Section 3.11.2). Off-site critical organ doses from station effluents should not, however, be the only indicator of potential on-site doses.

1.2 Summary of Methods, Dose Factors, Limits, Constants, Variables and Definitions

This section summarizes the Method I dose equations which are used as the primary means of demonstrating compliance with RECP. The concentration and setpoint methods are identified in Table B.1-2 through Table B.1-7. Appendix C provides documentation for an alternate computerized option, designated as Method IA in the ODCM, for calculating doses necessary to demonstrate compliance with RECP. The Effluent Management System (EMS) software package used for this purpose is provided by Canberra Industries, Inc. Where more refined dose calculations are needed, the use of Method II dose determinations are described in Sections 3.2 through 3.9 and 3.11. The dose factors used in the equations are in Tables B.1-10 through B.1-14 and the Regulatory Limits are summarized in Table B.1-1.

The variables and special definitions used in this ODCM, Part B, are in Tables B.1-8 and B.1-9.

TABLE B.1-1

SUMMARY OF RADIOLOGICAL EFFLUENT PART A CONTROLS AND IMPLEMENTING EQUATIONS

Part A Control		Category	Method I(1)	Limit
C.6.1.1	Liquid Effluent Concentration	Total Fraction of MPC Excluding Noble Gases	Eq. 2-1	≤ 1.0
		Total Noble Gas Concentration	Eq. 2-2	≤ 2×10^{-4} μCi/ml
C.6.2.1	Liquid Effluent Dose	Total Body Dose	Eq. 3-1	≤ 1.5 mrem in a qtr.
				≤ 3.0 mrem in a yr.
		Organ Dose	Eq. 3-2	≤ 5 mrem in a qtr.
				≤ 10 mrem in a yr.
C.6.3.1	Liquid Radwaste Treatment Operability	Total Body Dose	Eq. 3-1	≤ 0.06 mrem in a mo.
		Organ Dose	Eq. 3-2	≤ 0.2 mrem in a mo.
C.7.1.1	Gaseous Effluents Dose Rate	Total Body Dose Rate from Noble Gases	Eq. 3-3	≤ 500 mrem/yr.
		Skin Dose Rate from Noble Gases	Eq. 3-4	≤ 3000 mrem/yr.
		Organ Dose Rate from I-131, I-133, Tritium and Particulates with $T_{1/2}$ > 8 Days	Eq. 3-5	≤ 1500 mrem/yr.

TABLE B.1-1

SUMMARY OF RADIOLOGICAL EFFLUENT PART A CONTROLS AND IMPLEMENTING EQUATIONS

(Continued)

Part A Control		Category	Method I(1)	Limit
C.7.2.1	Gaseous Effluents Dose from Noble Gases	Gamma Air Dose from Noble Gases	Eq. 3-6	≤ 5 mrad in a qtr. ≤ 10 mrad in a yr.
		Beta Air Dose from Noble Gases	Eq. 3-7	≤ 10 mrad in a qtr. ≤ 20 mrad in a yr.
C.7.3.1	Gaseous Effluents Dose from I-131, I-133, Tritium, and Particulates	Organ Dose from Iodines, Tritium and Particulates with $T_{1/2}$ > 8 Days	Eq. 3-8	≤ 7.5 mrem in a qtr. ≤ 15 mrem in a yr.
C.7.4.1	Ventilation Exhaust Treatment	Organ Dose	Eq. 3-8	≤ 0.3 mrem in a mo.
C.8.1.1	Total Dose (from All Sources)	Total Body Dose	Footnote (2).	≤ 25 mrem in a yr.
		Organ Dose		≤ 25 mrem in a yr.
		Thyroid Dose		≤ 75 mrem in a yr.
C.5.1	Liquid Effluent Monitor Setpoint			
	Liquid Waste Test Tank Monitor	Alarm Setpoint	Eq. 5-1	Control C.6.1.1

TABLE B.1-1

SUMMARY OF RADIOLOGICAL EFFLUENT PART A CONTROLS AND IMPLEMENTING EQUATIONS

(Continued)

Part A Controls		Category	Method I[1]	Limit
C.5.2	Gaseous Effluent Monitor Setpoint			
	Plant Vent Wide Range Gas Monitors	Alarm/Trip Setpoint For Total Body Dose Rate	Eq. 5-9	Control C.7.1.1a (Total Body)
		Alarm/Trip Setpoint for Skin Dose Rate	Eq. 5-10	Control C.7.1.1a (Skin)

(1) More accurate methods may be available (see subsequent chapters).

(2) Part A Control C.8.1.1a requires this evaluation only if twice the limit of equations 3-1, 3-2, 3-12, 3-15 or 3-18 is reached. If this occurs a Method II calculation, using actual release point parameters with annual average or concurrent meteorology and identified pathways for a real individual, shall be made.

TABLE B.1-2

SUMMARY OF METHOD I EQUATIONS TO CALCULATE UNRESTRICTED AREA LIQUID CONCENTRATIONS

Equation Number	Category	Equation
2-1	Total Fraction of MPC in Liquids, Except Noble Gases	$F_i^{ENG} = \sum_p \sum_i \frac{C_{pi}}{MPC_i} \leq 1$
2-2	Total Activity of Dissolved and Entrained Noble Gases from all Station Sources	$C_i^{NG}\left(\frac{\mu Ci}{ml}\right) = \sum_i C_i^{NG} \leq 2E\text{-}04$

TABLE B.1-3

SUMMARY OF METHOD I EQUATIONS TO CALCULATE OFF-SITE DOSES FROM LIQUID RELEASES

Equation Number	Category	Equation
3-1	Total Body Dose	$D_{tb}(\text{mrem}) = k \sum_i Q_i DFL_{itb}$
3-2	Maximum Organ Dose	$D_{mo}(\text{mrem}) = k \sum_i Q_i DFL_{imo}$

TABLE B.1-4

SUMMARY OF METHOD I EQUATIONS TO CALCULATE DOSE RATES

Category	Equation Number	Receptor Location[a]	Release Height[b]	Equation
Total Body Dose Rate From Noble Gases	3-3a	OS	E	$\dot{D}_{tb(e)} = 0.85 * \sum_i(\dot{Q}_i * DFB_i)$
	3-3b	OS	G	$\dot{D}_{tb(g)} = 3.4 * \sum_i(\dot{Q}_i * DFB_i)$
	3-3c	EC	E	$\dot{D}_{tbE(e)} = 0.0015 * \sum_i(\dot{Q}_i * DFB_i)$
	3-3d	EC	G	$\dot{D}_{tbE(g)} = 0.0074 * \sum_i(\dot{Q}_i * DFB_i)$
	3-3e	R	E	$\dot{D}_{tbR(e)} = 0.038 * \sum_i(\dot{Q}_i * DFB_i)$
	3-3f	R	G	$\dot{D}_{tbR(g)} = 0.2 * \sum_i(\dot{Q}_i * DFB_i)$

[a]OS = Off-Site, EC = Science & Nature Center, formerly the Education Center, R = The "Rocks"

[b]E = Elevated, G = Ground

TABLE B.1-4
SUMMARY OF METHOD I EQUATIONS TO CALCULATE DOSE RATES
(Continued)

Category	Equation Number	Receptor Location[a]	Release Height[b]	Equation
Skin Dose Rate From Noble Gases	3-4a	OS	E	$\dot{D}_{skin(e)} = \sum_i (\dot{Q}_i * DF'_{i(e)})$
	3-4b	OS	G	$\dot{D}_{skin(g)} = \sum_i (\dot{Q}_i * DF'_{i(g)})$
	3-4c	EC	E	$\dot{D}_{skinE(e)} = 0.0014 * \sum_i (\dot{Q}_i * DF'_{iE(e)})$
	3-4d	EC	G	$\dot{D}_{skinE(g)} = 0.0014 * \sum_i (\dot{Q}_i * DF'_{iE(g)})$
	3-4e	R	E	$\dot{D}_{skinR(e)} = 0.0076 * \sum_i (\dot{Q}_i * DF'_{iR(e)})$
	3-4f	R	G	$\dot{D}_{skinR(g)} = 0.0076 * \sum_i (\dot{Q}_i * DF'_{iR(g)})$

[a]OS = Off-Site, EC = Science & Nature Center, formerly the Education Center, R = The "Rocks"
[b]E = Elevated, G = Ground

TABLE B.1-4
SUMMARY OF METHOD I EQUATIONS TO CALCULATE DOSE RATES
(Continued)

Category	Equation Number	Receptor Location[a]	Release Height[b]	Equation
Critical Organ Dose Rate From I-131, I-133, H-3, and Particulate With $T_{1/2}$ >8 Days	3-5a	OS	E	$\dot{D}_{co(e)} = \sum_i (\dot{Q}_i * DFG'_{ico(e)})$
	3-5b	OS	G	$\dot{D}_{co(g)} = \sum_i (\dot{Q}_i * DFG'_{ico(g)})$
	3-5c	EC	E	$\dot{D}_{coE(e)} = 0.0014 * \sum_i (\dot{Q}_i * DFG'_{icoE(e)})$
	3-5d	EC	G	$\dot{D}_{coE(g)} = 0.0014 * \sum_i (\dot{Q}_i * DFG'_{icoE(g)})$
	3-5e	R	E	$\dot{D}_{coR(e)} = 0.0076 * \sum_i (\dot{Q}_i * DFG'_{icoR(e)})$
	3-5f	R	G	$\dot{D}_{coR(g)} = 0.0076 * \sum_i (\dot{Q}_i * DFG'_{icoR(g)})$

[a]OS = Off-Site, EC = Science & Nature Center, formerly the Education Center, R = The "Rocks"
[b]E = Elevated, G = Ground

TABLE B.1-5

SUMMARY OF METHOD I EQUATIONS TO CALCULATE DOSES TO AIR FROM NOBLE GASES

Category	Equation Number	Receptor Location[a]	Release Height[b]	Equation
Gamma Dose to Air From Noble Gases	3-6a	OS	E	$D^{\gamma}_{air(e)} = 3.2E-07 * t^{-0.275} * \sum_i (Q_i * DF^{\gamma}_i)$
	3-6b	OS	G	$D^{\gamma}_{air(g)} = 1.6E-06 * t^{-0.293} * \sum_i (Q_i * DF^{\gamma}_i)$
	3-6c	EC	E	$D^{\gamma}_{airE(e)} = 4.9E-10 * t^{-0.252} * \sum_i (Q_i * DF^{\gamma}_i)$
	3-6d	EC	G	$D^{\gamma}_{airE(g)} = 4.4E-09 * t^{-0.321} * \sum_i (Q_i * DF^{\gamma}_i)$
	3-6e	R	E	$D^{\gamma}_{airR(e)} = 5.1E-09 * t^{-0.155} * \sum_i (Q_i * DF^{\gamma}_i)$
	3-6f	R	G	$D^{\gamma}_{airR(g)} = 4.1E-08 * t^{-0.204} * \sum_i (Q_i * DF^{\gamma}_i)$

[a] OS = Off-Site, EC = Science & Nature Center, formerly the Education Center, R = The "Rocks"
[b] E = Elevated, G = Ground

TABLE B.1-5
SUMMARY OF METHOD I EQUATIONS TO CALCULATE DOSES TO AIR FROM NOBLE GASES
(Continued)

Category	Equation Number	Receptor Location[a]	Release Height[b]	Equation
Beta Dose to Air From Noble Gases	3-7a	OS	E	$D^{\beta}_{air(e)} = 4.1E\text{-}07 * t^{-0.3} * \sum_i (Q_i * DF_i^{\beta})$
	3-7b	OS	G	$D^{\beta}_{air(g)} = 6.0E\text{-}06 * t^{-0.319} * \sum_i (Q_i * DF_i^{\beta})$
	3-7c	EC	E	$D^{\beta}_{airE(e)} = 1.8E\text{-}09 * t^{-0.35} * \sum_i (Q_i * DF_i^{\beta})$
	3-7d	EC	G	$D^{\beta}_{airE(g)} = 2.4E\text{-}08 * t^{-0.347} * \sum_i (Q_i * DF_i^{\beta})$
	3-7e	R	E	$D^{\beta}_{airR(e)} = 3.9E\text{-}08 * t^{-0.249} * \sum_i (Q_i * DF_i^{\beta})$
	3-7f	R	G	$D^{\beta}_{airR(g)} = 4.6E\text{-}07 * t^{-0.267} * \sum_i (Q_i * DF_i^{\beta})$

[a]OS = Off-Site, EC = Science & Nature Center, formerly the Education Center, R = The "Rocks"
[b]E = Elevated, G = Ground

TABLE B.1-6
SUMMARY OF METHOD I EQUATIONS TO CALCULATE DOSE TO AN INDIVIDUAL FROM TRITIUM, IODINE AND PARTICULATES

Category	Equation Number	Receptor Location[a]	Release Height[b]	Equation
Dose to Critical Organ From Iodines, Tritium, and Particulates	3-8a	OS	E	$D_{co(e)} = 14.8 * t^{-0.297} * \Sigma(Q_i * DFG_{ico(e)})$
	3-8b	OS	G	$D_{co(g)} = 17.7 * t^{-0.316} * \Sigma(Q_i * DFG_{ico(g)})$
	3-8c	EC	E	$D_{co\,E(e)} = 3.3E\text{-}02 * t^{-0.349} * \Sigma(Q_i * DFG_{ico\,E(e)})$
	3-8d	EC	G	$D_{co\,E(g)} = 3.3E\text{-}02 * t^{-0.347} * \Sigma(Q_i * DFG_{ico\,E(g)})$
	3-8e	R	E	$D_{co\,R(e)} = 7.3E\text{-}02 * t^{-0.248} * \Sigma(Q_i * DFG_{ico\,R(e)})$
	3-8f	R	G	$D_{co\,R(g)} = 8.6E\text{-}02 * t^{-0.267} * \Sigma(Q_i * DFG_{ico\,R(g)})$

[a]OS = Off-Site, EC = Science & Nature Center, formerly the Education Center, R = The "Rocks"
[b]E = Elevated, G = Ground

TABLE B.1-7
SUMMARY OF METHODS FOR
SETPOINT DETERMINATIONS

Equation Number	Category	Equation
5-1	Liquid Effluents: Liquid Waste Test Tank Monitor (RM-6509)	$R_{setpoint}\left(\frac{\mu Ci}{ml}\right) = f_1 \frac{F_d}{F_m \times DF_{min_\gamma}} \Sigma C\gamma i$
5-23	PCCW Rate-of-Change Alarm	$RC_{set}(gph) = 1x10^{-8} \cdot SWF \cdot \frac{1}{PCC}$
	Gaseous Effluents: Plant Vent Wide Range Gas Monitors (RM-6528-1, 2, 3)	
5-5	Total Body	$R_{tb}\ (\mu Ci/sec) = 588\ \frac{1}{DFB_c}\ f_v$
5-6	Skin	$R_{skin}(\mu Ci/sec) = 3000\ \frac{1}{DF'_c}\ f_v$

TABLE B.1-8
SUMMARY OF VARIABLES

Variable		Definition	Units
C_{li}^{NG}	=	Concentration at point of discharge and entrained noble gas "i" in liquid pathways from all station sources	µCi/ml
C_{i}^{NG}	=	Total activity of all dissolved and entrained noble gases in liquid pathways from all station sources	µCi/ml
C_{di}	=	Concentration of radionuclide "i" at the point of liquid discharge	µCi/ml
C_{i}	=	Concentration of radionuclide "i"	µCi/ml
C_{pi}	=	Concentration, exclusive of noble gases, of radionuclide "i" from tank "p" at point of discharge	µCi/ml
$C_{\gamma\ i}$	=	Concentration of radionuclide "i" in mixture at the monitor	µCi/ml
$D_{air(e)}^{\beta}$	=	Off-site beta dose to air due to noble gases in elevated release	mrad
$D_{air(g)}^{\beta}$	=	Off-site beta dose to air due to noble gas in ground level release	mrad
$D_{airE(e)}^{\beta}$	=	Beta dose to air at Science & Nature Center due to noble gases in elevated release	mrad
$D_{airE(g)}^{\beta}$	=	Beta dose to air at Science & Nature Center due to noble gases in ground level release	mrad
$D_{airR(e)}^{\beta}$	=	Beta dose to air at "Rocks" due to noble gases in elevated release	mrad
$D_{airR(g)}^{\beta}$	=	Beta dose to air at "Rocks" due to noble gases in ground level release	mrad
$D_{air(e)}^{\gamma}$	=	Off-site gamma dose to air due to noble gases in elevated release	mrad
$D_{air(g)}^{\gamma}$	=	Off-site gamma dose to air due to noble gases in ground level release	mrad
$D_{airE(e)}^{\gamma}$	=	Gamma dose to air at Science & Nature Center due to noble gases in elevated release	mrad
$D_{airE(g)}^{\gamma}$	=	Gamma dose to air at Science & Nature Center due to noble gases in ground level release	mrad
$D_{airR(e)}^{\gamma}$	=	Gamma dose to air at "Rocks" due to noble gases in elevated release	mrad

TABLE B.1-8
SUMMARY OF VARIABLES
(Continued)

Variable		Definition	Units
$D^{\gamma}_{airR(g)}$	=	Gamma dose to air at "Rocks" due to noble gases in ground level release	mrad
$D_{co(e)}$	=	Critical organ dose from an elevated release to an off-site receptor	mrem
$D_{co(g)}$	=	Critical organ dose from a ground level release to an off-site receptor	mrem
$D_{coE(e)}$	=	Critical organ dose from an elevated release to a receptor at the Science & Nature Center	mrem
$D_{coE(g)}$	=	Critical organ dose from a ground level release to a receptor at the Science & Nature Center	mrem
$D_{coR(e)}$	=	Critical organ dose from an elevated release to a receptor at the "Rocks"	mrem
$D_{coR(g)}$	=	Critical organ dose from a ground level release to a receptor at the "Rocks"	mrem
D_d	=	Direct dose	mrem
D^{γ}_{finite}	=	Gamma dose to air, corrected for finite cloud	mrad
D_{mo}	=	Dose to the maximum organ	mrem
D^S	=	Dose to skin from beta and gamma	mrem
D_{tb}	=	Dose to the total body	mrem
DF_{min}	=	Minimum required dilution factor based on all (beta – emitting and gamma – emitting) radionuclides	ratio
$DF_{min\gamma}$	=	Minimum required dilution factor necessary to ensure that the sum of the ratios for the concentration of each gamma-emitting radionuclide to the respective MPC value is not greater than 1 (dimensionless).	
DF'_i	=	Composite skin dose factor for off-site receptor	mrem-sec/μCi-yr
DF'_{iE}	=	Composite skin dose factor for Science & Nature Center	mrem-sec/μCi-yr
DF'_{iR}	=	Composite skin dose factor for the "Rocks"	mrem-sec/μCi-yr
DFB_i	=	Total body gamma dose factor for nuclide "i" (Table B.1-10)	$\frac{mrem^3}{pCi\text{-}yr}$

TABLE B.1-8

SUMMARY OF VARIABLES

(Continued)

Variable		Definition	Units
DFB_c	=	Composite total body dose factor	$\frac{mrem^3}{pCi-yr}$
DFL_{itb}	=	Site-specific, total body dose factor for a liquid release of nuclide "i" (Table B.1-11)	mrem/µCi1
DFL_{imo}	=	Site-specific, maximum organ dose factor for a liquid release of nuclide "i" (Table B.1-11)	mrem/µCi
$DFB_{ico(e)}$	=	Site-specific, critical organ dose factor for an elevated gaseous release of nuclide "i" (Table B.1-12)	mrem/µCi
$DFG_{ico(g)}$	=	Site-specific critical organ dose factor for a ground level release of nuclide "i" (Table B.1-12)	mrem/µCi
$DFG_{icoE(e)}$	=	Science & Nature Center-specific critical organ dose factor for an elevated release of nuclide "i" (Table B.1-14)	mrem/µCi
$DFG_{icoE(g)}$	=	Science & Nature Center-specific critical organ dose factor for a ground level release of nuclide "i" (Table B.1-14)	mrem/µCi
$DFG_{icoR(e)}$	=	The "Rocks"-specific critical organ dose factor for an elevated release of nuclide "i" (Table B.1-15)	mrem/µCi
$DFG_{icoR(g)}$	=	The "Rocks"-specific critical dose factor for a ground level release of nuclide "i" (Table B.1-15)	mrem/µCi
$DFG'_{ico(e)}$	=	Site-specific critical organ dose rate factor for an elevated gaseous release of nuclide "i" (Table B.1-12)	mrem-sec/µCi-yr
$DFG'_{ico(g)}$	=	Site-specific critical organ dose rate factor for a ground level release of nuclide "i" (Table B.1-12)	mrem-sec/µCi-yr
$DFG'_{icoE(e)}$	=	Science & Nature Center-specific critical organ dose rate factor for an elevated release of nuclide "i" (Table B.1-14)	mrem-sec/µCi-yr
$DFG'_{icoE(g)}$	=	Science & Nature Center-specific critical organ dose rate factor for a ground level release of nuclide "i" (Table B.1-14)	mrem-sec/µCi-yr
$DFG'_{icoR(e)}$	=	The "Rocks"-specific critical organ dose rate factor for an elevated release of nuclide "i" (Table B.1-15)	mrem-sec/µCi-yr
$DFG'_{icoR(g)}$	=	The "Rocks"-specific critical organ dose rate factor for a ground level release of nuclide "i" (Table B.1-15)	mrem-sec/µCi-yr

TABLE B.1-8
SUMMARY OF VARIABLES
(Continued)

Variable		Definition	Units
DFS_i	=	Beta skin dose factor for nuclide "i" (Table B.1-10)	$\frac{mrem\text{-}m^3}{pCi\text{-}yr}$
DF'_i	=	Combined skin dose factor for nuclide "i" (Table B.1-10)	mrem- sec/μCi-yr
DF_i^{γ}	=	Gamma air dose factor for nuclide "i" (Table B.1-10)	$\frac{mrad\text{-}m^3}{pCi\text{-}yr}$
DF_i^{β}	=	Beta air dose factor for nuclide "i" (Table B.1-10)	$\frac{mrad\text{-}m^3}{pCi\text{-}yr}$
$\dot{D}_{co(e)}$	=	Critical organ dose rate to an off-site receptor due to elevated release of iodines, tritium, and particulates	$\frac{mrem}{yr}$
$\dot{D}_{co(g)}$	=	Critical organ dose rate to an off-site receptor due to ground level release of iodines, tritium, and particulates	$\frac{mrem}{yr}$
$\dot{D}_{coE(e)}$	=	Critical organ dose rate to a receptor at the Science & Nature Center due to an elevated release of iodines, tritium, and particulates	$\frac{mrem}{yr}$
$\dot{D}_{coE(g)}$	=	Critical organ dose rate to a receptor at the Science & Nature Center due to a ground level release of iodines, tritium, and particulates	$\frac{mrem}{yr}$
$\dot{D}_{coR(e)}$	=	Critical organ dose rate to a receptor at the "Rocks" due to an elevated release of iodines, tritium, and particulates	$\frac{mrem}{yr}$
$\dot{D}_{coR(g)}$	=	Critical organ dose rate to a receptor at the "Rocks" due to a ground level release of iodines, tritium, and particulates	$\frac{mrem}{yr}$
$\dot{D}_{skin(e)}$	=	Skin dose rate to an off-site receptor due to noble gases in an elevated release	$\frac{mrem}{yr}$
$\dot{D}_{skin(g)}$	=	Skin dose rate to an off-site receptor due to noble gases in a ground level release	$\frac{mrem}{yr}$
$\dot{D}_{skinE(e)}$	=	Skin dose rate to a receptor at the Science & Nature Center due to noble gases in an elevated release	$\frac{mrem}{yr}$
$\dot{D}_{skinE(g)}$	=	Skin dose rate to a receptor at the Science & Nature Center due to noble gases in a ground level release	$\frac{mrem}{yr}$

TABLE B.1-8
SUMMARY OF VARIABLES
(Continued)

Variable		Definition	Units
$\dot{D}_{skinR(e)}$	=	Skin dose rate to a receptor at the "Rocks" due to noble gases in an elevated release	$\frac{mrem}{yr}$
$\dot{D}_{skinR(g)}$	=	Skin dose rate to a receptor at the "Rocks" due to noble gases in a ground level release	$\frac{mrem}{yr}$
$\dot{D}_{tb(e)}$	=	Total body dose rate to an off-site receptor due to noble gases in an elevated release	$\frac{mrem}{yr}$
$\dot{D}_{tb(g)}$	=	Total body dose rate to an off-site receptor due to noble gases in a ground level release	$\frac{mrem}{yr}$
$\dot{D}_{tbE(e)}$	=	Total body dose rate to a receptor at the Science & Nature Center due to noble gases in an elevated release	$\frac{mrem}{yr}$
$\dot{D}_{tbE(g)}$	=	Total body dose rate to a receptor at the Science & Nature Center due to noble gases in a ground level release	$\frac{mrem}{yr}$
$\dot{D}_{tbR(e)}$	=	Total body dose rate to a receptor at the "Rocks" due to noble gases in an elevated release	$\frac{mrem}{yr}$
$\dot{D}_{tbR(g)}$	=	Total body dose rate to a receptor at the "Rocks" due to noble gases in a ground level release	$\frac{mrem}{yr}$
D/Q	=	Deposition factor for dry deposition of elemental radioiodines and other particulates	$\frac{1}{m^2}$
f_v	=	The fraction of the offsite limiting total body dose rate administratively assigned to the plant vent release	Dimensionless
F_d	=	Actual or estimated flow rate out of discharge tunnel	gpm or ft^3/sec
F_m	=	Flow rate past liquid waste test tank monitor	gpm
F_{max}	=	Maximum allowable discharge flow rate from liquid test tanks based on all (beta – emitting and gamma – emitting) radionuclides	gpm
$F_{max\gamma}$	=	Maximum allowable discharge flow rate from the test tank past the monitor which would equate to the control concentration limit for the gamma radioactivity mixture determined to be in the test tank	gpm
f_g	=	The fraction of the offsite limiting total body dose rate administratively assigned to monitored ground level release	Dimensionless

TABLE B.1-8
SUMMARY OF VARIABLES
(Continued)

Variable		Definition	Units
F	=	Flow rate past plant vent monitor	$\frac{cc}{sec}$
f_{gland}	=	Release reduction factor to be administratively assigned to account for potential unmonitored contributions from the Turbine Gland Seal Exhaust	Dimensionless
f_1; f_2; f_3; f_4	=	Fraction of total MPC associated with Paths 1, 2, 3, and 4	Dimensionless
F_i^{ENG}	=	Total fraction of MPC in liquid pathways (excluding noble gases)	Dimensionless
MPC_i	=	Maximum permissible concentration for radionuclide "i" (10CFR20, Appendix B, Table 2, Column 2)	µCi/cc
Q_i	=	Release to the environment for radionuclide "i"	curies, or µ curies
$\dot{Q}_i$	=	Release rate to the environment for radionuclide "i"	µCi/sec
$R_{setpoint}$	=	Liquid monitor response for the limiting concentration at the point of discharge	µCi/ml
R_{skin}	=	Response of the noble gas monitor to limiting total body dose rate	cpm, or µCi/sec
R_{tb}	=	Response of the noble gas monitor to limiting total body dose rate	cpm, or µCi/sec
S_F	=	Shielding factor	Dimensionless
S_g	=	Detector counting efficiency from the gas monitor calibration	$\frac{cpm}{\mu Ci\text{-}cc}$ or $\frac{mR/hr}{\mu Ci/cc}$
S_{gi}	=	Detector counting efficiency for noble gas "i"	$\frac{cpm}{\mu Ci\text{-}cc}$ or $\frac{mR/hr}{\mu Ci/cc}$
S_l	=	Detector counting efficiency from the liquid monitor calibration	cps/µCi/ml
S_{li}	=	Detector counting efficiency for radionuclide "i"	cps/µCi/ml
X/Q	=	Average long-term undepleted atmospheric dispersion factor (Tables B.7-4, B.7-5, and B.7-6)	$\frac{sec}{m^3}$
$[X/Q]\gamma$	=	Effective long-term average gamma atmospheric dispersion factor (Tables B.7-4, B.7-5, and B.7-6)	$\frac{sec}{m^3}$
SWF	=	Service Water System flow rate	gph

TABLE B.1-8
SUMMARY OF VARIABLES
(Continued)

Variable		Definition	Units
PCC	=	Primary component cooling water measured (decay corrected) gross radioactivity concentration	μCi/ml
t^{-a}	=	Unitless factor which adjusts the value of atmospheric dispersion factors for elevated or ground-level releases with a total release duration of t hours	Dimensionless

TABLE B.1-9
DEFINITION OF TERMS

Critical Receptor - A hypothetical or real individual whose location and behavior cause him or her to receive a dose greater than any other possible real individual.

Dose - As used in Regulatory Guide 1.109, the term "dose," when applied to individuals, is used instead of the more precise term "dose equivalent," as defined by the International Commission on Radiological Units and Measurements (ICRU). When applied to the evaluation of internal deposition or radioactivity, the term "dose," as used here, includes the prospective dose component arising from retention in the body beyond the period of environmental exposure, i.e., the dose commitment. The dose commitment is evaluated over a period of 50 years. The dose is measured in mrem to tissue or mrad to air.

Dose Rate - The rate for a specific averaging time (i.e., exposure period) of dose accumulation.

Liquid Radwaste Treatment System - The components or subsystems which comprise the available treatment system as shown in Figure B.6-1.

TABLE B.1-10
DOSE FACTORS SPECIFIC FOR SEABROOK STATION FOR NOBLE GAS RELEASES

Radio-nuclide	Gamma Total Body Dose Factor $DFB_i\left(\frac{mrem\text{-}m^3}{pCi\text{-}yr}\right)$	Beta Skin Dose Factor $DFS_i\left(\frac{mrem\text{-}m^3}{pCi\text{-}yr}\right)$	Combined Skin Dose Factor for Elevated Release Points $DF'_{i(e)}\left(\frac{mrem\text{-}sec}{\mu Ci\text{-}yr}\right)$	Combined Skin Dose Factor for Ground Level Release Points $DF'_{i(g)}\left(\frac{mrem\text{-}sec}{\mu Ci\text{-}yr}\right)$	Beta Air Dose Factor $DF_i^{\beta}\left(\frac{mrad\text{-}m^3}{pCi\text{-}yr}\right)$	Gamma Air Dose Factor $DF_i^{\gamma}\left(\frac{mrad\text{-}m^3}{pCi\text{-}yr}\right)$
Ar-41	8.84E-03	2.69E-03	1.09E-02	6.20E-02	3.28E-03	9.30E-03
Kr-83m	7.56E-08	-----	1.81E-05	7.28E-05	2.88E-04	1.93E-05
Kr-85m	1.17E-03	1.46E-03	2.35E-03	1.92E-02	1.97E-03	1.23E-03
Kr-85	1.61E-05	1.34E-03	1.11E-03	1.35E-02	1.95E-03	1.72E-05
Kr-87	5.92E-03	9.73E-03	1.38E-02	1.21E-01	1.03E-02	6.17E-03
Kr-88	1.47E-02	2.37E-03	1.62E-02	8.10E-02	2.93E-03	1.52E-02
Kr-89	1.66E-02	1.01E-02	2.45E-02	1.66E-01	1.06E-02	1.73E-02
Kr-90	1.56E-02	7.29E-03	2.13E-02	1.34E-01	7.83E-03	1.63E-02
Xe-131m	9.15E-05	4.76E-04	5.37E-04	5.35E-03	1.11E-03	1.56E-04
Xe-133m	2.51E-04	9.94E-04	1.12E-03	1.12E-02	1.48E-03	3.27E-04
Xe-133	2.94E-04	3.06E-04	5.83E-04	4.39E-03	1.05E-03	3.53E-04
Xe-135m	3.12E-03	7.11E-04	3.74E-03	1.98E-02	7.39E-04	3.36E-03
Xe-135	1.81E-03	1.86E-03	3.33E-03	2.58E-02	2.46E-03	1.92E-03
Xe-137	1.42E-03	1.22E-02	1.14E-02	1.28E-01	1.27E-02	1.51E-03
Xe-138	8.83E-03	4.13E-03	1.20E-02	7.60E-02	4.75E-03	9.21E-03

8.84E-03 = 8.84×10^{-3}

TABLE B.1-11
DOSE FACTORS SPECIFIC FOR SEABROOK STATION FOR LIQUID RELEASES

Radionuclide	Total Body Dose Factor DFL_{itb} $(\frac{mrem}{\mu Ci})$	Maximum Organ Dose Factor DFL_{imo} $(\frac{mrem}{\mu Ci})$
H-3	3.02E-13	3.02E-13
Na-24	1.38E-10	1.42E-10
Cr-51	1.83E-11	1.48E-09
Mn-54	5.15E-09	2.68E-08
Fe-55	1.26E-08	7.67E-08
Fe-59	8.74E-08	6.66E-07
Co-58	2.46E-09	1.40E-08
Co-60	6.15E-08	9.22E-08
Zn-65	2.73E-07	5.49E-07
Br-83	1.30E-14	1.89E-14
Rb-86	4.18E-10	6.96E-10
Sr-89	2.17E-10	7.59E-09
Sr-90	3.22E-08	1.31E-07
Nb-95	5.25E-10	1.58E-06
Mo-99	3.72E-11	2.67E-10
Tc-99m	5.22E-13	1.95E-12
Ag-110m	1.01E-08	6.40E-07
Sb-124	1.71E-09	9.89E-09
Sb-125	6.28E-09	8.31E-09
Te-127m	7.07E-08	1.81E-06
Te-127	3.53E-10	9.54E-08
Te-129m	1.54E-07	3.46E-06
Te-129	7.02E-14	1.05E-13
Te-131m	3.16E-08	2.94E-06
Te-132	9.06E-08	3.80E-06
I-130	2.75E-11	3.17E-09
I-131	2.30E-10	1.00E-07
I-132	6.28E-11	6.36E-11
I-133	3.85E-11	1.15E-08
I-134	1.19E-12	1.41E-12
I-135	5.33E-11	4.69E-10
Cs-134	3.24E-08	3.56E-08
Cs-136	2.47E-09	3.27E-09
Cs-137	3.58E-08	4.03E-08
Ba-140	1.70E-10	3.49E-09
La-140	1.07E-10	4.14E-08
Ce-141	3.85E-11	9.31E-09
Ce-144	1.96E-10	6.46E-08
Other*	3.12E-08*	1.58E-06*

* Dose factors to be used in Method I calculation for any "other" detected gamma emitting radionuclide which is not included in the above list.

TABLE B.1-12
DOSE AND DOSE RATE FACTORS SPECIFIC FOR SEABROOK STATION FOR IODINES, TRITIUM AND PARTICULATE RELEASES

Radio-nuclide	Critical Organ Dose Factor for Elevated Release Point $DFG_{ico(e)}\ (\frac{mrem}{\mu Ci})$	Critical Organ Dose Factor for Ground Level Release Point $DFG_{ico(g)}\ (\frac{mrem}{\mu Ci})$	Critical Organ Dose Rate Factor for Elevated Release Point $DFG'_{ico(e)}\ (\frac{mrem\text{-}sec}{yr\text{-}\mu Ci})$	Critical Organ Dose Rate Factor for Ground Level Release Point $DFG'_{ico(g)}\ (\frac{mrem\text{-}sec}{yr\text{-}\mu Ci})$
H-3	3.08E-10	3.76E-09	9.71E-03	1.19E-01
Cr-51	8.28E-09	2.89E-08	2.91E-01	1.01E+00
Mn-54	1.11E-06	3.79E-06	4.38E+01	1.50E+02
Fe-59	1.06E-06	3.65E-06	3.53E+01	1.21E+02
Co-58	5.56E-07	1.91E-06	2.00E+01	6.88E+01
Co-60	1.21E-05	4.12E-05	5.42E+02	1.85E+03
Zn-65	2.33E-06	7.93E-06	7.82E+01	2.66E+02
Sr-89	1.98E-05	6.73E-05	6.24E+02	2.12E+03
Sr-90	7.21E-04	2.47E-03	2.27E+04	7.79E+04
Zr-95	1.10E-06	3.77E-06	3.63E+01	1.24E+02
Nb-95	2.01E-06	6.86E-06	6.40E+01	2.20E+02
Mo-99	1.63E-08	1.10E-07	5.39E-01	3.56E+00
Ru-103	3.03E-06	1.04E-05	9.62E+01	3.31E+02
Ag-110m	5.02E-06	1.72E-05	1.80E+02	6.15E+02
Sb-124	1.83E-06	6.28E-06	6.15E+01	2.11E+02
I-131	1.47E-04	5.04E-04	4.64E+03	1.59E+04
I-133	1.45E-06	5.72E-06	4.57E+01	1.80E+02
Cs-134	5.62E-05	1.91E-04	1.81E+03	6.18E+03
Cs-137	5.47E-05	1.86E-04	1.79E+03	6.09E+03
Ba-140	1.55E-07	6.39E-07	5.01E+00	2.06E+01
Ce-141	2.65E-07	9.28E-07	8.45E+00	2.96E+01
Ce-144	6.09E-06	2.09E-05	1.93E+02	6.62E+02
Other*	4.09E-06	1.39E-05	1.29E+02	4.38E+02

* Dose factors to be used in Method I calculations for any "other" detected gamma emitting radionuclide which is not included in the above list.

TABLE B.1-13
COMBINED SKIN DOSE RATE FACTORS SPECIFIC FOR SEABROOK STATION SPECIAL RECEPTORS[1] FOR NOBLE GAS RELEASE

Radio-nuclide	Science & Nature Center Combined Skin Dose Rate Factor for Elevated Release Point $DF'_{iE(e)} (\frac{mrem\text{-}sec}{\mu Ci\text{-}yr})$	Science & Nature Center Combined Skin Dose Rate Factor for Ground Level Release Point $DF'_{iE(g)} (\frac{mrem\text{-}sec}{\mu Ci\text{-}yr})$	The "Rocks" Combined Skin Dose Rate Factor for Elevated Release Point $DF'_{iR(e)} (\frac{mrem\text{-}sec}{\mu Ci\text{-}yr})$	The "Rocks" Combined Skin Dose Rate Factor for Ground Level Release Point $DF'_{iR(g)} (\frac{mrem\text{-}sec}{\mu Ci\text{-}yr})$
Ar-41	1.57E-02	1.17E-01	9.73E-02	6.99E-01
Kr-83m	2.35E-05	1.13E-04	1.07E-04	5.57E-04
Kr-85m	3.84E-03	4.08E-02	3.16E-02	2.69E-01
Kr-85	2.16E-03	3.09E-02	2.29E-02	2.15E-01
Kr-87	2.31E-02	2.60E-01	2.00E-01	1.73E+00
Kr-88	2.23E-02	1.44E-01	1.25E-01	8.18E-01
Kr-89	3.73E-02	3.34E-01	2.68E-01	2.12E+00
Kr-90	3.15E-02	2.64E-01	2.14E-01	1.64E+00
Xe-131m	9.52E-04	1.19E-02	8.96E-03	8.07E-02
Xe-133m	1.99E-03	2.48E-02	1.87E-02	1.68E-01
Xe-133	9.20E-04	9.11E-03	7.16E-03	5.91E-02
Xe-135m	5.24E-03	3.61E-02	3.07E-02	2.11E-01
Xe-135	5.32E-03	5.41E-02	4.23E-02	3.53E-01
Xe-137	2.14E-02	2.89E-01	2.16E-01	2.00E+00
Xe-138	1.78E-02	1.49E-01	1.21E-01	9.27E-01

(1) See Seabrook Station Technical Specification Figure 5.1-1.

TABLE B.1-14
DOSE AND DOSE RATE FACTORS SPECIFIC FOR THE SCIENCE & NATURE CENTER FOR IODINE, TRITIUM, AND PARTICULATE RELEASES

Radio-nuclide	Critical Organ Dose Factor for Elevated Release Point $DFG_{icoE(e)}$ $(\frac{mrem}{\mu Ci})$	Critical Organ Dose Factor for Ground Level Release Point $DFG_{icoE(g)}$ $(\frac{mrem}{\mu Ci})$	Critical Organ Dose Rate Factor for Elevated Release Point $DFG'_{icoE(e)}$ $(\frac{mrem\text{-}sec}{\mu Ci\text{-}yr})$	Critical Organ Dose Rate Factor for Ground Level Release Point $DFG'_{icoE(g)}$ $(\frac{mrem\text{-}sec}{\mu Ci\text{-}yr})$
H-3	6.45E-11	9.27E-10	2.03E-03	2.92E-02
Cr-51	4.98E-09	2.88E-08	2.12E-01	1.11E+00
Mn-54	1.39E-06	5.71E-06	6.24E+01	2.39E+02
Fe-59	3.09E-07	1.89E-06	1.29E+01	7.16E+01
Co-58	3.89E-07	2.10E-06	1.72E+01	8.26E+01
Co-60	2.17E-05	8.03E-05	9.78E+02	3.63E+03
Zn-65	7.34E-07	3.19E-06	3.31E+01	1.33E+02
Sr-89	1.15E-07	1.61E-06	3.63E+00	5.08E+01
Sr-90	5.14E-06	7.19E-05	1.62E+02	2.27E+03
Zr-95	3.38E-07	2.57E-06	1.35E+01	9.15E+01
Nb-95	1.53E-07	9.35E-07	6.43E+00	3.53E+01
Mo-99	1.62E-08	1.92E-07	5.58E-01	6.21E+00
Ru-103	1.30E-07	8.64E-07	5.33E+00	3.19E+01
Ag-110m	3.43E-06	1.54E-05	1.55E+02	6.34E+02
Sb-124	6.96E-07	4.46E-06	2.89E+01	1.67E+02
I-131	7.79E-07	1.08E-05	2.47E+01	3.41E+02
I-133	1.84E-07	2.56E-06	5.83E+00	8.11E+01
Cs-134	6.83E-06	2.53E-05	3.08E+02	1.14E+03
Cs-137	1.03E-05	3.81E-05	4.64E+02	1.72E+03
Ba-140	1.14E-07	1.42E-06	3.85E+00	4.54E+01
Ce-141	4.09E-08	4.51E-07	1.45E+00	1.48E+01
Ce-144	6.95E-07	9.11E-06	2.27E+01	2.90E+02
Other*	2.26E-06	9.24E-06	1.02E+02	3.91E+02

* Dose factors to be used in Method I calculations for any "other" detected gamma emitting radionuclide which is not included in the above list.

TABLE B.1-15
DOSE AND DOSE RATE FACTORS SPECIFIC FOR THE "ROCKS" FOR IODINE, TRITIUM, AND PARTICULATE RELEASES

Radio-nuclide	Critical Organ Dose Factor for Elevated Release Point $DFG_{icoR(e)}$ $(\frac{mrem}{\mu Ci})$	Critical Organ Dose Factor for Ground Level Release Point $DFG_{icoR(g)}$ $(\frac{mrem}{\mu Ci})$	Critical Organ Dose Rate Factor for Elevated Release Point $DFG'_{icoR(e)}$ $(\frac{mrem\text{-}sec}{\mu Ci\text{-}yr})$	Critical Organ Dose Rate Factor for Ground Level Release Point $DFG'_{icoR(g)}$ $(\frac{mrem\text{-}sec}{\mu Ci\text{-}yr})$
H-3	6.85E-10	6.45E-09	2.16E-02	2.03E-01
Cr-51	2.68E-08	1.75E-07	1.07E+00	6.53E+00
Mn-54	5.84E-06	3.18E-05	2.55E+02	1.31E+03
Fe-59	1.74E-06	1.17E-05	6.78E+01	4.29E+02
Co-58	2.01E-06	1.25E-05	8.11E+01	4.79E+02
Co-60	8.83E-05	4.09E-04	3.97E+03	1.85E+04
Zn-65	3.23E-06	1.80E-05	1.37E+02	7.29E+02
Sr-89	1.23E-06	1.15E-05	3.88E+01	3.63E+02
Sr-90	5.48E-05	5.14E-04	1.73E+03	1.62E+04
Zr-95	2.22E-06	1.68E-05	8.14E+01	5.83E+02
Nb-95	8.59E-07	5.79E-06	3.37E+01	2.13E+02
Mo-99	1.50E-07	1.34E-06	4.92E+00	4.32E+01
Ru-103	7.74E-07	5.47E-06	2.95E+01	1.96E+02
Ag-110m	1.54E-05	8.77E-05	6.47E+02	3.53E+03
Sb-124	4.04E-06	2.80E-05	1.56E+02	1.01E+03
I-131	8.27E-06	7.73E-05	2.61E+02	2.44E+03
I-133	1.95E-06	1.83E-05	6.18E+01	5.77E+02
Cs-134	2.78E-05	1.29E-04	1.25E+03	5.80E+03
Cs-137	4.19E-05	1.94E-04	1.89E+03	8.77E+03
Ba-140	1.10E-06	9.99E-06	3.56E+01	3.19E+02
Ce-141	3.59E-07	3.14E-06	1.20E+01	1.02E+02
Ce-144	7.02E-06	6.46E-05	2.25E+02	2.05E+03
Other*	9.56E-06	5.09E-05	4.16E+02	2.12E+03

* Dose factors to be used in Method I calculations for any "other" detected gamma emitting radionuclide which is not included in the above list.

2.0 METHOD TO CALCULATE OFF-SITE LIQUID CONCENTRATIONS

Chapter 2 contains the basis for station procedures used to demonstrate compliance with ODCM Part A Control C.6.1.1, which limits the total fraction of MPC in liquid pathways, other than noble gases (denoted here as F_1^{ENG}) at the point of discharge from the station to the environment (see Figure B.6-1).

F_1^{ENG} is limited to less than or equal to one, i.e.,

$$F_1^{ENG} \leq 1.$$

The total concentration of all dissolved and entrained noble gases at the point of discharge from the multiport diffuser from all station sources combined, denoted C_1^{NG}, is limited to 2E-04 µCi/ml, i.e.,

$$C_1^{NG} \leq 2E\text{-}04 \ \mu Ci/ml.$$

Appendix C, Attachments 3 and 4, provide the option and bases for the use of the EMS determination of liquid concentration limits for plant discharges to the environment.

2.1 Method to Determine F_1^{ENG} AND C_1^{NG}

First, determine the total fraction of MPC (excluding noble gases), at the point of discharge from the station from all significant liquid sources denoted F_1^{ENG}; and then separately determine the total concentration at the point of discharge of all dissolved and entrained noble gases from all station sources, denoted C_1^{NG}, as follows:

$$F_1^{ENG} = \sum_p \sum_i \frac{C_{pi}}{MPC_i} \leq 1. \qquad (2\text{-}1)$$

$$\left(\frac{\mu Ci/ml}{\mu Ci/ml}\right)$$

and:

$$C_1^{NG} = \sum_i C_{1i}^{NG} \leq 2E\text{-}04 \qquad (2\text{-}2)$$

(µCi/ml) (µCi/ml) (µCi/ml)

where:

F_1^{ENG} = Total fraction of MPC in liquids, excluding noble gases, at the point of discharge from the multiport difuser.

C_{pi} = Concentration at point of discharge from the multiport diffuser of radionuclide "i", except for dissolved and entrained noble gases, from all tanks and other significant sources, p, from which a discharge may be made (including the waste test tanks and any other significant source from which a discharge can be made). C_{pi} is determined by dividing the product of the measured radionuclide concentration in liquid waste test tanks, PCCW, steam generator blowdown, or other effluent streams times their discharge flow rate by the total available dilution water flow rate of circulating and service water at the time of release (μCi/ml).

MPC_i = Maximum permissible concentration of radionuclide "i" except for dissolved and entrained noble gases from 10CFR20, Appendix B, Table II, Column 2 (μCi/ml). See Appendix B for a list of MPC values.

C_l^{NG} = Total concentration at point of discharge of all dissolved and entrained noble gases in liquids from all station sources (μCi/ml)

C_{li}^{NG} = Concentration at point of discharge of dissolved and entrained noble gas "i" in liquids from all station sources (μCi/ml)

2.2 Method to Determine Radionuclide Concentration for Each Liquid Effluent Source

2.2.1 Waste Test Tanks

C_{pi} is determined for each radionuclide detected from the activity in a representative grab sample of any of the waste test tanks and the predicted flow at the point of discharge.

The batch releases are normally made from two 25,000-gallon capacity waste test tanks. These tanks normally hold liquid waste which may have been processed through the installed vendor equipment. The waste test tanks can also contain other waste such as liquid taken directly from the floor drain/chemical drain treatment tanks when that liquid does not require processing in the evaporator, from the installed vendor resin skid, distillate from the boron recovery evaporator when the BRS evaporator is substituting for the waste evaporator, or waste distillate from the Steam Generator Blowdown System when that system must discharge liquid off site.

If testing indicates that purification of the waste test tank contents is required prior to release, the liquid can be circulated through the waste demineralizer and filter.

The contents of the waste test tank may be reused in the Nuclear System if the sample test meets the purity requirements.

Prior to discharge, each waste test tank is analyzed for principal gamma emitters in accordance with the liquid sample and analysis program outlined in Part A to the ODCM.

2.2.2 Turbine Building Sump

The Turbine Building sump collects leakage from the Turbine Building floor drains and discharges the liquid unprocessed to the circulating water system.

Sampling of this potential source is normally done once per week for determining the radioactivity released to the environment (see Table A.6.1-1).

2.2.3 Steam Generator Blowdown Flash Tank

The primary method to process radioactive secondary liquid from the steam generators is to direct steam blowdown flash tank bottoms cooler discharge to the floor drain tanks. If no secondary pressure is available, the steam blowdown and wet lay-ups pumps can be used. From the floor drain tanks, processing through the installed vendor resin skid (WL-SKD-135) to the waste test tanks is the preferred method. Other methods may be used as defined below.

The steam generator blowdown evaporators may process the liquid from the steam generator blowdown flash tank when there is primary to secondary leakage. Distillate from the evaporators can be sent to the waste test tanks or recycled to the condensate system. When there is no primary to secondary leakage, flash tank liquid is processed through the steam generator blowdown demineralizers and returned to the secondary side.

Steam generator blowdown is only subject to sampling and analysis when all or part of the blowdown liquid is being discharged to the environment instead of the normal recycling process (see Table A.6.1-1).

2.2.4 Primary Component Cooling Water (PCCW) System

The PCCW System is used to cool selected primary components.

The system is normally sampled weekly to determine if there is any radwaste in-leakage. If leakage has been determined, the Service Water System is sampled to determine if any release to the environment has occurred.

3.0 OFF-SITE DOSE CALCULATION METHODS

Chapter 3 provides the basis for station procedures required to meet the Radiological Effluent Control Program (RECP) dose and dose rate requirements contained in ODCM Part A Controls. A simple, conservative method (called Method I) is listed in Tables B.1-2 to B.1-7 for each of the requirements of the RECP. Each of the Method I equations is presented in Part B, Sections 3.2 through 3.9. As an alternate to Method I, the EMS computer program documented in Appendix C can be used to determine regulatory compliance for effluent doses and dose rates. The use of the EMS software is designated as Method IA in Chapter 3. In addition, those sections include more sophisticated methods (called Method II) for use when more refined results are needed. This chapter provides the methods, data, and reference material with which the operator can calculate the needed doses, dose rates and setpoints. For the requirements to demonstrate compliance with Part A off-site dose limits, the contribution from all measured ground level releases must be added to the calculated contribution from the vent stack to determine the Station's total radiological impact. The bases for the dose and dose rate equations are given in Chapter 7.0. Method IA bases and software verification documentation are contained in Appendix C.

The Annual Radioactive Effluent Release Report, to be filed after January 1 each year per Technical Specification 6.8.1.4, and Part A, Section 10.2, requires that meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents, as determined by sampling frequency and measurement, be used for determining the gaseous pathway doses. For continuous release sources (i.e., plant vent, condenser air removal exhaust, and gland steam packing exhauster), concurrent quarterly average meteorology will be used in the dose calculations along with the quarterly total radioactivity released. For batch releases or identifiable operational activities (i.e., containment purge or venting to atmosphere of the Waste Gas System), concurrent meteorology during the period of release will be used to determine dose if the total noble gas or iodine and particulates released in the batch exceeds five percent of the total quarterly radioactivity released from the unit; otherwise quarterly average meteorology will be applied. Quarterly average meteorology will also be applied to batch releases if the hourly met data for the period of batch release is unavailable.

Annual dose assessment reports prepared in accordance with the requirements of the ODCM will include a statement indicating that the appropriate portions of Regulatory Guide 1.109 (as identified in the individual subsections of the ODCM for each class of effluent exposure) have been used to determine dose impact from station releases. Any deviation from the methodology, assumptions, or parameters given in Regulatory Guide 1.109, and not already identified in the bases of the ODCM, will be explicitly described in the effluent report, along with the bases for the deviation.

3.1 Introductory Concepts

In Part A Controls, the RECP limits for dose or dose rate are stated. The term "dose" for ingested or inhaled radioactivity means the dose commitment, measured in mrem, which results from the exposure to radioactive materials that, because of uptake and deposition in the body, will continue to expose the body to radiation for some period of time after the source of radioactivity is stopped. The time frame over which the dose commitment is evaluated is 50 years. The phrases "annual dose" or "dose in one year" then refers to the 50-year dose commitment resulting from exposure to one year's worth of releases. "Dose in a quarter" similarly means the 50-year dose commitment resulting from exposure to one quarter's releases. The term "dose," with respect to external exposures, such as to noble gas clouds, refers only to the doses received during the actual time period of exposure to the radioactivity released from the plant. Once the source of the radioactivity is removed, there is no longer any additional accumulation to the dose commitment.

"Dose rate" is the total dose or dose commitment divided by exposure period. For example, an individual who is exposed via the ingestion of milk for one year to radioactivity from plant gaseous effluents and receives a 50-year dose commitment of 10 mrem is said to have been exposed to a dose rate of 10 mrem/year, even though the actual dose received in the year of exposure may be less than 10 mrem.

In addition to limits on dose commitment, gaseous effluents from the station are also controlled so that the maximum or peak dose rates at the site boundary at any time are limited to the equivalent annual dose limits of 10CFR, Part 20 to unrestricted areas (if it were assumed that the peak dose rates continued for one year). These dose rate limits provide reasonable assurance that members of the public, either inside or outside the site boundary, will not be exposed to annual averaged concentrations exceeding the limits specified in Appendix B, Table II of 10CFR, Part 20 (10CFR20.106(a)). See Appendix B for a listing of these concentration limits.

The quantities ΔD and $\dot{D}$ are introduced to provide calculable quantities, related to off-site doses or dose rates that demonstrate compliance with the RETS.

Delta D, denoted ΔD, is the quantity calculated by the Part B, Chapter 3, Method I dose equations. It represents the conservative increment in dose. The ΔD calculated by Method I equations is not necessarily the actual dose received by a real individual, but usually provides an upper bound for a given release because of the conservative margin built into the dose factors and the selection and definition of critical receptors. The radionuclide specific dose factors in each Method I dose equation represent the greatest dose to any organ of any age group. (Organ dose is a function of age because organ mass and intake are functions of age.) The critical receptor assumed by "Method I" equations is then generally a hypothetical individual whose behavior - in terms of location and intake - results in a dose which is higher than any real individual is likely to receive. Method IA dose calculations using the EMS software evaluate each age group and organ combination to determine the maximum organ dose for each mix of radionuclides specified in a release period. Method II also allows for a more exact dose calculation for each individual if necessary.

D dot, denoted $\dot{D}$, is the quantity calculated in the Part B, Chapter 3 dose rate equations. It is calculated using the station's effluent monitoring system reading and an annual or long-term average atmospheric dispersion factor. $\dot{D}$ predicts the maximum off-site annual dose if the peak observed radioactivity release rate from the plant stack continued for one entire year. Since peak release rates, or resulting dose rates, are usually of short time duration on the order of an hour or less, this approach then provides assurance that 10CFR20.106 limits will be met.

Each of the methods to calculate dose or dose rate is presented in the following subsections. Each dose type has two levels of complexity. Method I is the simplest and contains many conservative factors. As an alternate to Method I the EMS computer program documented in Appendix C can be used to determine regulatory compliance for effluent doses and dose rates. The use of the EMS system is designated as Method IA in Chapter 3 of Part B.

Method II is a more realistic analysis which makes use of the models in Regulatory Guide 1.109 (Revision 1), as noted in each subsection of Part B, Chapter 3 for the various exposure types. A detailed description of the methodology, assumptions, and input parameters to the dose models that are applied in each Method II calculation, if not already explicitly described in the ODCM, shall be documented and provided when this option is used for NRC reporting and ODCM, Part A RECP dose compliance.

3.2 Method to Calculate the Total Body Dose from Liquid Releases

Part A Control C.6.2.1 limits the total body dose commitment to a member of the public from radioactive material in liquid effluents to 1.5 mrem per quarter and 3 mrem per year per unit. Part A Control C.6.3.1 requires liquid radwaste treatment when the total body dose estimate exceeds 0.06 mrem in any 31-day period. Part A Control C.8.1.1 limits the total body dose commitment to any real member of the public from all station sources (including liquids) to 25 mrem in a year.

Use Method I or Method IA first to calculate the maximum total body dose from a liquid release from the station as it is simpler to execute and more conservative than Method II.

Use Method II if a more refined calculation of total body dose is needed, i.e., Method I or Method IA indicates the dose might be greater than Part A Control limits.

To evaluate the total body dose, use Equation 3-1 to estimate the dose from the planned release and add this to the total body dose accumulated from prior releases during the month. See Part B, Section 7.1.1 for basis.

3.2.1 Method I

The total body dose from a liquid release is:

$$D_{tb} = k \sum_i Q_i \, DFL_{itb} \qquad (3\text{-}1)$$

$$(\text{mrem}) = (\ ) \ (\mu Ci) \left(\frac{\text{mrem}}{\mu \text{Ci}}\right)$$

where

DFL_{itb} = Site-specific total body dose factor (mrem/μCi) for a liquid release. It is the highest of the four age groups. See Table B.1-11.

Q_i = Total activity (μCi) released for radionuclide "i". (For strontiums, use the most recent measurement available.)

k = $918/F_d$; where F_d is the average (typically monthly average) dilution flow of the Circulating Water System at the point of discharge from the multiport diffuser (in ft^3/sec). For normal operations with a cooling water flow of 918 ft^3/sec, k is equal to 1. During periods when no or low flow is recorded from the Discharge Transition Structure (DTS), a minimum dilution flow of 23 ft^3/sec (10,500 gpm for one service water pump) can be used since this would be the minimum flow available when discharges to the tunnel are reestablished. Alternately, the monthly average discharge flow for the period in which the release occurs can be used when this value is available.

3.2 Method to Calculate the Total Body Dose from Liquid Releases

3.2.1 Method I (Continued)

Equation 3-1 can be applied under the following conditions (otherwise, justify Method I or consider Method II):

1. Liquid releases via the multiport diffuser to unrestricted areas (at the edge of the initial mixing or prompt dilution zone that corresponds to a factor of 10 dilution), and

2. Any continuous or batch release over any time period up to 1 year. For annual dose estimates, the annual average discharge flow from the DTS should be used as the dilution flow estimate.

Method IA is implemented by the EMS software as described in Appendix C. Liquid release models are detailed in sections 2.1 - 2.6 of the EMS Technical Reference Manual (Attachment 4 of Appendix C).

3.2.2 Method II

Method II consists of the models, input data and assumptions (bioaccumulation factors, shore-width factor, dose conversion factors, and transport and buildup times) in Regulatory Guide 1.109, Rev. 1 (Reference A), except where site-specific data or assumptions have been identified in the ODCM. The general equations (A-3 and A-7) taken from Regulatory Guide 1.109, and used in the derivation of the simplified Method I approach as described in the Bases section, are also applied to Method II assessments, except that doses calculated to the whole body from radioactive effluents are evaluated for each of the four age groups to determine the maximum whole body dose of an age-dependent individual via all existing exposure pathways. Table B.7-1 lists the usage factors of Method II calculations. As noted in Section B.7.1, the mixing ratio associated with the edge of the 1°F surface isotherm above the multiport diffuser may be used in Method II calculations for the shoreline exposure pathway (Mp = 0.025). Aquatic food ingestion pathways shall limit credit taken for mixing zone dilution to the same value assumed in Method I ($M_p = 0.10$).

3.3 Method to Calculate Maximum Organ Dose from Liquid Releases

Part A Control C.6.2.1 limits the maximum organ dose commitment to a Member of the Public from radioactive material in liquid effluents to 5 mrem per quarter and 10 mrem per year per unit. Part A Control C.6.3.1 requires liquid radwaste treatment when the maximum organ dose projected exceeds 0.2 mrem in any 31 days (see Part B, Subsection 3.11 for dose projections). Part A Control C.8.1.1 limits the maximum organ dose commitment to any real member of the public from all station sources (including liquids) to 25 mrem in a year except for the thyroid, which is limited to 75 mrem in a year.

Use Method I or Method IA first to calculate the maximum organ dose from a liquid release to unrestricted areas (see Figure B.6-1) as it is simpler to execute and more conservative than Method II.

Use Method II if a more refined calculation of organ dose is needed, i.e., Method I or Method IA indicates the dose may be greater than the limit.

Use Equation 3-2 to estimate the maximum organ dose from individual or combined liquid releases. See Part B, Section 7.1.2 for basis.

3.3.1 Method I

The maximum organ dose from a liquid release is:

$$D_{mo} = k \sum_i Q_i \; DFL_{imo} \qquad (3\text{-}2)$$

$$(\text{mrem}) = (\;)\;(\mu\text{Ci})\left(\frac{\text{mrem}}{\mu\text{Ci}}\right)$$

where

DFL_{imo} = Site-specific maximum organ dose factor (mrem/μCi) for a liquid release. It is the highest of the four age groups. See Table B.1-11.

Q_i = Total activity (μCi) released for radionuclide "i". (For composited analyses of strontiums, use the most recent measurement available.)

k = $918/F_d$; where F_d is the average (typically monthly average) dilution flow of the Circulating Water System at the point of discharge from the multiport diffuser (in ft^3/sec). For normal operations with a cooling water flow of 918 ft^3/sec, k is equal to 1. During periods when no or low flow is recorded from the Discharge Transition Structure (DTS), a minimum dilution flow of 23 ft^3/sec (10,500 gpm for one service water pump) can be used since this would be the minimum flow available when discharges to the tunnel are reestablished. Alternately, the monthly average discharge flow for the period in which the release occurs can be used when this value is available.

3.3 Method to Calculate Maximum Organ Dose from Liquid Releases

3.3.1 Method I (Continued)

Equation 3-2 can be applied under the following conditions (otherwise, justify Method I or consider Method II):

1. Liquid releases via the multiport diffuser to unrestricted areas (at the edge of the initial mixing or prompt dilution zone that corresponds to a factor of 10 dilution), and

2. Any continuous or batch release over any time period up to 1 year. For annual dose estimates, the annual average discharge flow from the DTS should be used as the dilution flow estimate.

Method IA is implemented by the EMS software as described in Appendix C. Liquid release models are detailed in sections 2.1 - 2.6 of the EMS Technical Reference Manual (Attachment 4 of Appendix C).

3.3.2 Method II

Method II consists of the models, input data and assumptions (bioaccumulation factors, shore-width factor, dose conversion factors, and transport and buildup times) in Regulatory Guide 1.109, Rev. 1 (Reference A), except where site-specific data or assumptions have been identified in the ODCM. The general equations (A-3 and A-7) taken from Regulatory Guide 1.109, and used in the derivation of the simplified Method I approach as described in the Bases section, are also applied to Method II assessments, except that doses calculated to critical organs from radioactive effluents are evaluated for each of the four age groups to determine the maximum critical organ of an age-dependent individual via all existing exposure pathways. Table B.7-1 lists the usage factors for Method II calculations. As noted in Section B.7.1, the mixing ratio associated with the edge of the 1°F surface isotherm above the multiport diffuser may be used in Method II calculations for the shoreline exposure pathway (Mp =0.025). Aquatic food ingestion pathways shall limit credit taken for mixing zone dilution to the same value assumed in Method I ($M_p = 0.10$).

3.4 Method to Calculate the Total Body Dose Rate from Noble Gases

Part A Control C.7.1.1 limits the dose rate at any time to the total body from noble gases at any location at or beyond the site boundary to 500 mrem/year. The Part A Control indirectly limits peak release rates by limiting the dose rate that is predicted from continued release at the peak rate. By limiting $\dot{D}_{tb}$ to a rate equivalent to no more than 500 mrem/year, we assure that the total body dose accrued in any one year by any member of the general public is less than 500 mrem.

Use Method I or Method IA first to calculate the Total Body Dose Rate from the peak release rate via the station vents or ground level effluent release points. Method I applies at all release rates.

Use Method II if a more refined calculation of $\dot{D}_{tb}$ is desired by the station (i.e., use of actual release point parameters with annual or actual meteorology to obtain release-specific X/Qs) or if Method I or Method IA predicts a dose rate greater than the Part A Control limit to determine if it had actually been exceeded during a short time interval. See Part B, Section 7.2.1 for basis.

Compliance with the dose rate limits for noble gases are continuously demonstrated when effluent release rates are below the plant vent noble gas activity monitor alarm setpoint by virtue of the fact that the alarm setpoint is based on a value which corresponds to the off-site dose rate limit, or a value below it. Determinations of dose rate for compliance with Part A Control are performed when the effluent monitor alarm setpoint is exceeded, or as required by the Action Statement (Part A Control C.5.2, Table A.5.2-1) when the monitor is inoperable.

3.4.1 Method I

The Total Body Dose Rate to an off-site receptor due to noble gases in effluents released via the plant vent can be determined as follows:

$$\dot{D}_{tb(e)} = 0.85 * \sum_i \left(\dot{Q}_i \cdot DFB_i\right) \qquad (3\text{-}3a)$$

$$\frac{mrem}{yr} = \left(\frac{pCi\text{-}sec}{\mu Ci - m^3}\right) \sum \left(\frac{\mu Ci}{sec}\right) \left(\frac{mrem\text{-}m^3}{pCi\text{-}yr}\right)$$

where

$\dot{D}_{tb(e)}$ = The off-site total body dose rate (mrem/yr) due to noble gases in elevated effluent releases,

$\dot{Q}_i$ = the release rate at the station vents (µCi/sec), for each noble gas radionuclide, "i", shown in Table B.1-10, and

DFB_i = total body gamma dose factor (see Table B.1-10).

The Total Body Dose Rate (to an off-site receptor) due to noble gas in ground level effluent releases can be determined as follows:

3.4 Method to Calculate the Total Body Dose Rate from Noble Gases

3.4.1 Method I (Continued)

$$\dot{D}_{tb(g)} = 3.4 \quad * \sum_i (\dot{Q}_i * DFB_i) \qquad (3\text{-}3b)$$

$$\frac{mrem}{yr} = \left(\frac{pCi\text{-}sec}{\mu Ci - m^3}\right) \sum \left(\frac{\mu Ci}{sec}\right) \left(\frac{mrem\text{-}m^3}{pCi\text{-}yr}\right)$$

where

$\dot{D}_{tb(g)}$ = The total off-site body dose rate (mrem/yr) due to noble gases in ground level equivalent effluent releases, and

$\dot{Q}_i$ and DFB_i are as defined for Equation 3-3a.

For the special on-site receptor locations, the Science & Nature Center and the "Rocks," the total body dose rates due to noble gases in effluent discharges can be determined as follows:

For the Science & Nature Center, elevated effluent release:

$$\dot{D}_{tbE(e)} = 0.0015 * \sum_i (\dot{Q}_i * DFB_i) \qquad (3\text{-}3c)$$

For the Science & Nature Center, ground level effluent release:

$$\dot{D}_{tbE(g)} = 0.0074 * \sum_i (\dot{Q}_i * DFB_i) \qquad (3\text{-}3d)$$

For the "Rocks," elevated effluent release:

$$\dot{D}_{tbR(e)} = 0.038 * \sum_i (\dot{Q}_i * DFB_i) \qquad (3\text{-}3e)$$

For the "Rocks," ground level effluent release:

$$\dot{D}_{tbR(g)} = 0.2 * \sum_i (\dot{Q}_i * DFB_i) \qquad (3\text{-}3f)$$

where

$\dot{D}_{tbE(e)}$, $\dot{D}_{tbE(g)}$, $\dot{D}_{tbR(e)}$, and $\dot{D}_{tbR(g)}$ = The total body dose rate (mrem/yr) at the Science & Nature Center and the "Rocks," respectively, due to noble gases in gaseous discharges from elevated (e) and ground level (g) release points, and

$\dot{Q}_i$ and DFB_i are as defined previously.

Equations 3-3a through 3-3f can be applied under the following conditions (otherwise, justify Method I or consider Method II):

1. Normal operations (nonemergency event), and

2. Noble gas releases via any station vent to the atmosphere.

Method IA is implemented by the EMS software as described in Appendix C. Gaseous release models are detailed in Section 6.7.3 of the EMS Software Requirements Specification (Attachment 3 of Appendix C).

3.4.2 Method II

Method II consists of the model and input data (whole body dose factors) in Regulatory Guide 1.109, Rev. 1 (Reference A), except where site-specific data or assumptions have been identified in the ODCM. The general equation (B-8) taken from Regulatory Guide 1.109, and used in the derivation of the simplified Method I approach as described in the Bases section, is also applied to a Method II assessment. No credit for a shielding factor (S_F) associated with residential structures is assumed. Concurrent meteorology with the release period may be utilized for the gamma atmospheric dispersion factor identified in ODCM Equation 7-3 (Part B, Section 7.2.1), and determined as indicated in Part B, Section 7.3.2 for the release point (either ground level or vent stack) from which recorded effluents have been discharged.

3.5 METHOD TO CALCULATE THE SKIN DOSE RATE FROM NOBLE GASES

Part A Control C.7.1.1 limits the dose rate at any time to the skin from noble gases at any location at or beyond the site boundary to 3,000 mrem/year. The Part A Control indirectly limits peak release rates by limiting the dose rate that is predicted from continued release at the peak rate. By limiting $\dot{D}_{skin}$ to a rate equivalent to no more than 3,000 mrem/year, we assure that the skin dose accrued in any one year by any member of the general public is less than 3,000 mrem. Since it can be expected that the peak release rate on which $\dot{D}_{skin}$ is derived would not be exceeded without corrective action being taken to lower it, the resultant average release rate over the year is expected to be considerably less than the peak release rate.

Use Method I or Method IA first to calculate the Skin Dose Rate from peak release rate via station vents. Method I applies at all release rates.

Use Method II if a more refined calculation of $\dot{D}_{skin}$ is desired by the station (i.e., use of actual release point parameters with annual or actual meteorology to obtain release-specific X/Qs) or if Method I or Method IA predicts a dose rate greater than the Part A Control limit to determine if it had actually been exceeded during a short time interval. See Part B, Section 7.2.2 for basis.

Compliance with the dose rate limits for noble gases are continuously demonstrated when effluent release rates are below the plant vent noble gas activity monitor alarm setpoint by virtue of the fact that the alarm setpoint is based on a value which corresponds to the off-site dose rate limit, or a value below it. Determinations of dose rate for compliance with Part A Controls are performed when the effluent monitor alarm setpoint is exceeded.

3.5.1 Method I

For an off-site receptor and elevated effluent release, the Skin Dose Rate due to noble gases is:

$$\dot{D}_{skin(e)} = \sum_i (\dot{Q}_i * DF'_{i(e)}) \qquad (3\text{-}4a)$$

$$\frac{mrem}{yr} = \sum \left(\frac{\mu Ci}{sec}\right) \left(\frac{mrem - sec}{\mu Ci - yr}\right)$$

where

$\dot{D}_{skin(e)}$ = the off-site skin dose rate (mrem/yr) due to noble gases in an effluent discharge from an elevated release point,

$\dot{Q}_i$ = as defined previously, and

$DF'_{i(e)}$ = the combined skin dose factor for elevated discharges (see Table B.1-10).

For an off-site receptor and ground level release, the skin dose rate due to noble gases is:

$$\dot{D}_{skin(g)} = \sum_i (\dot{Q}_i * DF'_{i(g)}) \tag{3-4b}$$

where

$\dot{D}_{skin(g)}$ = The off-site skin dose rate (mrem/yr) due to noble gases in an effluent discharge from a ground level release point,

$\dot{Q}_i$ = as defined previously, and

$DF'_{i(g)}$ = The combined skin dose factor for ground level discharges (see Table B.1-10).

For an on-site receptor at the Science & Nature Center and elevated release conditions, the skin dose rate due to noble gases is:

$$\dot{D}_{skinE(e)} = 0.0014 * \sum_i (\dot{Q}i * DF'_{iE(e)}) \tag{3-4c}$$

where

$\dot{D}_{skinE(e)}$ = The skin dose rate (mrem/yr) at the Science & Nature Center due to noble gases in an elevated release,

$\dot{Q}_i$ = as defined previously, and

$DF'_{iE(e)}$ = the combined skin dose factor for elevated discharges (see Table B.1-13).

For an on-site receptor at the Science & Nature Center and ground level release conditions, the skin dose rate due to noble gases is:

$$\dot{D}_{skinE(g)} = 0.0014 * \sum_i (\dot{Q}i * DF'_{iE(g)}) \tag{3-4d}$$

where

$\dot{D}_{skinE(g)}$ = the skin dose rate (mrem/yr) at the Science & Nature Center due to noble gases in a ground level release,

$\dot{Q}_i$ = as defined previously, and

$DF'_{iE(g)}$ = The combined skin dose factor for ground level discharges (see Table B.1-13).

For an on-site receptor at the "Rocks" and elevated release conditions, the skin dose rate due to noble gases is:

$$\dot{D}_{skinR(e)} = 0.0076 * \sum_i (\dot{Q}i * DF'_{iR(e)}) \tag{3-4e}$$

where

$\dot{D}_{skinR(e)}$ = the skin dose rate at the "Rocks" due to noble gases in an elevated release,

$\dot{Q}_i$ = as defined previously, and

$DF'_{iR(e)}$ = The combined skin dose factor for elevated discharges (see Table B.1-13).

For an on-site receptor at the "Rocks" and ground level release conditions, the skin dose rate due to noble gases is:

$$\dot{D}_{skinR(g)} = 0.0076 * \sum_i (\dot{Q}_i * DF'_{iR(g)}) \tag{3-4f}$$

where

$\dot{D}_{skinR(g)}$ = the skin dose rate (mrem/yr) at the "Rocks" due to noble gases in a ground level release,

$\dot{Q}_i$ = as defined previously, and

$DF'_{iR(g)}$ = the combined skin dose factor for ground level discharges (see Table B.1-13).

Equations 3-4a through 3-4f can be applied under the following conditions (otherwise, justify Method I or consider Method II).

1. Normal operations (nonemergency event), and

2. Noble gas releases via any station vent to the atmosphere.

Method IA is implemented by the EMS software as described in Appendix C. Gaseous release models are detailed in Section 6.7.3 of the EMS Software Requirements Specification (Attachment 3 of Appendix C).

3.5.2 Method II

Method II consists of the model and input data (skin dose factors) in Regulatory Guide 1.109, Rev. 1 (Reference A), except where site-specific data or assumptions have been identified in the ODCM. The general equation (B-9) taken from Regulatory Guide 1.109, and used in the derivation of the simplified Method I approach as described in the Bases section, is also applied to a Method II assessment, no credit for a shielding factor (S_F) associated with residential structures is assumed. Concurrent meteorology with the release period may be utilized for the gamma atmospheric dispersion factor and undepleted atmospheric dispersion factor identified in ODCM Equation 7-8 (Part B, Section 7.2.2), and determined as indicted in Part B, Sections 7.3.2 and 7.3.3 for the release point (either ground level or vent stack) from which recorded effluents have been discharged.

3.6 Method to Calculate the Critical Organ Dose Rate from Iodines, Tritium and Particulates with $T_{1/2}$ Greater Than 8 Days

Part A Control C.7.1.1 limits the dose rate at any time to any organ from ^{131}I, ^{133}I, ^{3}H and radionuclides in particulate form with half lives greater than 8 days to 1500 mrem/year to any organ. The Part A Control indirectly limits peak release rates by limiting the dose rate that is predicted from continued release at the peak rate. By limiting $\dot{D}_{co}$ to a rate equivalent to no more than 1500 mrem/year, we assure that the critical organ dose accrued in any one year by any member of the general public is less than 1500 mrem.

Use Method I or Method IA first to calculate the Critical Organ Dose Rate from the peak release rate via the station vents. Method I applies at all release rates.

Use Method II if a more refined calculation of $\dot{D}_{co}$ is desired by the station (i.e., use of actual release point parameters with annual or actual meteorology to obtain release-specific X/Qs) or if Method I or Method IA predicts a dose rate greater than the Part A Control limit to determine if it had actually been exceeded during a short time interval. See Section Part B, 7.2.3 for basis.

3.6.1 Method I

The Critical Organ Dose Rate to an off-site receptor and elevated release conditions can be determined as follows:

$$\dot{D}_{co(e)} = \sum_i (\dot{Q} * DFG'_{ico(e)}) \qquad (3\text{-}5a)$$

$$\left(\frac{mrem}{yr}\right) = \sum \left(\frac{\mu Ci}{sec}\right) * \left(\frac{mrem - sec}{\mu Ci - yr}\right)$$

where

$\dot{D}_{co(e)}$ = The off-site critical organ dose rate (mrem/yr) due to iodine, tritium, and particulates in an elevated release,

$\dot{Q}_i$ = the activity release rate at the station vents of radionuclide "i" in µCi/sec (i.e., total activity measured of radionuclide "i" averaged over the time period for which the filter/charcoal sample collector was in the effluent stream. For i = Sr89 or Sr90, use the best estimates, such as most recent measurements), and

$DFG'_{ico(e)}$ = the site-specific critical organ dose rate factor $\left(\frac{mrem - sec}{\mu Ci - yr}\right)$ for an elevated gaseous release (See Table B.1-12).

For an off-site receptor and ground level release, the critical organ dose rate can be determined as follows:

$$\dot{D}_{co(g)} = \sum_i (\dot{Q}_i \, DFG'_{ico(g)}) \tag{3-5b}$$

where

$\dot{D}_{co(g)}$ = the off-site critical organ dose rate (mrem/yr) due to iodine, tritium, and particulates in a ground level release,

$\dot{Q}_i$ = as defined previously, and

$DFG'_{ico(g)}$ = the site-specific critical organ dose rate factor for a ground level gaseous discharge (see Table B.1-12).

For an on-site receptor at the Science & Nature Center and elevated release conditions, the critical organ dose rate can be determined as follows:

$$\dot{D}_{coE(e)} = 0.0014 * \sum_i (\dot{Q}_i \, DFG'_{icoE(e)}) \tag{3-5c}$$

where

$\dot{D}_{coE(e)}$ = The critical organ dose rate (mrem/yr) to a receptor at the Science & Nature Center due to iodine, tritium, and particulates in an elevated release,

$\dot{Q}_i$ = as defined previously, and

$DFG'_{icoE(e)}$ = the Science & Nature Center-specific critical organ dose rate factor for an elevated discharge (see Table B.1-14).

For an on-site receptor at the Science & Nature Center and ground level release conditions, the critical organ dose rate is:

$$\dot{D}_{coE(g)} = 0.0014 * \sum_i (\dot{Q}_i * DFG'_{icoE(g)}) \quad (3\text{-}5d)$$

where

$\dot{D}_{coE(g)}$ = the critical organ dose rate (mrem/yr) to a receptor at the Science & Nature Center due to iodine, tritium, and particulates in a ground level release,

$\dot{Q}_i$ = as defined previously, and

$DFG'_{icoE(g)}$ = the Science & Nature Center-specific critical organ dose rate factor for a ground level discharge (see Table B.1-14).

For an on-site receptor at the "Rocks" and elevated release conditions, the critical organ dose rate is:

$$\dot{D}_{coR(e)} = 0.0076 * \sum_i (\dot{Q}_i * DFG'_{icoR(e)}) \quad (3\text{-}5e)$$

where

$\dot{D}_{coR(e)}$ = The critical organ dose rate (mrem/yr) to a receptor at the "Rocks" due to iodine, tritium, and particulates in an elevated release,

$\dot{Q}_i$ = as defined previously, and

$DFG'_{icoR(e)}$ = the "Rocks"-specific critical organ dose rate factor for an elevated discharge (see Table B.1-15).

For an on-site receptor at the "Rocks" and ground level release conditions, the critical organ dose rate is:

$$\dot{D}_{coR(g)} = 0.0076 * \sum_i (\dot{Q}_i * DFG'_{icoR(g)}) \quad (3\text{-}5f)$$

where

$\dot{D}_{coR}$ and $\dot{Q}_i$ = are as defined previously, and

$DFG'_{icoR(g)}$ = the "Rocks"-specific critical organ dose rate factor for a ground level discharge (see Table B.1-15).

Equations 3-5a through 3-5f can be applied under the following conditions (otherwise, justify Method I or consider Method II):

1. Normal operations (not emergency event), and

2. Tritium, I-131 and particulate releases via monitored station vents to the atmosphere.

Method IA is implemented by the EMS software as described in Appendix C. Gaseous release models are detailed in Section 6.7.3 of the EMS Software Requirements Specification (Attachment 3 of Appendix C).

3.6.2 Method II

Method II consists of the models, input data and assumptions in Appendix C of Regulatory Guide 1.109, Rev. 1 (Reference A), except where site-specific data or assumptions have been identified in the ODCM (see Tables B.7-2 and B.7-3). The critical organ dose rate will be determined based on the location (site boundary, nearest resident, or farm) of receptor pathways as identified in the most recent annual land use census, or by conservatively assuming the existence of all pathways (ground plane, inhalation, ingestion of stored and leafy vegetables, milk, and meat) at an off-site location of maximum potential dose. Concurrent meteorology with the release period may be utilized for determination of atmospheric dispersion factors in accordance with Part B, Sections 7.3.2 and 7.3.3 for the release point (either ground level or vent stack) from which recorded effluents have been discharged. The maximum critical organ dose rates will consider the four age groups independently, and take no credit for a shielding factor (S_F) associated with residential structures.

3.7 Method to Calculate the Gamma Air Dose from Noble Gases

Part A Control C.7.2.1 limits the gamma dose to air from noble gases at any location at or beyond the site boundary to 5 mrad in any quarter and 10 mrad in any year per unit. Dose evaluation is required at least once per 31 days.

Use Method I or Method IA first to calculate the gamma air dose from the station gaseous effluent releases during the period.

Use Method II if a more refined calculation is needed (i.e., use of actual release point parameter with annual or actual meteorology to obtain release-specific X/Qs), or if Method I or Method IA predicts a dose greater than the Part A Control limit to determine if it had actually been exceeded. See Part B, Section 7.2.4 for basis.

3.7.1 Method I

The general form of the gamma air dose equation is:

$$D^{\gamma}_{air} = 3.17E-02 * \left[X/Q\right]^{\gamma}_{1hr} * t^{-a} * \sum_i \left(Q_i * DF^{\gamma}_i\right) \qquad (3\text{-}6)$$

$$(\text{mrad}) = \left(\frac{\text{pCi-yr}}{\mu\text{Ci-sec}}\right) * \left(\frac{\text{sec}}{\text{m}^3}\right) * (\ ) * \Sigma(\mu\text{Ci}) \left(\frac{\text{mrad-m}^3}{\text{pCi-yr}}\right)$$

where

D^{γ}_{air} is the gamma air dose.

3.17E-02 is the number of pCi per µCi divided by the number of second per year,

$[X/Q]^{\gamma}_{1hr}$ is the 1-hour gamma atmospheric dispersion factor,

t^{-a} is a unitless factor which adjusts the 1-hour $[X/Q]^{\gamma}$ value for a release with a total duration of t hours,

Q_i is the total activity in µCi of each radionuclide "i" released to the atmosphere from the station gaseous effluent release point during the period of interest, and

DF^{γ}_i is the gamma dose factor to air for radionuclide "i" (see Table B.1-10).

Incorporating receptor location-specific atmospheric dispersion factors ($[X/Q]^{\gamma}$), adjustment factors (t^{-a}) for elevated and ground-level effluent release conditions, and occupancy factors when applicable (see Section 7.2.7), yields a series of equations by which the gamma air dose can be determined.

a. Maximum off-site receptor location, elevated release conditions:

$$D^{\gamma}_{air(e)} = 3.2E-07 * t^{-0.275} * \sum_{i} (Q_i * DF^{\gamma}_i) \qquad (3\text{-}6a)$$

$$(\text{mrad}) = \left(\frac{\text{pCi - yr}}{\mu\text{Ci - m}^3}\right) * (\ ) * \Sigma(\mu\text{Ci}) \left(\frac{\text{mrad - m}^3}{\text{pCi - yr}}\right)$$

b. Maximum off-site receptor location, ground-level release conditions:

$$D^{\gamma}_{air(g)} = 1.6E-06 * t^{-0.293} * \sum_{i} (Q_i * DF^{\gamma}_i) \qquad (3\text{-}6b)$$

$$(\text{mrad}) = \left(\frac{\text{pCi - yr}}{\mu\text{Ci - m}^3}\right) * (\ ) * \Sigma(\mu\text{Ci}) \left(\frac{\text{mrad - m}^3}{\text{pCi - yr}}\right)$$

c. Science & Nature Center receptor; elevated release conditions:

$$D^{\gamma}_{airE(e)} = 4.9E-10 * t^{-0.252} * \sum_{i} (Q_i * DF^{\gamma}_i) \qquad (3\text{-}6c)$$

$$(\text{mrad}) = \left(\frac{\text{pCi-yr}}{\mu\text{Ci-m}^3}\right) * (\ ) \Sigma \left(\mu\text{Ci} * \frac{\text{mrad-m}^3}{\text{pCi-yr}}\right)$$

d. Science & Nature Center receptor; ground-level release conditions:

$$D^{\gamma}_{airE(g)} = 4.4E-09 * t^{-0.321} * \sum_{i} (Q_i * DF^{\gamma}_i) \qquad (3\text{-}6d)$$

$$(\text{mrad}) = \left(\frac{\text{pCi-yr}}{\mu\text{Ci-m}^3}\right) * (\ ) \Sigma \left(\mu\text{Ci} * \frac{\text{mrad-m}^3}{\text{pCi-yr}}\right)$$

e. Receptor at the "Rocks"; elevated release conditions:

$$D^{\gamma}_{airR(e)} = 5.1E-09 * t^{-0.155} * \sum_{i} (Q_i * DF^{\gamma}_i) \qquad (3\text{-}6e)$$

$$(\text{mrad}) = \left(\frac{\text{pCi-yr}}{\mu\text{Ci-m}^3}\right) * (\ ) \Sigma \left(\mu\text{Ci} * \frac{\text{mrad-m}^3}{\text{pCi-yr}}\right)$$

f. Receptor at the "Rocks"; ground-level release conditions:

$$D^{\gamma}_{airR(g)} = 4.1E\text{-}08 * t^{-0.204} * \sum_i (Q_i * DF^{\gamma}_i) \qquad (3\text{-}6f)$$

$$(\text{mrad}) = (\frac{\text{pCi-yr}}{\mu\text{Ci-m}^3}) * (\ ) \Sigma (\mu\text{Ci} * \frac{\text{mrad-m}^3}{\text{pCi-yr}})$$

Equations 3-6a through 3-6f can be applied under the following conditions (otherwise justify Method I or consider Method II):

1. Normal operations (nonemergency event), and

2. Noble gas releases via station vents to the atmosphere.

Method IA is implemented by the EMS software as described in Appendix C. Gaseous release models are detailed in Section 6.7.3 of the EMS Software Requirements Specification (Attachment 3 of Appendix C).

3.7.2 Method II

Method II consists of the models, input data (dose factors) and assumptions in Regulatory Guide 1.109, Rev. 1 (Reference A), except where site-specific data or assumptions have been identified in the ODCM. The general equations (B-4 and B-5) taken from Regulatory Guide 1.109, and used in the derivation of the simplified Method I approach as described in the Part B Bases Section 7.2.4 are also applied to Method II assessments. Concurrent meteorology with the release period may be utilized for the gamma atmospheric dispersion factor identified in ODCM Equation 7-14, and determined as indicated in Part B, Section 7.3.2 for the release point (either ground level or vent stack) from which recorded effluents have been discharged.

3.8 Method to Calculate the Beta Air Dose from Noble Gases

Part A Control C.7.2.1 limits the beta dose to air from noble gases at any location at or beyond the site boundary to 10 mrad in any quarter and 20 mrad in any year per unit. Dose evaluation is required at least once per 31 days.

Use Method I or Method IA first to calculate the beta air dose from gaseous effluent releases during the period. Method I applies at all dose levels.

Use Method II if a more refined calculation is needed (i.e., use of actual release point parameters with annual or actual meteorology to obtain release-specific X/Qs) or if Method I or Method IA predicts a dose greater than the Part A Control limit to determine if it had actually been exceeded. See Part B, Section 7.2.5 for basis.

3.8.1 Method I

The general form of the beta air dose equation is:

$$D^{\beta}_{air} = 3.17E\text{-}02 * (X/Q)_{1hr} * t^{-a} * \sum(Q_i * DF^{\beta}_i) \quad (3\text{-}7)$$

$$(\text{mrad}) = \left(\frac{\text{pCi-yr}}{\mu\text{Ci-m}^3}\right) * \left(\frac{\text{sec}}{\text{m}^3}\right) * (\quad) * \Sigma\left(\mu\text{Ci} * \frac{\text{mrad-m}^3}{\text{pCi-yr}}\right)$$

where

D^{β}_{air} is the beta air dose,

3.17E-02 is the number of pCi per μCi divided by the number of seconds per year,

$(X/Q)_{1hr}$ is the 1-hour undepleted atmospheric dispersion factor,

t^{-a} is a unitless factor which adjusts the 1-hour X/Q value for a release with a total duration of t hours,

Q_i is the total activity (μCi) of each radionuclide "i" released to the atmosphere during the period of interest, and

DF^{β}_i is the beta dose factor to air for radionuclide "i" (see Table B.1-10).

Incorporating receptor location-specific atmospheric dispersion factor (X/Q), adjustment factors (t^{-a}) for elevated and ground-level effluent release conditions, and occupancy factors when applicable (see Section 7.2.7) yields a series of equations by which the Beta Air Dose can be determined.

a. Maximum off-site receptor location, elevated release conditions:

$$D^{\beta}_{air(e)} = 4.1E\text{-}7 * t^{-0.3} * \sum_i (Q_i * DF_i^{\beta}) \tag{3-7a}$$

$$(\text{mrad}) = (\frac{\text{pCi-yr}}{\mu\text{Ci-m}^3}) * (\ ) \Sigma (\mu\text{Ci} * \frac{\text{mrad-m}^3}{\text{pCi-yr}})$$

b. Maximum off-site receptor location, ground-level release conditions:

$$D^{\beta}_{air(g)} = 6.0E\text{-}06 * t^{-0.319} * \sum_i (Q_i * DF_i^{\beta}) \tag{3-7b}$$

$$(\text{mrad}) = (\frac{\text{pCi-yr}}{\mu\text{Ci-m}^3}) * (\ ) \Sigma (\mu\text{Ci} * \frac{\text{mrad-m}^3}{\text{pCi-yr}})$$

c. Science & Nature Center receptor; elevated release conditions:

$$D^{\beta}_{airE(e)} = 1.8E\text{-}09 * t^{-0.35} * \sum_i (Q_i * DF_i^{\beta}) \tag{3-7c}$$

$$(\text{mrad}) = (\frac{\text{pCi-yr}}{\mu\text{Ci-m}^3}) * (\ ) \Sigma (\mu\text{Ci} * \frac{\text{mrad-m}^3}{\text{pCi-yr}})$$

d. Science & Nature Center receptor; ground-level release conditions:

$$D^{\beta}_{airE(g)} = 2.4E\text{-}08 * t^{-0.347} * \sum_i (Q_i * DF_i^{\beta}) \tag{3-7d}$$

$$(\text{mrad}) = (\frac{\text{pCi-yr}}{\mu\text{Ci-m}^3}) * (\ ) \Sigma (\mu\text{Ci} * \frac{\text{mrad-m}^3}{\text{pCi-yr}})$$

e. Receptor at the "Rocks"; elevated release conditions:

$$D^{\beta}_{airR(e)} = 3.9E\text{-}08 * t^{-0.249} * \sum_i (Q_i * DF_i^{\beta}) \tag{3-7e}$$

$$(\text{mrad}) = (\frac{\text{pCi-yr}}{\mu\text{Ci-m}^3}) * (\ ) \Sigma (\mu\text{Ci} * \frac{\text{mrad-m}^3}{\text{pCi-yr}})$$

f. Receptor at the "Rocks"; ground-level release conditions:

$$D^{\beta}_{airR(g)} = 4.6E\text{-}07 * t^{-0.267} * \sum_i (Q_i * DF_i^{\beta}) \tag{3-7f}$$

$$(\text{mrad}) = (\frac{\text{pCi-yr}}{\mu\text{Ci-m}^3}) * (\ ) \Sigma (\mu\text{Ci} * \frac{\text{mrad-m}^3}{\text{pCi-yr}})$$

Equations 3-7a through 3-7f can be applied under the following conditions (otherwise justify Method I or consider Method II):

1. Normal operations (nonemergency event), and

2. Noble gas releases via station vents to the atmosphere.

Method IA is implemented by the EMS software as described in Appendix C. Gaseous release models are detailed in Section 6.7.3 of the EMS Software Requirements Specification (Attachment 3 of Appendix C).

3.8.2 <u>Method II</u>

Method II consists of the models, input data (dose factors) and assumptions in Regulatory Guide 1.109, Rev. 1 (Reference A), except where site-specific data or assumptions have been identified in the ODCM. The general equations (B-4 and B-5) taken from Regulatory Guide 1.109, and used in the derivation of the simplified Method I approach as described in the Part B Bases Section 7.2.5, are also applied to Method II assessments. Concurrent meteorology with the release period may be utilized for the atmospheric dispersion factor identified in ODCM Equation 7-15, and determined, as indicated in Part B, Sections 7.3.2 and 7.3.3 for the release point (either ground level or vent stack) from which recorded effluents have been discharged.

3.9 Method to Calculate the Critical Organ Dose from Iodines, Tritium and Particulates

Part A Control C.7.3.1 limits the critical organ dose to a member of the public from radioactive iodines, tritium, and particulates with half-lives greater than 8 days in gaseous effluents to 7.5 mrem per quarter and 15 mrem per year per unit. Part A Control C.7.3.1 limits the total body and organ dose to any real member of the public from all station sources (including gaseous effluents) to 25 mrem in a year except for the thyroid, which is limited to 75 mrem in a year.

Use Method I or Method IA first to calculate the critical organ dose from gaseous effluent releases as it is simpler to execute and more conservative than Method II.

Use Method II if a more refined calculation of critical organ dose is needed (i.e., Method I or Method IA indicates the dose is greater than the limit). See Part B, Section 7.2.6 for basis.

3.9.1 Method I

$$D_{co} = (X/Q)_{1hr}^{depl} / (X/Q)_{an}^{depl} * t^{-a} * \sum_i (Q_i * DFG_{ico}) \quad (3\text{-}8)$$

$$(\text{mrem}) = (\frac{\text{sec}}{\text{m}^3}) / (\frac{\text{sec}}{\text{m}^3}) * (\ ) * \Sigma (\mu\text{Ci}) * (\frac{\text{mrem}}{\mu\text{Ci}})$$

where

D_{co} is the critical organ dose from iodines, tritium, and particulates,

$(X/Q)_{1hr}^{depl}$ is the 1-hour depleted atmospheric dispersion factor.

$(X/Q)_{an}^{depl}$ is the annual average depleted atmospheric dispersion.

t^{-a} is a unitless adjustment factor to account for a release with a total duration of t hours,

Q_i is the total activity in µCi of radionuclide "i" released to the atmosphere during the period of interest (for strontiums, use the most recent measurement), and

DFG_{ico} is the site-specific critical organ dose factor for radionuclide "i", see Tables B.1-12, B.1-14, and B.1-15. (For each radionuclide, it is the age group and organ with the largest dose factor.)

Incorporating receptor location-specific atmospheric dispersion factors ($(X/Q)_{1hr}^{depl}$ and $(X/Q)_{an}^{depl}$) and adjustment factors (t^{-a}) for elevated and ground-level release conditions, and incorporating occupancy factors when applicable (see Section 7.2.7), yields a series of equations by which the critical organ dose can be determined.

a. Maximum off-site receptor location, elevated release conditions:

$$D_{co(e)} = 14.8 * t^{-0.297} * \sum_i (Q_i * DFG_{ico(e)}) \qquad (3\text{-}8a)$$

$$(\text{mrem}) = (\ \ ) * (\ \ ) \Sigma (\mu\text{Ci} * \frac{\text{mrem}}{\mu\text{Ci}})$$

b. Maximum off-site receptor location, ground-level release conditions:

$$D_{co(g)} = 17.7 * t^{-0.316} * \sum_i (Q_i * DFG_{ico(g)}) \qquad (3\text{-}8b)$$

$$(\text{mrem}) = (\ \ ) * (\ \ ) \Sigma (\mu\text{Ci} * \frac{\text{mrem}}{\mu\text{Ci}})$$

c. Science & Nature Center receptor; elevated release conditions:

$$D_{coE(e)} = 3.3\text{E-}02 * t^{-0.349} * \sum_i (Q_i * DFG_{icoE(e)}) \qquad (3\text{-}8c)$$

$$(\text{mrem}) = (\ \ ) * (\ \ ) \Sigma (\mu\text{Ci} * \frac{\text{mrem}}{\mu\text{Ci}})$$

d. Science & Nature Center receptor; ground-level release conditions:

$$D_{coE(g)} = 3.3\text{E-}02 * t^{-0.347} * \sum_i (Q_i * DFG_{icoE(g)}) \qquad (3\text{-}8d)$$

$$(\text{mrem}) = (\ \ ) * (\ \ ) \Sigma (\mu\text{Ci} * \frac{\text{mrem}}{\mu\text{Ci}})$$

e. Receptor at the "Rocks"; elevated release conditions:

$$D_{coR(e)} = 7.3\text{E-}02 * t^{-0.248} * \sum_i (Q_i * DFG_{icoR(e)}) \qquad (3\text{-}8e)$$

$$(\text{mrem}) = (\ \ ) * (\ \ ) \Sigma (\mu\text{Ci} * \frac{\text{mrem}}{\mu\text{Ci}})$$

f. Receptor at the "Rocks"; ground-level release conditions:

$$D_{coR(g)} = 8.6\text{E-}02 * t^{-0.267} * \sum_i (Q_i * DFG_{icoR(g)}) \qquad (3\text{-}8f)$$

$$(\text{mrem}) = (\ \ ) * (\ \ ) \Sigma (\mu\text{Ci} * \frac{\text{mrem}}{\mu\text{Ci}})$$

Equations 3-8a through 3-8f can be applied under the following conditions (otherwise, justify Method I or consider Method II):

1. Normal operations (nonemergency event),

2. Iodine, tritium, and particulate releases via station vents to the atmosphere, and

3. Any continuous or batch release over any time period.

Method IA is implemented by the EMS software as described in Appendix C. Gaseous release models are detailed in Section 6.7.3 of the EMS Software Requirements Specification (Attachment 3 of Appendix C).

3.9.2 Method II

Method II consists of the models, input data and assumptions in Appendix C of Regulatory Guide 1.109, Rev. 1 (Reference A), except where site-specific data or assumptions have been identified in the ODCM (see Tables B.7-2 and B.7-3). The critical organ dose will be determined based on the location (site boundary, nearest resident, or farm) of receptor pathways, as identified in the most recent annual land use census, or by conservatively assuming the existence of all pathways (ground plane, inhalation, ingestion of stored and leafy vegetables, milk and meat) at an off-site location of maximum potential dose. Concurrent meteorology with the release period may be utilized for determination of atmospheric dispersion factors in accordance with Part B, Sections 7.3.2 and 7.3.3 for the release point (either ground level or vent stack) from which recorded effluents have been discharged. The maximum critical organ dose will consider the four age groups independently, and use a shielding factor (S_F) of 0.7 associated with residential structures.

3.10 Method to Calculate Direct Dose from Plant Operation

Part A Control C.8.1.1 restricts the dose to the whole body or any organ to any member of the public from all uranium fuel cycle sources to 25 mrem in a calendar year (except the thyroid, which is limited to 75 mrem). Direct radiation from contained sources is required to be included in the assessment of compliance with this standard.

3.10.1 Method

The direct dose from the station will be determined by obtaining the dose from TLD locations situated on-site near potential sources of direct radiation, as well as those TLDs near the site boundary which are part of the environmental monitoring program, and subtracting out the dose contribution from background. Additional methods to calculate the direct dose may also be used to supplement the TLD information, such as high pressure ion chamber measurements, or analytical design calculations of direct dose from identified sources (such as solid waste storage facilities).

The dose determined from direct measurements or calculations will be related to the nearest real person off-site, as well as those individuals on-site involved in activities at either the Education Center or the Rocks boat landing, to assess the contribution of direct radiation to the total dose limits of Part A Control C.8.1.1 in conjunction with liquid and gaseous effluents.

3.11 Dose Projections

Part A Controls C.6.3.1 and C.7.4.1 require that appropriate portions of liquid and gaseous radwaste treatment systems, respectively, be used to reduce radioactive effluents when it is projected that the resulting dose(s) would exceed limits which represent small fractions of the "as low as reasonably achievable" criteria of Appendix I to 10CFR Part 50. The surveillance requirements of these Part A Controls state that dose projections be performed at least once per 31 days when the liquid radwaste treatment systems or gaseous radwaste treatment systems are not being fully utilized.

Since dose assessments are routinely performed at least once per 31 days to account for actual releases, the projected doses shall be determined by comparing the calculated dose from the last (typical of expected operations) completed 31-day period to the appropriate dose limit for use of radwaste equipment, adjusted if appropriate for known or expected differences between past operational parameters and those anticipated for the next 31 days.

3.11.1 Liquid Dose Projections

The 31-day liquid dose projections are calculated by the following:

a. Determine the total body D_{tb} and organ dose D_{mo} (Equations 3-1 and 3-2, respectively) for the last typical completed 31-day period. The last typical 31-day period should be one without significant identified operational differences from the period being projected to, such as full power operation vs. periods when the plant is shut down. For periods with identified operational differences, skip to subsection 3.11.1.e. below.

b. Calculate the ratio (R_1) of the total estimated volume of batch releases expected to be released for the projected period to that actually released in the reference period.

c. Calculate the ratio (R_2) of the estimated gross primary coolant activity for the projected period to the average value in the reference period. Use the most recent value of primary coolant activity as the projected value if no trend in decreasing or increasing levels can be determined.

d. Determine the projected dose from:

Total Body: $D_{tb\ pr} = D_{tb} \cdot R_1 \cdot R_2$

Max. Organ: $D_{mo\ pr} = D_{mo} \cdot R_1 \cdot R_2$

e. During periods when significant operational differences are identified, such as shutdowns vs. normal power operations, or when specific treatment components are expected to be bypassed or out of service for repair or maintenance, the projected dose should be based on an assessment of the expected amount of radioactivity that could be discharged, both through treated and any untreated pathways, over the next 31 days. Specific consideration should be given to effluent streams and treatment systems noted on Figure B.6-1. The volume of liquid to be released, the current or projected maximum radioactivity concentration in the effluent streams either prior to treatment or at the point of release to the environment, and the duration of expected release evaluations should be estimated as part of the projection of offsite dose.

For these periods outside the bounds of steps 3.11.1.a. when significant operational differences exist from the last reference period, the projected dose to the total body D_{tb} and organ dose D_{mo} shall use Equations 3-1 and 3-2, respectively to project dose for each definable time segment of release evolution and summed over the next 31 days. The radioactive release quantity, Q_i, in equations 3-1 and 3-2 represents the estimated quantity of radionuclide "i" estimated to be released over the next 31 days, or during short time periods for defined plant operational evaluations, based on expected volumes, concentrations and treatment options to be applied.

The EMS software can also be used to perform monthly projected dose calculations as described in Appendix C. The methodology applied by EMS in projecting liquid doses is outlined in Section 2.7 of Attachment 4 to Appendix C (EMS Technical Reference Manual).

3.11.2 Gaseous Dose Projections

1. For the gaseous radwaste treatment system, the 31-day dose projections are calculated by the following:

   a. Determine the gamma air dose D^{γ}_{air} (Equation 3-6a), and the beta air dose D^{β}_{air} (Equation 3 -7a) from the last typical 31-day operating period. The last typical 31-day period should be one without significant identified operational differences from the period being projected to, such as full power steady state operation vs. periods when the plant is shutdown. For periods with identified operational differences, skip to subsection 3.11.2.2.e. below.

   b. Calculate the ratio (R3) of anticipated number of curies of noble gas to be released from the hydrogen surge tank to the atmosphere over the next 31 days to the number of curies released in the reference period on which the gamma and beta air doses are based. If no differences between the reference period and the next 31 days can be identified, set R3 to 1.

   c. Determine the projected dose from:

   Gamma Air: $D^{\gamma}_{air\,pr} = D^{\gamma}_{air} \cdot R_3$

   Beta Air: $D^{\beta}_{air\,pr} = D^{\beta}_{air} \cdot R_3$

2. For the ventilation exhaust treatment system, the critical organ dose from iodines, tritium, and particulates are projected for the next 31 days by the following:

   a. Determine the critical organ dose D_{co} (Equation 3-8a) from the last typical 31-day operating period. (If the limit of Part A Control C.7.4.1.c (i.e., 0.3 mrem in 31 days) is exceeded, the projected controlled area annual total effective dose equivalent from all station sources should be assessed to assure that the 10CFR20.1301 dose limits to members of the public are not exceeded.)* . The last typical 31-day period should be one without significant identified operational differences from the period being projected to, such as full power steady state operation vs. periods when the plant is shutdown. For periods with identified operational differences, skip to subsection 3.11.2.2.e. below.

b. Calculate the ratio (R_4) of anticipated primary coolant dose equivalent I-131 for the next 31 days to the average dose equivalent I-131 level during the reference period. Use the most current determination of DE I-131 as the projected value if no trend can be determined.

c. Calculate the ratio (R_5) of anticipated primary system leakage rate to the average leakage rate during the reference period. Use the current value of the system leakage as an estimate of the anticipated rate for the next 31 days if no trend can be determined.

d. Determine the projected dose from:

Critical Organ: $D_{co\ pr} = D_{co} \cdot R_4 \cdot R_5$

e. During periods when significant operational differences are identified, such as shutdowns vs. normal power operations, or when specific treatment components are expected to be bypassed or out of service for repair or maintenance, the projected dose should be based on an assessment of the expected amount of radioactivity that could be discharged, both through treated and any untreated pathways, over the next 31 days. Specific consideration should be given to effluent streams and treatment systems noted on Figure B.6-2. The volume or flow rate of gas to be released, the current or projected maximum radioactivity concentration in the effluent streams either prior to treatment or at the point of release to the environment, and the duration of expected release evaluations should be estimated as part of the projection of offsite dose.

For these periods outside the bounds of steps 3.11.2.1.a or 3.11.2.2.a. when significant operational differences exist from the last reference period, the projected air dose from gamma and beta emissions from noble gases (Equations 3-6 and Equations 3-7, respectively), or from iodines, tritium, and particulates (Equations 3-8) shall use the referenced equations to project dose for each definable time segment of release evolution and summed over the next 31 days. The radioactive release quantity, Q_i in the dose equations represents the estimated quantity of radionuclide "i" estimated to be released over the next 31 days, or during short time periods for defined plant operational evaluations, based on expected volumes, concentrations and treatment options to be applied.

3. Alternate Projection Method for Use with Containment Ventilation Exhaust Treatment System (Charcoal Filters)

During periods when the Containment Building air needs to be vented to the atmosphere, the decision to use the Containment charcoal filter train to exhaust Containment air can be based on dose conversion factors and critical organ dose equation that reflect only those real exposure pathways in the offsite environment as indicated by the annual Land Use Census. This reduces the excess conservatism associated with the standard Method I assumptions that all typical (potential) exposure pathways (including milk) may exist at the most limiting atmospheric dispersion point off site.

In place of the dose conversion factors found in Table B.1-12, and critical organ dose equation 3-8a for Dco, Chemistry Department technical evaluation CHSTID 02-004 contains the dose conversion factors (DFG) and critical organ dose equation which were developed in the same manner as the current Method I factors and time dependent dose equation, but which utilize the most recent Land Use Census data to define which exposure pathways and identified receptor locations exist. CHSTID 02-004 documents the development of this alternate dose projection method. After the Land Use Census is performed each year, and before application to any Containment venting evolution, CHSTID 02-004 will be reviewed to see if any new receptor location impacts the selection of controlling dose location.

The EMS software can also be used to perform monthly projected dose calculations as described in Appendix C. The methodology applied by EMS in projecting gaseous dose is outlined in Section 3.8 of Attachment 4 to Appendix C (EMS Technical Reference Manual).

*Note: This action is based on the assumption that tritium is the controlling nuclide for whole body exposures through the inhalation pathway. Maximum annual average on-site X/Q's for station effluent release points are approximately 100 times the values used for the site boundary dose calculations. However, the site boundary doses calculated by the ODCM for iodines, tritium, and particulates with half lives greater than 8 days, includes all potential off-site exposure pathways. For tritium, the inhalation pathway only accounts for 10% of the total dose contribution being calculated. As a result, if the monthly calculation indicates that the site boundary maximum organ dose reached 0.3 mrem, the on-site maximum dose due to inhalation would be approximately 3.0 mrem for this period. If this were projected to continue for a year with a 2000 hour occupancy factor applied, the projected inhalation whole body dose would be approximately 8 mrem, or 8% of the 10CFR20.1301 limit. This is a reasonable trigger value for the need to consider the dose contribution from all station sources to members of the public in controlled areas.

3.12 Method to Calculate Total Dose From Plant Operations

ODCM Control C.8.1.1 restricts the annual dose to the whole body or any organ of a member of the public from all uranium fuel cycle sources (including direct radiation) to 25 mrem (except the thyroid, which is limited to 75 mrem). These cumulative dose contribution limits from liquids and gaseous effluents, and direct radiation, implement the Environmental Protection Agency (EPA) 40CFR190, "Environmental Standards for the Uranium Fuel Cycle."

3.12.1 Method

Compliance with the Seabrook Station Effluent Controls dose objectives for the maximum individual, as calculated by the methods described in sections B.3.2, B.3.3, B.3.7, B.3.8, B.3.9 of the ODCM also demonstrates compliance with the EPA limits to any member of the public. This indirect determination of compliance is based on the fact that the Effluent Control liquid and gaseous dose objectives are taken from 10CFR50, Appendix I, and represent lower values than the 40CFR190 dose limits. Direct radiation dose from contained sources is not expected to be a significant contributor to the total dose to areas beyond the site boundary. If the operational dose objectives in the Seabrook ODCM Effluent Controls C.6.2.1.a, C.6.2.1.b, C.7.2.1.a, C.7.2.1.b, C.7.3.1.a, or C.7.3.1.b are determined to be exceeded by a factor of two, a Special Report must be prepared. The purpose of this Special Report is to determine by direct assessment if the cumulative dose (calendar year) to any member of the public (real individual) from all sources is within the limits of the Total Dose Control C.8.1.1.

In addition, section A.10.2, "Annual Radioactive Effluent Release Report," requires that an assessment of radiation doses to the likely most exposed member of the public from all effluent and direct radiation sources be included for the previous calendar year to show compliance with 40CFR190.

When required, the total dose to a member of the public will be calculated for all significant effluent release points for all real pathways, including direct radiation. Only effluent releases from Seabrook Station need be considered since no other uranium fuel cycle facilities exist within five miles. EPA has determined that for fuel cycle facilities separated by more than five miles, their contribution to each other's total dose would not be significant and cause dose Standard for the Uranium Fuel Cycle to be exceeded. The calculations will be based on the liquid and gaseous Methods II dose models as described in Section B.3, including usage factors and other documented site-specific parameters reflecting realistic assumptions, where appropriate. The liquid and gaseous effluent Method II models are derived from the methods given in Regulatory Guide 1.109, Rev. 1, October 1977.

The direct radiation component from the facility can be determined using environmental TLD results as noted in Section B.3.10.1 (or alternately, high pressure ion chamber measurements or analytical design calculations for estimating the direct radiation dose from identified contained radioactive sources within the facility).