EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT

Supplemental Information 1993

Facility: Seabrook Station Unit 1

Licensee: North Atlantic Energy Service Corporation

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 mrem per quarter to any organ.

2. Maximum Permissible Concentrations

Provide the MPC's used in determining allowable releases 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, alpha by proportional counter, and iron 55 by liquid scintillation. Total error is based on the volume discharge error and analytical error.

5. Batch Releases

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

a. Liquid

1. Number of batch releases: 165
2. Total time for batch releases: 32940 minutes
3. Maximum time period for batch releases: 522 minutes
4. Average time period for batch release: 200 minutes
5. Minimum time period for a batch release: 75 minutes
6. Average stream flow during periods of release of effluent into a flowing stream: 1.54E06 liters per minute.

b. Gaseous

1. Number of batch releases: 49
2. Total time period for batch releases: 3836 minutes
3. Maximum time period for a batch release: 1685 minutes
4. Average time period for batch releases: 78 minutes
5. Minimum time period for a batch releases: 1 minute

6. Abnormal Releases

a. Liquid

1. Number of releases: 0
2. Total activity releases: N/A

b. Gaseous

1. Number of releases: 0
2. Total activity released: N/A

TABLE 1A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 1993

GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

SEABROOK STATION	UNIT 1	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4	Est. Total Error, %
A. Fission & Activation Gases						
1. Total release	Ci	1.96e-02	5.46e-02	1.24e-02	2.29e-02	1.70E+01
2. Average release rate for period	µCi/sec	2.55e-03	6.94e-03	1.56e-03	2.88e-03	
3. Percent of technical specification limit	%	2.3E-03 (1)	4.32E-03 (1)	3.38E-04 (1)	2.08E-03 (1)	
B. Iodines						
1. Total Iodine	Ci	ND	ND	ND	ND	1.50E+01
2. Average release rate for period	µCi/sec	NA	NA	NA	NA	
3. Percent of technical specification limit	%	NA	NA	NA	NA	
C. Particulates						
1. Particulates with half-lives >8 days	Ci	ND	ND	2.57E-07	4.03E-07	1.80E+01
2. Average release rate for period	µCi/sec	NA	NA	3.23E-08	5.07E-08	
3. Percent of technical specification limit	%	1.95E-03	3.99E-04	8.04E-04	8.93E-03	
4. Gross alpha radioactivity	Ci	ND	ND	ND	ND	
D. Tritium						
1. Total release	Ci	1.62E-03	3.90E-03	7.41E-03	6.20E-01	1.60E+01
2. Average release rate for period	µCi/sec	2.11E-04	4.96E-04	9.35E-04	7.80E-02	
3. Percent of technical specification limit	%	1.95E-03	3.99E-04	8.04E-04	8.93E-03	

(1) Gamma Air Dose

TABLE 1B
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 1993
GASEOUS EFFLUENTS-MIXED RELEASES-CONTINUOUS MODE

1. Fission and Activation Gases

Nuclides Released	Unit 1	Quarter 1	Quarter 2	Quarter 3	Quarter 4
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
argon-41	Ci	ND	ND	ND	ND
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	ND	ND	ND	ND

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	ND	ND	ND	ND

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
niobium-95	Ci	ND	ND	ND	ND
zirconium-95	Ci	ND	ND	ND	ND
cobalt-58	Ci	ND	ND	ND	ND
cobalt-60	Ci	ND	ND	ND	ND
chromium-51	Ci	ND	ND	ND	ND
iron-59	Ci	ND	ND	ND	ND
manganese-54	Ci	ND	ND	ND	ND
beryllium-7	Ci	ND	ND	ND	ND
unidentified	Ci	ND	ND	ND	ND
Total for period		ND	ND	ND	ND

TABLE 1B
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 1993
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES-CONTINUOUS MODE

1. Fission and Activation Gases

Nuclides Released	Unit 1	Quarter 1	Quarter 2	Quarter 3	Quarter 4
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
argon-41	Ci	ND	ND	ND	ND
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	ND	ND	ND	ND

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	ND	ND	ND	ND

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
niobium-95	Ci	ND	ND	ND	ND
zirconium-95	Ci	ND	ND	ND	ND
cobalt-58	Ci	ND	ND	1.97E-07	4.03E-07
cobalt-60	Ci	ND	ND	ND	ND
chromium-51	Ci	ND	ND	ND	ND
iron-59	Ci	ND	ND	ND	ND
manganese-54	Ci	ND	ND	6.03E-08	ND
Total for this period	Ci	ND	ND	2.57E-07	4.03E-07

TABLE 1C
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 1993
GASEOUS EFFLUENTS-MIXED LEVEL RELEASES-BATCH MODE

1. Fission and Activation Gases

Nuclides Released	Unit 1	Quarter 1	Quarter 2	Quarter 3	Quarter 4
krypton-85	Ci				
krypton-85m	Ci	3.37E-04	1.56E-03	ND	3.34E-04
krypton-87	Ci	1.92E-03	3.61E-03	ND	7.87E-04
krypton-88	Ci	9.79E-04	4.02E-03	ND	7.73E-04
xenon-133	Ci	1.41E-03	9.18E-03	6.85E-03	2.80E-03
xenon-135	Ci	2.30E-03	9.65E-03	2.39E-03	3.71E-03
xenon-135m	Ci	9.55E-04	3.84E-03	2.80E-03	7.90E-03
xenon-138	Ci	4.36E-03	1.20E-02	ND	2.35E-03
argon-41	Ci	7.23E-03	1.07E-02	1.35E-04	4.28E-03
xenon-133m	Ci	ND	ND	1.83E-04	ND
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	1.96E-02	5.46E-02	1.24E-02	2.29E-02

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	ND	ND	ND	ND

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
niobium-95	Ci	ND	ND	ND	ND
zirconium-95	Ci	ND	ND	ND	ND
cobalt-58	Ci	ND	ND	ND	ND
cobalt-60	Ci	ND	ND	ND	ND
chromium-51	Ci	ND	ND	ND	ND
iron-59	Ci	ND	ND	ND	ND
manganese-54	Ci	ND	ND	ND	ND
beryllium-7	Ci	ND	ND	ND	ND
unidentified	Ci	ND	ND	ND	ND
Total for period		ND	ND	ND	ND

TABLE 1C
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 1993
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES-BATCH MODE

1. Fission and Activation Gases

Nuclides Released	Unit 1	Quarter 1	Quarter 2	Quarter 3	Quarter 4
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
argon-41	Ci	ND	ND	ND	ND
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	ND	ND	ND	ND

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	ND	ND	ND	ND

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
niobium-95	Ci	ND	ND	ND	ND
zirconium-95	Ci	ND	ND	ND	ND
cobalt-58	Ci	ND	ND	ND	ND
cobalt-60	Ci	ND	ND	ND	ND
chromium-51	Ci	ND	ND	ND	ND
iron-59	Ci	ND	ND	ND	ND
manganese-54	Ci	ND	ND	ND	ND
beryllium-7	Ci	ND	ND	ND	ND
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	ND	ND	ND	ND

TABLE 2A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 1993

LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES

SEABROOK STATION	UNIT 1	QUARTER 1	QUARTER 2	QUARTER 3	QUARTER 4	Est. Total Error, %
A. Fission & Activation Products						
1. Total releaseinot including tritium, gases, alpha)	Ci	3.99E-02	3.12E-02	1.29E-02	6.03E-03	6.00E+00
2. Average diluted concentration during period	µCi/ml	2.12E-10	1.48E-10	6.42E-11	3.17E-11	
3. Percent of applicable limit	%	6.66E-02 (2)	5.80E-02 (2)	1.94E-02 (2)	8.4E-03 (1)	
B. Tritium						
1. Total Release	Ci	1.27E+02	1.59E+02	5.87E+01	2.18E+02	8.00E+00
2. Average diluted concentration during period	MCi/ML	6.75E-07	7.54E-07	2.92E-07	1.15E-06	
3. Percent of applicable limit	%	6.66E-02 (2)	5.80E-02 (2)	1.94E-02 (2)	8.4E-03 (1)	
C. Dissolved and Entrained Gases						
1. Total Release	Ci	ND	ND	ND	1.17E-05	1.90E+01
2. Average diluted concentration during period	MCi/ML	NA	NA	NA	6.16E-14	
3. Percent of applicable limit	%	NA	NA	NA	3.1E-08	
D. Gross Alpha Radioactivity						
1. Total release	Ci	ND	ND	ND	ND	1.00E+01
E. Volume of waste released(prior to dilution)	liters	4.31E+07	4.32E+07	3.92E+07	4.26E+07	1.30E+00
F. Volume of dilution water used during period	liters	1.88E+11	2.11E+11	2.01E+11	1.90E+11	9.00E+00

TABLE 2B
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 1993
LIQUID EFFLUENTS - CONTINUOUS

Nuclides released	Units	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	ND	ND	ND
cesium-137	Ci	ND	ND	ND	ND
iodine-131	Ci	ND	ND	ND	ND
iodine-133	Ci	ND	ND	ND	ND
cobalt-58	Ci	ND	ND	ND	ND
cobalt-60	Ci	ND	1.72E-05	ND	ND
iron-55	Ci	ND	ND	ND	ND
iron-55	Ci	ND	ND	ND	ND
sinc-65	Ci	ND	ND	ND	ND
manganese-54	Ci	ND	1.86E-06	ND	ND
chromium-51	Ci	ND	ND	ND	ND
nibium-97	Ci	ND	ND	ND	ND
xirconium-niobium-95	Ci	ND	ND	ND	ND
berylium-7	Ci	ND	ND	ND	ND
technetium-99m	Ci	ND	ND	ND	ND
antimony-124	Ci	ND	ND	ND	ND
antimony-125	Ci	ND	ND	ND	ND
bromine-82	Ci	ND	ND	ND	ND
sodium-24	Ci	ND	ND	ND	ND
cesium-137	Ci	ND	ND	ND	ND
molybdenum-99	Ci	ND	ND	ND	ND
barium-lanthanum-140	Ci	ND	ND	ND	ND
cerium-141	Ci	ND	ND	ND	ND
undidentified	Ci	ND	ND	ND	ND
total for period	Ci	ND	1.91E-05	ND	ND
	Ci				
	Ci				
xenon-133	Ci	ND	ND	ND	ND
xenon-135	Ci	ND	ND	ND	ND

TABLE 2B
EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 1993
LIQUID EFFLUENTS - BATCH

NUCLIDES RELEASED	UNITS	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	ND	ND	ND
cesium-137	Ci	ND	ND	ND	ND
iodine-131	Ci	1.36E-04	3.49E-06	ND	ND
iodine-133	Ci	1.16E-04	ND	1.35E-06	1.94E-06
cobalt-58	Ci	3.97E-03	2.82E-03	9.74E-04	2.17E-03
cobalt-60	Ci	7.18E-04	5.50E-04	2.04E-04	5.22E-04
iron-59	Ci	5.02E-04	2.17E-04	ND	7.56E-06
iron-55	Ci	2.97E-02	2.43E-02	1.17E-02	ND
manganese-54	Ci	2.55E-04	2.44E-04	4.18E-05	4.88E-04
chromium-51	Ci	1.65E-04	ND	ND	ND
niobium-97	Ci	3.32E-06	ND	ND	1.90E-05
xirconium-niobium-95	Ci	3.08E-5	6.74E-06	ND	ND
beryllium-7	Ci	1.17E-04	ND	ND	ND
technetium-99m	Ci	1.58E-05	1.60E-05	ND	2.59E-06
antimony-124	Ci	8.24E-05	6.32E-04	ND	ND
antimony-125	Ci	3.98E-03	2.03E-03	ND	2.82E-05
bromine-82	Ci	1.03E-04	7.25E-06	ND	ND
sodium-24	Ci	2.05E-05	ND	ND	ND
cesium-137	Ci	ND	3.30E-05	ND	ND
unidentified	Ci	ND	ND	ND	ND
total for period	Ci	3.99E-02	3.12E-02	1.29E-02	6.03E-03
	Ci				
	Ci				
	Ci				
	Ci				
	Ci				
xenon-133	Ci	ND	ND	ND	ND
xenon-135	Ci	ND	ND	ND	1.17E-05

TABLE 3

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 1993

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

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

1. Type of waste - NONE	Unit	First 6-month Period	Est. Total Error, %
a. Spent resins, filter sludges, evaporator bottoms, etc	0 m^3 0 Ci	NONE	
b. Dry compressible waste, contaminated equip, etc	0 m^3 0 Ci	NONE	
c. Irradiated components, control rods etc	0 m^3 0 Ci	NONE	
d. Other (described)	0 m^3 0 Ci	NONE	

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

a.	N/A		
b.			
c.			
d.			

3. Solid waste Disposition

Number of Shipments	Mode of Transportation	Destination
NONE		

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
NONE		

APPENDIX A

Off-Site Dose Calculation Manual

Requirement: Technical Specification 6.13.2.b requires that licensee initiated changes to the Off-Site Dose Calculation Manual (ODCM) be submitted to the Commission in the Annual Radioactive Effluent Release Report for the period in which the change(s) was made effective. Changes made to the Radiological Environmental Monitoring Program (REMP) in accordance with Technical Specification 3.12.1 and 3.12.2 are to be included.

Response: Two revisions to the ODCM were made effective during the reporting period.

Revision 12
The Method 1 gaseous dose calculations were revised so that short term batch release doses would be more accurately determined. Several typographical errors were also corrected.

Revision 13
Periodic review. No changes.

A complete copy of the ODCM is enclosed for simplicity of review due to the extensive number of pages effected by Revision 12.

No changes were made to the Radiological Environmental Monitoring Program during this reporting period.