NEXTera ENERGY SEABROOK

April 28, 2014

Docket No. 50-443
SBK-L-14083

U.S. Nuclear Regulatory Commission
Attn.: Document Control Desk
Washington, DC 20555-0001

Seabrook Station
2013 Annual Radioactive Effluent Release Report

Pursuant to 10CFR 50.36a (a).2 and Technical Specification 6.8.1.4, NextEra Energy Seabrook, LLC submits the Annual Radioactive Effluent Release Report for 2013. Pursuant to Technical Specification 6.13.c, a copy of the Offsite Dose Calculation Manual (ODCM) is not being provided with this submittal as there were no changes made to the ODCM in 2013.

The following information is provided in the enclosures:

Enclosure 1	Effluent release data as required by Regulatory Guide 1.21
Enclosure 2	Joint frequency distributions of wind speed, wind direction, and atmospheric stability
Enclosure 3	Radiation dose assessment

Should you have any questions regarding this letter, please contact David Robinson, Chemistry Department Manager, at (603) 773-7496.

Sincerely,

NextEra Energy Seabrook, LLC

Michael Ossing
Licensing Manager

IE48
NRR

cc: NRC Region I Administrator
NRC Project Manager, Project Directorate I-2
NRC Senior Resident Inspector
Seth Breitmaier, American Nuclear Insurers

Enclosure 1

Effluent Release Data
as Required by Regulatory Guide 1.21

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
Supplemental Information 2013

Facility: Seabrook Station Unit 1 Licensee: NextEra 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. 2.0 E-04 μCi/ml dissolved or entrained gas.

2. Effluent Concentration Limits

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

a. Fission and activation gases: 10 ECL
b. Iodines: 10 ECL
c. Particulates, half-lives >8 days: 10 ECL
d. Liquid Effluents: 10 ECL

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: 73
b. Total time for batch releases: 18245 minutes
c. Maximum time period for batch release: 1028 minutes
d. Average time period for batch release: 250 minutes
e. Minimum time period for batch release: 60 minutes
f. Average stream flow during periods of release of effluents into a flowing stream: 1.67 E+06 liters per minute

B. Gaseous

a. Number of batch releases: 25
b. Total time for batch releases: 3535 minutes
c. Maximum time period for batch release: 1703 minutes
d. Average time period for batch release: 199 minutes
e. Minimum time period for batch release: 3 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 2013

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	3.57E-03	3.12E-02	7.41E-03	4.08E-02	1.70E+01
2. Average release rate for period	uCi/sec	4.59E-04	3.97E-03	9.32E-04	5.13E-03	
3. Percent of applicable Technical Specification limit	%	1.02E-04	9.64E-05	2.12E-04	9.74E-04	
B. Iodines (Note 1)						
1. Total release	Ci	ND	ND	ND	ND	1.50E+01
2. Average release rate for period	uCi/sec	N/A	N/A	N/A	N/A	
3. Percent of applicable Technical Specification limit	%	2.73E-01	1.73E-01	4.00E-01	1.96E-01	
C. Particulates						
1. Total release	Ci	2.19E+00	3.06E+00	3.36E+00	3.90E+00	1.80E+01
2. Average release rate for period	uCi/sec	2.77E-01	3.88E-01	4.25E-01	4.94E-01	
3. Percent of applicable Technical Specification limit	%	2.73E-01	1.73E-01	4.00E-01	1.96E-01	
4. Total alpha radioactivity	Ci	ND	ND	ND	ND	
D. Tritium						
1. Total release	Ci	2.05E+01	1.27E+01	2.91E+01	1.34E+01	1.60E+01
2. Average release rate for period	uCi/sec	2.64E+00	1.62E+00	3.66E+00	1.69E+00	
3. Percent of applicable Technical Specification limit	%	2.73E-01	1.73E-01	4.00E-01	1.96E-01	

TABLE 1B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2013

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	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-133	Ci	ND	ND	ND	ND
xenon-133m	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 (Note 1)					
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
cobalt-58	Ci	ND	ND	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
carbon-14	Ci	2.19E+00	3.06E+00	3.36E+00	3.90E+00
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	2.19E+00	3.06E+00	3.36E+00	3.90E+00

TABLE 1B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2013

GASEOUS EFFLUENTS-ELEVATED RELEASES

BATCH

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4
1. Fission and activation gases					
argon-41	Ci	3.57E-03	3.12E-03	7.41E-03	4.08E-02
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-133	Ci	ND	ND	ND	ND
xenon-133m	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				
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	3.57E-03	3.12E-03	7.41E-03	4.08E-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	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 2A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2013

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	9.64E-04	6.07E-04	8.92E-04	1.67E-04	6.00E+00
2. Average diluted concentration during period	uCi/ml	1.51E-12	9.45E-13	1.56E-12	2.38E-13	
3. Percent of applicable limit	%	2.97E-04	1.01E-03	6.27E-04	3.37E-03	
B. Tritium						
1. Total release	Ci	1.29E+02	3.96E+01	1.73E+01	1.77E+02	8.00E+00
2. Average diluted concentration during period	uCi/ml	2.02E-07	6.17E-08	3.02E-08	2.52E-07	
3. Percent of applicable limit	%	1.50E-03	3.68E-04	2.40E-04	2.08E-03	
C. Dissolved and entrained gases						
1. Total release	Ci	ND	ND	ND	ND	1.90E+01
2. Average diluted concentration during period	uCi/ml	N/A	N/A	N/A	N/A	
3. Percent of applicable limit	%	N/A	N/A	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	9.46E+07	3.11E+07	2.02E+07	2.30E+07	1.30E+00
F. Volume of dilution water used during period	liters	6.39E+11	6.42E+11	5.73E+11	7.02E+11	9.00E+00

TABLE 2B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2013

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	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-57	Ci	ND	ND	ND	ND
cobalt-58	Ci	ND	1.03E-05	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	1.03E-05	0.00E+00	0.00E+00

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

TABLE 2B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2013

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	ND	ND	ND	ND
cesium-137	Ci	ND	ND	ND	6.08E-06
iodine-131	Ci	ND	ND	ND	ND
iodine-133	Ci	ND	ND	ND	ND
cobalt-57	Ci	ND	ND	ND	ND
cobalt-58	Ci	3.63E-04	1.70E-04	1.03E-04	4.81E-05
cobalt-60	Ci	2.86E-05	1.21E-05	ND	2.52E-05
chromium-51	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	1.40E-06	ND	3.33E-06	ND
zirconium-niobium-95	Ci	ND	ND	ND	ND
molybdenum-99	Ci	ND	ND	ND	ND
technetium-99m	Ci	ND	ND	ND	ND
silver-110m	Ci	ND	ND	ND	ND
barium-lanthanum-140	Ci	ND	ND	ND	ND
cerium-141	Ci	ND	ND	ND	ND
antimony-122	Ci	ND	ND	ND	ND
antimony-124	Ci	7.49E-06	ND	ND	ND
antimony-125	Ci	5.64E-04	4.14E-04	7.87E-04	8.77E-05
antimony-126	Ci	ND	ND	ND	ND
niobium-97	Ci	ND	ND	ND	ND
tin-117m	Ci	ND	ND	ND	ND
sodium-24	Ci	ND	ND	ND	ND
Tellurium-129m	Ci	ND	ND	ND	ND
Tellurium-132	Ci	ND	ND	ND	ND
unidentified	Ci	ND	ND	ND	ND
Total for period(above)	Ci	9.64E-04	5.96E-04	8.93E-04	1.67E-04
xenon-133	Ci	ND	ND	ND	ND
xenon-135	Ci	ND	ND	ND	ND

TABLE 1C

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2013

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 (Note 1)					
iodine-131	Ci	ND	ND	ND	ND
iodine-133	Ci	ND	ND	ND	ND
	Ci				
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-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	ND	ND	ND
cobalt-60	Ci	ND	ND	ND	ND
chromium-51	Ci	ND	ND	ND	ND
unidentified	Ci	ND	ND	ND	ND
Total for period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 1C

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2013

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	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-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	0.00E+00	0.00E+00	0.00E+00
2. Iodines					
iodine-131	Ci	ND	ND	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	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-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	ND	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	ND	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	0.00E+00	0.00E+00	0.00E+00

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT 2013
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	N/A	N/A
b. Dry compressible waste, contaminated Equip, etc.	m^3 Ci	6.93E+01 3.76E+00	2.50E+01
c. Irradiated components, control Rods, etc.	m^3 Ci	N/A	N/A
d. Other (describe)	m^3 Ci	N/A	N/A

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

a.	N/A	%	N/A
b.	Ni-63	%	4.65E+01
	Fe-55	%	3.87E+01
	Co-60	%	1.26E+01
	Co-58	%	1.28E+00
	Sb-125	%	3.43E-01
	Mn-54	%	2.24E-01
	Nb-94	%	1.49E-01
	H-3	%	8.67E-02
	Cs-137	%	8.13E-02
	Co-57	%	3.94E-02
	Nb-95	%	3.58E-03
	Cm-243	%	1.78E-03
c.	N/A	%	N/A
d.	N/A	%	N/A

3. Solid Waste Disposition

Number of Shipments	Waste Class	Container Type	Solidification Agent	Mode of Transportation	Destination
5	A	General Design	N/A	Truck	Duratek, Oak Ridge, TN
1	A	General Design	N/A	Truck	Duratek, Kingston, TN
1	A	General Design	N/A	Truck	EnergySolutions, Clive, UT

B. IRRADIATED FUEL SHIPMENTS (Disposition)

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

C. REVIEW AND APPROVAL

Prepared By: _____ **Date:** 4/18/14

Reviewed By: _____ **Date:** 4/22/14

Approved By: _____ **Date:** 04/25/2014

List of Appendices

Appendix	Title
A	Offsite Dose Calculation Manual
B	Process Control Program
C	Liquid Holdup Tanks
D	Radwaste Treatment Systems
E	Unplanned Releases

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: No changes were made to the ODCM in 2013.

Appendix B

Process Control Program

Requirement: The Offsite Dose Calculation Manual 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: No changes were made to the process control program in 2013.

Appendix C

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, 2013 to December 31, 2013, there was no radioactive material stored in any temporary outdoor tank that exceeded the limits of T. S. 3.11.1.4.

Appendix D

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 2013 FPL Energy Seabrook LLC, will submit any changes to the Radwaste Treatment Systems (liquid, gaseous and solid) as part of the FSAR update.

Appendix E

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.

- Submit all groundwater monitoring well sample results and a description of any significant onsite leaks/spills that impact groundwater

Response: A review of the January 1, 2013 to December 31, 2013 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. See next sheet for groundwater monitoring well results.

2013 Ground Water Monitoring Well Tritium Data

Date/Time	BD-1 (pCi/L)	BD-2 (pCi/L)	BD-3 (pCi/L)	BD-4 (pCi/L)	BD-5 (pCi/L)	BD-6 (pCi/L)	BU-1 (pCi/L)	SC-1 (pCi/L)	SD-1 (pCi/L)	SD-2 (pCi/L)	SD-3 (pCi/L)	SD-4 (pCi/L)	SD-5 (pCi/L)	SU-1 (pCi/L)	SW-1 (pCi/L)	SW-2 (pCi/L)	SW-3 (pCi/L)	SW-4 (pCi/L)	SW-5 (pCi/L)	SW-6 (pCi/L)	SU-10 (pCi/L)	SU-11 (pCi/L)	BU-10 (pCi/L)	BU-11 (pCi/L)	TW-1 (pCi/L)	TW-2 (pCi/L)	TW-3 (pCi/L)
Spring / Summer 2013 Sampling																											
03/21/13		1480													5520												
03/22/13									<563								<532										
03/27/13															2580												
05/01/13		1330							<554								<554										
05/02/13																<553						<554		<553			
05/03/13															1780						<544		<544				
05/06/13																		<549	<546								
05/08/13	<538				<540			<539				<537															
05/30/13							<548							<546													
05/31/13			<518	<525						<507	<591																
06/05/13						<537							<536							<537							
07/12/13																									<545		<547
07/18/13																										<552	
Fall / Winter 2013 Sampling																											
09/17/13																	<564										
09/18/13		969							1120						2100												
09/19/13																<565					<564	<563	<563	<563			
09/25/13			<593	<587			<591			<586	<587			<543	3030												
09/26/13	<542				<541			<541				<526															
09/27/13															2840												
12/04/13																		<547									
12/20/13															2770												
12/27/13						<533							<533														
12/30/13		672							1040								NA		Dry	Dry							

Paired well locations:
SD-1 / BD-2 South of plant near seawall inside PA fence
SD-2 / BD-3 East of plant inside owner controlled area
SD-3 / BD-4 Northeast of plant inside owner controlled area
SD-4 / BD-5 Southwest of plant, south of cooling tower inside owner controlled area
SD-5 / BD-6 South of Unit 2 containment equipment hatch outside PA fence
SU-1 / BU-1 Northwest of plant (Background location) inside owner controlled area
SU-10 / BU-10 North / northwest of plant inside PA fence
SU-11 / BU-11 North of plant inside PA fence

Selected well locations:
SW-1 South of Fuel Storage Building (Indicator location) inside PA fence
SW-2 East of plant near Service Water Pump House inside PA fence
SW-3 Southwest of plant near Unit 1 to Unit 2 tunnel inside PA fence
SW-4 South of waste process building / steam generator blowdown room inside PA fence
SW-5 West of service water building inside PA fence
SW-6 Southwest of demineralized tank 259 inside PA fence
TW-1 Southeast of plant inside owner controlled area outside PA fence
TW-2 Southeast of plant inside owner controlled area outside PA fence
TW-3 Southeast of plant inside owner controlled area outside PA fence

Note: All sample results in pCi/L

Definitions:
S = Shallow C = Cross gradient U = up gradient W = well
B = Bedrock D = down gradient T = temporary

Enclosure 2

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

SEABROOK JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS A CLASS FREQUENCY (PERCENT) = 6.29

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	2	0	1	1	0	2	1	1	0	0	0	1	0	0	0	9
(1)	.00	.00	.37	.00	.19	.19	.00	.37	.19	.19	.00	.00	.00	.19	.00	.00	.00	1.69
(2)	.00	.00	.02	.00	.01	.01	.00	.02	.01	.01	.00	.00	.00	.01	.00	.00	.00	.11
4-7	1	2	1	1	11	5	9	4	5	7	10	16	22	11	7	0	0	112
(1)	.19	.37	.19	.19	2.06	.94	1.69	.75	.94	1.31	1.87	3.00	4.12	2.06	1.31	.00	.00	20.97
(2)	.01	.02	.01	.01	.13	.06	.11	.05	.06	.08	.12	.19	.26	.13	.08	.00	.00	1.32
8-12	1	1	2	10	40	29	62	5	12	17	37	27	51	23	9	0	0	326
(1)	.19	.19	.37	1.87	7.49	5.43	11.61	.94	2.25	3.18	6.93	5.06	9.55	4.31	1.69	.00	.00	61.05
(2)	.01	.01	.02	.12	.47	.34	.73	.06	.14	.20	.44	.32	.60	.27	.11	.00	.00	3.84
13-18	0	0	3	7	6	6	9	0	5	6	9	4	10	13	4	0	0	82
(1)	.00	.00	.56	1.31	1.12	1.12	1.69	.00	.94	1.12	1.69	.75	1.87	2.43	.75	.00	.00	15.36
(2)	.00	.00	.04	.08	.07	.07	.11	.00	.06	.07	.11	.05	.12	.15	.05	.00	.00	.97
19-24	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	4
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.19	.19	.00	.19	.19	.00	.00	.00	.75
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.00	.01	.01	.00	.00	.00	.05
GT 24	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
(1)	.00	.00	.00	.00	.19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.19
(2)	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01
ALL SPEEDS	2	3	8	18	59	41	80	11	23	32	57	47	84	49	20	0	0	534
(1)	.37	.56	1.50	3.37	11.05	7.68	14.98	2.06	4.31	5.99	10.67	8.80	15.73	9.18	3.75	.00	.00	100.00
(2)	.02	.04	.09	.21	.70	.48	.94	.13	.27	.38	.67	.55	.99	.58	.24	.00	.00	6.29

(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 JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS B CLASS FREQUENCY (PERCENT) = 4.03

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	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	2	0	0	2	1	0	1	0	1	0	0	2	0	10
(1)	.00	.00	.00	.29	.58	.00	.00	.58	.29	.00	.29	.00	.29	.00	.00	.58	.00	2.92
(2)	.00	.00	.00	.01	.02	.00	.00	.02	.01	.00	.01	.00	.01	.00	.00	.02	.00	.12
4-7	1	0	1	4	18	4	4	0	1	3	2	13	15	12	3	4	0	85
(1)	.29	.00	.29	1.17	5.26	1.17	1.17	.00	.29	.88	.58	3.80	4.39	3.51	.88	1.17	.00	24.85
(2)	.01	.00	.01	.05	.21	.05	.05	.00	.01	.04	.02	.15	.18	.14	.04	.05	.00	1.00
8-12	2	0	3	14	27	11	11	1	2	7	13	21	19	26	22	5	0	184
(1)	.58	.00	.88	4.09	7.89	3.22	3.22	.29	.58	2.05	3.80	6.14	5.56	7.60	6.43	1.46	.00	53.80
(2)	.02	.00	.04	.16	.32	.13	.13	.01	.02	.08	.15	.25	.22	.31	.26	.06	.00	2.17
13-18	0	0	3	2	0	0	0	0	0	0	4	1	12	17	16	2	0	57
(1)	.00	.00	.88	.58	.00	.00	.00	.00	.00	.00	1.17	.29	3.51	4.97	4.68	.58	.00	16.67
(2)	.00	.00	.04	.02	.00	.00	.00	.00	.00	.00	.05	.01	.14	.20	.19	.02	.00	.67
19-24	0	0	0	0	0	1	0	0	0	0	0	0	0	3	2	0	0	6
(1)	.00	.00	.00	.00	.00	.29	.00	.00	.00	.00	.00	.00	.00	.88	.58	.00	.00	1.75
(2)	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.04	.02	.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	3	0	7	21	47	16	15	3	4	10	20	35	47	58	43	13	0	342
(1)	.88	.00	2.05	6.14	13.74	4.68	4.39	.88	1.17	2.92	5.85	10.23	13.74	16.96	12.57	3.80	.00	100.00
(2)	.04	.00	.08	.25	.55	.19	.18	.04	.05	.12	.24	.41	.55	.68	.51	.15	.00	4.03

(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 JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS C CLASS FREQUENCY (PERCENT) = 5.03

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	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	1	0	3	0	0	1	1	0	0	0	1	0	2	0	0	9
(1)	.00	.00	.23	.00	.70	.00	.00	.23	.23	.00	.00	.00	.23	.00	.47	.00	.00	2.11
(2)	.00	.00	.01	.00	.04	.00	.00	.01	.01	.00	.00	.00	.01	.00	.02	.00	.00	.11
4-7	7	3	3	10	18	6	6	2	2	5	7	8	12	17	9	9	0	124
(1)	1.64	.70	.70	2.34	4.22	1.41	1.41	.47	.47	1.17	1.64	1.87	2.81	3.98	2.11	2.11	.00	29.04
(2)	.08	.04	.04	.12	.21	.07	.07	.02	.02	.06	.08	.09	.14	.20	.11	.11	.00	1.46
8-12	5	3	9	16	21	4	10	2	2	8	13	21	19	30	36	4	0	203
(1)	1.17	.70	2.11	3.75	4.92	.94	2.34	.47	.47	1.87	3.04	4.92	4.45	7.03	8.43	.94	.00	47.54
(2)	.06	.04	.11	.19	.25	.05	.12	.02	.02	.09	.15	.25	.22	.35	.42	.05	.00	2.39
13-18	0	0	2	2	3	0	0	0	1	1	6	3	11	31	21	0	0	81
(1)	.00	.00	.47	.47	.70	.00	.00	.00	.23	.23	1.41	.70	2.58	7.26	4.92	.00	.00	18.97
(2)	.00	.00	.02	.02	.04	.00	.00	.00	.01	.01	.07	.04	.13	.37	.25	.00	.00	.95
19-24	0	0	0	0	0	0	0	0	0	0	1	1	2	2	1	0	0	7
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.23	.23	.47	.47	.23	.00	.00	1.64
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.02	.02	.01	.00	.00	.08
GT 24	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
(1)	.00	.00	.00	.00	.70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.70
(2)	.00	.00	.00	.00	.04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04
ALL SPEEDS	12	6	15	28	48	10	16	5	6	14	27	33	45	80	69	13	0	427
(1)	2.81	1.41	3.51	6.56	11.24	2.34	3.75	1.17	1.41	3.28	6.32	7.73	10.54	18.74	16.16	3.04	.00	100.00
(2)	.14	.07	.18	.33	.57	.12	.19	.06	.07	.16	.32	.39	.53	.94	.81	.15	.00	5.03

(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 JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS D CLASS FREQUENCY (PERCENT) = 48.42

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	1	0	0	0	0	1
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	.00	.00	.00	.02
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.01
C-3	30	30	22	19	11	10	13	10	24	14	20	23	32	34	24	38	0	354
(1)	.73	.73	.54	.46	.27	.24	.32	.24	.58	.34	.49	.56	.78	.83	.58	.92	.00	8.62
(2)	.35	.35	.26	.22	.13	.12	.15	.12	.28	.16	.24	.27	.38	.40	.28	.45	.00	4.17
4-7	56	50	69	107	139	54	65	87	60	94	120	162	186	218	183	121	0	1771
(1)	1.36	1.22	1.68	2.60	3.38	1.31	1.58	2.12	1.46	2.29	2.92	3.94	4.53	5.31	4.45	2.94	.00	43.10
(2)	.66	.59	.81	1.26	1.64	.64	.77	1.03	.71	1.11	1.41	1.91	2.19	2.57	2.16	1.43	.00	20.87
8-12	30	25	81	59	62	19	24	31	27	73	147	117	157	273	199	65	0	1389
(1)	.73	.61	1.97	1.44	1.51	.46	.58	.75	.66	1.78	3.58	2.85	3.82	6.64	4.84	1.58	.00	33.80
(2)	.35	.29	.95	.70	.73	.22	.28	.37	.32	.86	1.73	1.38	1.85	3.22	2.34	.77	.00	16.37
13-18	2	8	59	26	19	1	2	5	6	24	18	14	46	151	88	13	0	482
(1)	.05	.19	1.44	.63	.46	.02	.05	.12	.15	.58	.44	.34	1.12	3.67	2.14	.32	.00	11.73
(2)	.02	.09	.70	.31	.22	.01	.02	.06	.07	.28	.21	.16	.54	1.78	1.04	.15	.00	5.68
19-24	3	1	12	9	14	0	0	0	0	4	2	1	5	34	2	3	0	90
(1)	.07	.02	.29	.22	.34	.00	.00	.00	.00	.10	.05	.02	.12	.83	.05	.07	.00	2.19
(2)	.04	.01	.14	.11	.16	.00	.00	.00	.00	.05	.02	.01	.06	.40	.02	.04	.00	1.06
GT 24	0	0	4	4	9	0	0	0	0	1	0	0	0	4	0	0	0	22
(1)	.00	.00	.10	.10	.22	.00	.00	.00	.00	.02	.00	.00	.00	.10	.00	.00	.00	.54
(2)	.00	.00	.05	.05	.11	.00	.00	.00	.00	.01	.00	.00	.00	.05	.00	.00	.00	.26
ALL SPEEDS	121	114	247	224	254	84	104	133	117	210	307	317	427	714	496	240	0	4109
(1)	2.94	2.77	6.01	5.45	6.18	2.04	2.53	3.24	2.85	5.11	7.47	7.71	10.39	17.38	12.07	5.84	.00	100.00
(2)	1.43	1.34	2.91	2.64	2.99	.99	1.23	1.57	1.38	2.47	3.62	3.74	5.03	8.41	5.84	2.83	.00	48.42

(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 JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS E CLASS FREQUENCY (PERCENT) = 22.05

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	1	2	1	0	0	0	0	0	0	0	0	1	1	2	1	2	0	11
(1)	.05	.11	.05	.00	.00	.00	.00	.00	.00	.00	.00	.05	.05	.11	.05	.11	.00	.59
(2)	.01	.02	.01	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.02	.01	.02	.00	.13
C-3	22	14	19	22	17	12	18	13	27	31	39	50	81	48	45	27	0	485
(1)	1.18	.75	1.02	1.18	.91	.64	.96	.69	1.44	1.66	2.08	2.67	4.33	2.57	2.41	1.44	.00	25.92
(2)	.26	.16	.22	.26	.20	.14	.21	.15	.32	.37	.46	.59	.95	.57	.53	.32	.00	5.71
4-7	21	16	8	10	37	15	46	36	42	74	142	279	192	131	87	25	0	1161
(1)	1.12	.86	.43	.53	1.98	.80	2.46	1.92	2.24	3.96	7.59	14.91	10.26	7.00	4.65	1.34	.00	62.05
(2)	.25	.19	.09	.12	.44	.18	.54	.42	.49	.87	1.67	3.29	2.26	1.54	1.03	.29	.00	13.68
8-12	17	3	2	0	6	3	2	6	3	17	26	48	16	28	8	1	0	186
(1)	.91	.16	.11	.00	.32	.16	.11	.32	.16	.91	1.39	2.57	.86	1.50	.43	.05	.00	9.94
(2)	.20	.04	.02	.00	.07	.04	.02	.07	.04	.20	.31	.57	.19	.33	.09	.01	.00	2.19
13-18	1	0	0	1	4	0	0	0	2	5	2	1	0	1	0	0	0	17
(1)	.05	.00	.00	.05	.21	.00	.00	.00	.11	.27	.11	.05	.00	.05	.00	.00	.00	.91
(2)	.01	.00	.00	.01	.05	.00	.00	.00	.02	.06	.02	.01	.00	.01	.00	.00	.00	.20
19-24	0	0	0	4	0	0	0	0	1	3	0	0	0	0	0	0	0	8
(1)	.00	.00	.00	.21	.00	.00	.00	.00	.05	.16	.00	.00	.00	.00	.00	.00	.00	.43
(2)	.00	.00	.00	.05	.00	.00	.00	.00	.01	.04	.00	.00	.00	.00	.00	.00	.00	.09
GT 24	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
(1)	.00	.00	.00	.00	.16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.16
(2)	.00	.00	.00	.00	.04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04
ALL SPEEDS	62	35	30	37	67	30	66	55	75	130	209	379	290	210	141	55	0	1871
(1)	3.31	1.87	1.60	1.98	3.58	1.60	3.53	2.94	4.01	6.95	11.17	20.26	15.50	11.22	7.54	2.94	.00	100.00
(2)	.73	.41	.35	.44	.79	.35	.78	.65	.88	1.53	2.46	4.47	3.42	2.47	1.66	.65	.00	22.05

(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 JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS F CLASS FREQUENCY (PERCENT) = 7.78

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	2	0	1	1	0	1	0	0	0	0	0	1	2	1	2	0	0	11
(1)	.30	.00	.15	.15	.00	.15	.00	.00	.00	.00	.00	.15	.30	.15	.30	.00	.00	1.67
(2)	.02	.00	.01	.01	.00	.01	.00	.00	.00	.00	.00	.01	.02	.01	.02	.00	.00	.13
C-3	11	8	9	20	6	6	3	1	5	25	28	54	75	84	41	25	0	401
(1)	1.67	1.21	1.36	3.03	.91	.91	.45	.15	.76	3.79	4.24	8.18	11.36	12.73	6.21	3.79	.00	60.76
(2)	.13	.09	.11	.24	.07	.07	.04	.01	.06	.29	.33	.64	.88	.99	.48	.29	.00	4.72
4-7	4	2	0	0	5	2	0	1	2	3	20	69	39	40	48	12	0	247
(1)	.61	.30	.00	.00	.76	.30	.00	.15	.30	.45	3.03	10.45	5.91	6.06	7.27	1.82	.00	37.42
(2)	.05	.02	.00	.00	.06	.02	.00	.01	.02	.04	.24	.81	.46	.47	.57	.14	.00	2.91
8-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.15	.00	.00	.15
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.01
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	17	10	10	21	11	9	3	2	7	28	48	124	116	125	92	37	0	660
(1)	2.58	1.52	1.52	3.18	1.67	1.36	.45	.30	1.06	4.24	7.27	18.79	17.58	18.94	13.94	5.61	.00	100.00
(2)	.20	.12	.12	.25	.13	.11	.04	.02	.08	.33	.57	1.46	1.37	1.47	1.08	.44	.00	7.78

(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 JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS G CLASS FREQUENCY (PERCENT) = 6.41

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	1	0	0	0	0	0	0	0	0	0	1	3	2	0	0	0	8
(1)	.18	.18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.18	.55	.37	.00	.00	.00	1.47
(2)	.01	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	.04	.02	.00	.00	.00	.09
C-3	4	6	8	10	0	2	0	0	4	2	27	63	159	127	38	9	0	459
(1)	.74	1.10	1.47	1.84	.00	.37	.00	.00	.74	.37	4.96	11.58	29.23	23.35	6.99	1.65	.00	84.38
(2)	.05	.07	.09	.12	.00	.02	.00	.00	.05	.02	.32	.74	1.87	1.50	.45	.11	.00	5.41
4-7	0	1	0	0	1	0	0	0	0	2	6	12	11	24	18	2	0	77
(1)	.00	.18	.00	.00	.18	.00	.00	.00	.00	.37	1.10	2.21	2.02	4.41	3.31	.37	.00	14.15
(2)	.00	.01	.00	.00	.01	.00	.00	.00	.00	.02	.07	.14	.13	.28	.21	.02	.00	.91
8-12	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
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	5	8	8	10	1	2	0	0	4	4	33	76	173	153	56	11	0	544
(1)	.92	1.47	1.47	1.84	.18	.37	.00	.00	.74	.74	6.07	13.97	31.80	28.13	10.29	2.02	.00	100.00
(2)	.06	.09	.09	.12	.01	.02	.00	.00	.05	.05	.39	.90	2.04	1.80	.66	.13	.00	6.41

(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 JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

43.0 FT WIND DATA STABILITY CLASS ALL CLASS FREQUENCY (PERCENT) = 100.00

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	4	3	2	1	0	1	0	0	0	0	0	3	7	5	3	2	0	31
(1)	.05	.04	.02	.01	.00	.01	.00	.00	.00	.00	.00	.04	.08	.06	.04	.02	.00	.37
(2)	.05	.04	.02	.01	.00	.01	.00	.00	.00	.00	.00	.04	.08	.06	.04	.02	.00	.37
C-3	67	58	61	72	40	31	34	29	63	73	115	190	349	294	150	101	0	1727
(1)	.79	.68	.72	.85	.47	.37	.40	.34	.74	.86	1.36	2.24	4.11	3.46	1.77	1.19	.00	20.35
(2)	.79	.68	.72	.85	.47	.37	.40	.34	.74	.86	1.36	2.24	4.11	3.46	1.77	1.19	.00	20.35
4-7	90	74	82	132	229	86	130	130	112	188	307	559	477	453	355	173	0	3577
(1)	1.06	.87	.97	1.56	2.70	1.01	1.53	1.53	1.32	2.22	3.62	6.59	5.62	5.34	4.18	2.04	.00	42.15
(2)	1.06	.87	.97	1.56	2.70	1.01	1.53	1.53	1.32	2.22	3.62	6.59	5.62	5.34	4.18	2.04	.00	42.15
8-12	55	32	97	99	156	66	109	45	46	122	236	234	262	380	275	75	0	2289
(1)	.65	.38	1.14	1.17	1.84	.78	1.28	.53	.54	1.44	2.78	2.76	3.09	4.48	3.24	.88	.00	26.97
(2)	.65	.38	1.14	1.17	1.84	.78	1.28	.53	.54	1.44	2.78	2.76	3.09	4.48	3.24	.88	.00	26.97
13-18	3	8	67	38	32	7	11	5	14	36	39	23	79	213	129	15	0	719
(1)	.04	.09	.79	.45	.38	.08	.13	.06	.16	.42	.46	.27	.93	2.51	1.52	.18	.00	8.47
(2)	.04	.09	.79	.45	.38	.08	.13	.06	.16	.42	.46	.27	.93	2.51	1.52	.18	.00	8.47
19-24	3	1	12	13	14	1	0	0	1	8	4	2	8	40	5	3	0	115
(1)	.04	.01	.14	.15	.16	.01	.00	.00	.01	.09	.05	.02	.09	.47	.06	.04	.00	1.36
(2)	.04	.01	.14	.15	.16	.01	.00	.00	.01	.09	.05	.02	.09	.47	.06	.04	.00	1.36
GT 24	0	0	4	4	16	0	0	0	0	1	0	0	0	4	0	0	0	29
(1)	.00	.00	.05	.05	.19	.00	.00	.00	.00	.01	.00	.00	.00	.05	.00	.00	.00	.34
(2)	.00	.00	.05	.05	.19	.00	.00	.00	.00	.01	.00	.00	.00	.05	.00	.00	.00	.34
ALL SPEEDS	222	176	325	359	487	192	284	209	236	428	701	1011	1182	1389	917	369	0	8487
(1)	2.62	2.07	3.83	4.23	5.74	2.26	3.35	2.46	2.78	5.04	8.26	11.91	13.93	16.37	10.80	4.35	.00	100.00
(2)	2.62	2.07	3.83	4.23	5.74	2.26	3.35	2.46	2.78	5.04	8.26	11.91	13.93	16.37	10.80	4.35	.00	100.00

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SEABROOK JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA STABILITY CLASS A CLASS FREQUENCY (PERCENT) = 6.41

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	0	1	1	0	0	2	0	1	1	0	0	0	0	0	0	8
(1)	.19	.19	.00	.19	.19	.00	.00	.37	.00	.19	.19	.00	.00	.00	.00	.00	.00	1.50
(2)	.01	.01	.00	.01	.01	.00	.00	.02	.00	.01	.01	.00	.00	.00	.00	.00	.00	.10
4-7	1	0	2	2	7	5	4	0	3	3	2	3	6	2	4	0	0	44
(1)	.19	.00	.37	.37	1.31	.94	.75	.00	.56	.56	.37	.56	1.12	.37	.75	.00	.00	8.24
(2)	.01	.00	.02	.02	.08	.06	.05	.00	.04	.04	.02	.04	.07	.02	.05	.00	.00	.53
8-12	0	1	1	8	26	24	48	4	6	11	22	22	50	12	7	1	0	243
(1)	.00	.19	.19	1.50	4.87	4.49	8.99	.75	1.12	2.06	4.12	4.12	9.36	2.25	1.31	.19	.00	45.51
(2)	.00	.01	.01	.10	.31	.29	.58	.05	.07	.13	.26	.26	.60	.14	.08	.01	.00	2.92
13-18	1	1	4	7	7	6	28	12	9	10	27	17	30	22	6	0	0	187
(1)	.19	.19	.75	1.31	1.31	1.12	5.24	2.25	1.69	1.87	5.06	3.18	5.62	4.12	1.12	.00	.00	35.02
(2)	.01	.01	.05	.08	.08	.07	.34	.14	.11	.12	.32	.20	.36	.26	.07	.00	.00	2.25
19-24	0	0	2	1	2	1	6	1	2	3	4	3	11	5	2	0	0	43
(1)	.00	.00	.37	.19	.37	.19	1.12	.19	.37	.56	.75	.56	2.06	.94	.37	.00	.00	8.05
(2)	.00	.00	.02	.01	.02	.01	.07	.01	.02	.04	.05	.04	.13	.06	.02	.00	.00	.52
GT 24	0	0	0	0	1	0	1	0	0	1	1	0	4	1	0	0	0	9
(1)	.00	.00	.00	.00	.19	.00	.19	.00	.00	.19	.19	.00	.75	.19	.00	.00	.00	1.69
(2)	.00	.00	.00	.00	.01	.00	.01	.00	.00	.01	.01	.00	.05	.01	.00	.00	.00	.11
ALL SPEEDS	3	3	9	19	44	36	87	19	20	29	57	45	101	42	19	1	0	534
(1)	.56	.56	1.69	3.56	8.24	6.74	16.29	3.56	3.75	5.43	10.67	8.43	18.91	7.87	3.56	.19	.00	100.00
(2)	.04	.04	.11	.23	.53	.43	1.04	.23	.24	.35	.68	.54	1.21	.50	.23	.01	.00	6.41

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SEABROOK JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA STABILITY CLASS B CLASS FREQUENCY (PERCENT) = 4.06

WIND DIRECTION FROM

SPEED MPH	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	VRBL	TOTAL
CALM	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	1	1	0	0	0	0	0	1	2	0	1	0	1	0	0	7
(1)	.00	.00	.30	.30	.00	.00	.00	.00	.00	.30	.59	.00	.30	.00	.30	.00	.00	2.07
(2)	.00	.00	.01	.01	.00	.00	.00	.00	.00	.01	.02	.00	.01	.00	.01	.00	.00	.08
4-7	2	0	0	3	10	3	5	0	0	2	0	5	5	5	4	1	0	45
(1)	.59	.00	.00	.89	2.96	.89	1.48	.00	.00	.59	.00	1.48	1.48	1.48	1.18	.30	.00	13.31
(2)	.02	.00	.00	.04	.12	.04	.06	.00	.00	.02	.00	.06	.06	.06	.05	.01	.00	.54
8-12	1	1	2	15	21	19	8	1	2	4	9	14	22	17	12	7	0	155
(1)	.30	.30	.59	4.44	6.21	5.62	2.37	.30	.59	1.18	2.66	4.14	6.51	5.03	3.55	2.07	.00	45.86
(2)	.01	.01	.02	.18	.25	.23	.10	.01	.02	.05	.11	.17	.26	.20	.14	.08	.00	1.86
13-18	0	0	5	4	1	0	4	2	2	4	5	7	11	30	17	3	0	95
(1)	.00	.00	1.48	1.18	.30	.00	1.18	.59	.59	1.18	1.48	2.07	3.25	8.88	5.03	.89	.00	28.11
(2)	.00	.00	.06	.05	.01	.00	.05	.02	.02	.05	.06	.08	.13	.36	.20	.04	.00	1.14
19-24	0	0	0	0	0	1	0	0	0	0	3	1	10	8	8	0	0	31
(1)	.00	.00	.00	.00	.00	.30	.00	.00	.00	.00	.89	.30	2.96	2.37	2.37	.00	.00	9.17
(2)	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.04	.01	.12	.10	.10	.00	.00	.37
GT 24	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	5
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.59	.89	.00	.00	.00	1.48
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.04	.00	.00	.00	.06
ALL SPEEDS	3	1	8	23	32	23	17	3	4	11	19	27	51	63	42	11	0	338
(1)	.89	.30	2.37	6.80	9.47	6.80	5.03	.89	1.18	3.25	5.62	7.99	15.09	18.64	12.43	3.25	.00	100.00
(2)	.04	.01	.10	.28	.38	.28	.20	.04	.05	.13	.23	.32	.61	.76	.50	.13	.00	4.06

(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 JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA STABILITY CLASS C CLASS FREQUENCY (PERCENT) = 4.98

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	0	0	0	1	1	0	0	0	0	0	1	1	1	0	0	7
(1)	.24	.24	.00	.00	.00	.24	.24	.00	.00	.00	.00	.00	.24	.24	.24	.00	.00	1.69
(2)	.01	.01	.00	.00	.00	.01	.01	.00	.00	.00	.00	.00	.01	.01	.01	.00	.00	.08
4-7	2	1	3	3	9	8	3	2	3	1	4	5	4	7	6	5	0	66
(1)	.48	.24	.72	.72	2.17	1.93	.72	.48	.72	.24	.96	1.20	.96	1.69	1.45	1.20	.00	15.90
(2)	.02	.01	.04	.04	.11	.10	.04	.02	.04	.01	.05	.06	.05	.08	.07	.06	.00	.79
8-12	11	0	10	15	6	18	11	5	2	5	6	11	17	17	18	4	0	156
(1)	2.65	.00	2.41	3.61	1.45	4.34	2.65	1.20	.48	1.20	1.45	2.65	4.10	4.10	4.34	.96	.00	37.59
(2)	.13	.00	.12	.18	.07	.22	.13	.06	.02	.06	.07	.13	.20	.20	.22	.05	.00	1.87
13-18	1	3	7	5	3	0	3	1	2	3	10	8	20	38	26	1	0	131
(1)	.24	.72	1.69	1.20	.72	.00	.72	.24	.48	.72	2.41	1.93	4.82	9.16	6.27	.24	.00	31.57
(2)	.01	.04	.08	.06	.04	.00	.04	.01	.02	.04	.12	.10	.24	.46	.31	.01	.00	1.57
19-24	0	0	0	0	0	0	0	0	1	1	3	3	9	22	7	0	0	46
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.24	.24	.72	.72	2.17	5.30	1.69	.00	.00	11.08
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.01	.01	.04	.04	.11	.26	.08	.00	.00	.55
GT 24	0	0	0	0	3	0	0	0	0	0	0	1	2	2	1	0	0	9
(1)	.00	.00	.00	.00	.72	.00	.00	.00	.00	.00	.00	.24	.48	.48	.24	.00	.00	2.17
(2)	.00	.00	.00	.00	.04	.00	.00	.00	.00	.00	.00	.01	.02	.02	.01	.00	.00	.11
ALL SPEEDS	15	5	20	23	21	27	18	8	8	10	23	28	53	87	59	10	0	415
(1)	3.61	1.20	4.82	5.54	5.06	6.51	4.34	1.93	1.93	2.41	5.54	6.75	12.77	20.96	14.22	2.41	.00	100.00
(2)	.18	.06	.24	.28	.25	.32	.22	.10	.10	.12	.28	.34	.64	1.04	.71	.12	.00	4.98

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

SEABROOK JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA STABILITY CLASS D CLASS FREQUENCY (PERCENT) = 48.81

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	12	9	8	9	7	6	11	4	9	3	7	4	9	6	4	16	0	124
(1)	.30	.22	.20	.22	.17	.15	.27	.10	.22	.07	.17	.10	.22	.15	.10	.39	.00	3.05
(2)	.14	.11	.10	.11	.08	.07	.13	.05	.11	.04	.08	.05	.11	.07	.05	.19	.00	1.49
4-7	58	49	53	69	75	68	44	29	32	45	41	48	63	73	91	68	0	906
(1)	1.43	1.21	1.30	1.70	1.85	1.67	1.08	.71	.79	1.11	1.01	1.18	1.55	1.80	2.24	1.67	.00	22.29
(2)	.70	.59	.64	.83	.90	.82	.53	.35	.38	.54	.49	.58	.76	.88	1.09	.82	.00	10.88
8-12	83	37	61	67	39	54	48	77	50	95	123	128	130	211	164	83	0	1450
(1)	2.04	.91	1.50	1.65	.96	1.33	1.18	1.89	1.23	2.34	3.03	3.15	3.20	5.19	4.03	2.04	.00	35.67
(2)	1.00	.44	.73	.80	.47	.65	.58	.92	.60	1.14	1.48	1.54	1.56	2.53	1.97	1.00	.00	17.41
13-18	40	20	65	21	12	8	5	23	26	56	95	91	145	263	146	39	0	1055
(1)	.98	.49	1.60	.52	.30	.20	.12	.57	.64	1.38	2.34	2.24	3.57	6.47	3.59	.96	.00	25.95
(2)	.48	.24	.78	.25	.14	.10	.06	.28	.31	.67	1.14	1.09	1.74	3.16	1.75	.47	.00	12.67
19-24	3	14	27	17	23	1	1	6	6	16	17	9	59	138	53	11	0	401
(1)	.07	.34	.66	.42	.57	.02	.02	.15	.15	.39	.42	.22	1.45	3.39	1.30	.27	.00	9.86
(2)	.04	.17	.32	.20	.28	.01	.01	.07	.07	.19	.20	.11	.71	1.66	.64	.13	.00	4.81
GT 24	5	5	18	14	18	0	3	0	0	4	3	0	11	42	3	3	0	129
(1)	.12	.12	.44	.34	.44	.00	.07	.00	.00	.10	.07	.00	.27	1.03	.07	.07	.00	3.17
(2)	.06	.06	.22	.17	.22	.00	.04	.00	.00	.05	.04	.00	.13	.50	.04	.04	.00	1.55
ALL SPEEDS	201	134	232	197	174	137	112	139	123	219	286	280	417	733	461	220	0	4065
(1)	4.94	3.30	5.71	4.85	4.28	3.37	2.76	3.42	3.03	5.39	7.04	6.89	10.26	18.03	11.34	5.41	.00	100.00
(2)	2.41	1.61	2.79	2.37	2.09	1.64	1.34	1.67	1.48	2.63	3.43	3.36	5.01	8.80	5.53	2.64	.00	48.81

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SEABROOK JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA STABILITY CLASS E CLASS FREQUENCY (PERCENT) = 21.60

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	1	0	0	0	0	0	0	1	0	2
(1)	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	.00	.00	.00	.00	.00	.06	.00	.11
(2)	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00	.01	.00	.02
C-3	6	3	10	1	3	13	9	8	10	11	4	6	8	8	2	7	0	109
(1)	.33	.17	.56	.06	.17	.72	.50	.44	.56	.61	.22	.33	.44	.44	.11	.39	.00	6.06
(2)	.07	.04	.12	.01	.04	.16	.11	.10	.12	.13	.05	.07	.10	.10	.02	.08	.00	1.31
4-7	13	8	12	10	21	26	27	27	37	27	26	22	19	18	16	19	0	328
(1)	.72	.44	.67	.56	1.17	1.45	1.50	1.50	2.06	1.50	1.45	1.22	1.06	1.00	.89	1.06	.00	18.23
(2)	.16	.10	.14	.12	.25	.31	.32	.32	.44	.32	.31	.26	.23	.22	.19	.23	.00	3.94
8-12	40	17	5	9	5	3	23	47	48	73	118	167	123	134	63	40	0	915
(1)	2.22	.94	.28	.50	.28	.17	1.28	2.61	2.67	4.06	6.56	9.28	6.84	7.45	3.50	2.22	.00	50.86
(2)	.48	.20	.06	.11	.06	.04	.28	.56	.58	.88	1.42	2.01	1.48	1.61	.76	.48	.00	10.99
13-18	20	6	2	1	2	3	1	12	7	22	44	101	93	79	16	8	0	417
(1)	1.11	.33	.11	.06	.11	.17	.06	.67	.39	1.22	2.45	5.61	5.17	4.39	.89	.44	.00	23.18
(2)	.24	.07	.02	.01	.02	.04	.01	.14	.08	.26	.53	1.21	1.12	.95	.19	.10	.00	5.01
19-24	2	2	0	1	1	0	2	0	1	3	1	0	0	1	0	0	0	14
(1)	.11	.11	.00	.06	.06	.00	.11	.00	.06	.17	.06	.00	.00	.06	.00	.00	.00	.78
(2)	.02	.02	.00	.01	.01	.00	.02	.00	.01	.04	.01	.00	.00	.01	.00	.00	.00	.17
GT 24	0	0	0	4	5	0	0	0	2	3	0	0	0	0	0	0	0	14
(1)	.00	.00	.00	.22	.28	.00	.00	.00	.11	.17	.00	.00	.00	.00	.00	.00	.00	.78
(2)	.00	.00	.00	.05	.06	.00	.00	.00	.02	.04	.00	.00	.00	.00	.00	.00	.00	.17
ALL SPEEDS	81	36	29	26	37	45	62	94	106	139	193	296	243	240	97	75	0	1799
(1)	4.50	2.00	1.61	1.45	2.06	2.50	3.45	5.23	5.89	7.73	10.73	16.45	13.51	13.34	5.39	4.17	.00	100.00
(2)	.97	.43	.35	.31	.44	.54	.74	1.13	1.27	1.67	2.32	3.55	2.92	2.88	1.16	.90	.00	21.60

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SEABROOK JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA STABILITY CLASS F CLASS FREQUENCY (PERCENT) = 7.78

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	1	0	0	0	0	0	2
(1)	.00	.00	.15	.00	.00	.00	.00	.00	.00	.00	.00	.15	.00	.00	.00	.00	.00	.31
(2)	.00	.00	.01	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.02
C-3	4	6	4	4	6	4	3	3	2	3	5	3	2	2	0	3	0	54
(1)	.62	.93	.62	.62	.93	.62	.46	.46	.31	.46	.77	.46	.31	.31	.00	.46	.00	8.33
(2)	.05	.07	.05	.05	.07	.05	.04	.04	.02	.04	.06	.04	.02	.02	.00	.04	.00	.65
4-7	13	10	7	1	5	5	6	17	17	24	22	12	11	6	12	9	0	177
(1)	2.01	1.54	1.08	.15	.77	.77	.93	2.62	2.62	3.70	3.40	1.85	1.70	.93	1.85	1.39	.00	27.31
(2)	.16	.12	.08	.01	.06	.06	.07	.20	.20	.29	.26	.14	.13	.07	.14	.11	.00	2.13
8-12	13	14	2	0	1	3	3	9	12	25	42	41	42	46	29	28	0	310
(1)	2.01	2.16	.31	.00	.15	.46	.46	1.39	1.85	3.86	6.48	6.33	6.48	7.10	4.48	4.32	.00	47.84
(2)	.16	.17	.02	.00	.01	.04	.04	.11	.14	.30	.50	.49	.50	.55	.35	.34	.00	3.72
13-18	5	3	1	0	0	1	0	0	0	0	10	23	26	11	9	16	0	105
(1)	.77	.46	.15	.00	.00	.15	.00	.00	.00	.00	1.54	3.55	4.01	1.70	1.39	2.47	.00	16.20
(2)	.06	.04	.01	.00	.00	.01	.00	.00	.00	.00	.12	.28	.31	.13	.11	.19	.00	1.26
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	35	33	15	5	12	13	12	29	31	52	79	80	81	65	50	56	0	648
(1)	5.40	5.09	2.31	.77	1.85	2.01	1.85	4.48	4.78	8.02	12.19	12.35	12.50	10.03	7.72	8.64	.00	100.00
(2)	.42	.40	.18	.06	.14	.16	.14	.35	.37	.62	.95	.96	.97	.78	.60	.67	.00	7.78

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SEABROOK JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA STABILITY CLASS G CLASS FREQUENCY (PERCENT) = 6.36

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	4	1	2	5	1	1	1	2	5	3	3	2	7	6	3	6	0	52
(1)	.75	.19	.38	.94	.19	.19	.19	.38	.94	.57	.57	.38	1.32	1.13	.57	1.13	.00	9.81
(2)	.05	.01	.02	.06	.01	.01	.01	.02	.06	.04	.04	.02	.08	.07	.04	.07	.00	.62
4-7	7	5	8	5	2	7	6	9	20	22	26	15	18	9	12	17	0	188
(1)	1.32	.94	1.51	.94	.38	1.32	1.13	1.70	3.77	4.15	4.91	2.83	3.40	1.70	2.26	3.21	.00	35.47
(2)	.08	.06	.10	.06	.02	.08	.07	.11	.24	.26	.31	.18	.22	.11	.14	.20	.00	2.26
8-12	27	4	3	0	0	0	0	2	8	17	39	27	27	42	34	25	0	255
(1)	5.09	.75	.57	.00	.00	.00	.00	.38	1.51	3.21	7.36	5.09	5.09	7.92	6.42	4.72	.00	48.11
(2)	.32	.05	.04	.00	.00	.00	.00	.02	.10	.20	.47	.32	.32	.50	.41	.30	.00	3.06
13-18	3	1	0	0	0	0	0	0	0	0	2	6	10	3	6	4	0	35
(1)	.57	.19	.00	.00	.00	.00	.00	.00	.00	.00	.38	1.13	1.89	.57	1.13	.75	.00	6.60
(2)	.04	.01	.00	.00	.00	.00	.00	.00	.00	.00	.02	.07	.12	.04	.07	.05	.00	.42
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	41	11	13	10	3	8	7	13	33	42	70	50	62	60	55	52	0	530
(1)	7.74	2.08	2.45	1.89	.57	1.51	1.32	2.45	6.23	7.92	13.21	9.43	11.70	11.32	10.38	9.81	.00	100.00
(2)	.49	.13	.16	.12	.04	.10	.08	.16	.40	.50	.84	.60	.74	.72	.66	.62	.00	6.36

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SEABROOK JAN13-DEC13 MET DATA JOINT FREQUENCY DISTRIBUTION (210-FOOT TOWER)

209.0 FT WIND DATA STABILITY CLASS ALL CLASS FREQUENCY (PERCENT) = 100.00

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	1	0	0	1	0	0	0	1	0	4
(1)	.00	.00	.01	.00	.00	.00	.00	.00	.01	.00	.00	.01	.00	.00	.00	.01	.00	.05
(2)	.00	.00	.01	.00	.00	.00	.00	.00	.01	.00	.00	.01	.00	.00	.00	.01	.00	.05
C-3	28	21	25	21	18	25	25	19	26	22	22	15	28	23	11	32	0	361
(1)	.34	.25	.30	.25	.22	.30	.30	.23	.31	.26	.26	.18	.34	.28	.13	.38	.00	4.33
(2)	.34	.25	.30	.25	.22	.30	.30	.23	.31	.26	.26	.18	.34	.28	.13	.38	.00	4.33
4-7	96	73	85	93	129	122	95	84	112	124	121	110	126	120	145	119	0	1754
(1)	1.15	.88	1.02	1.12	1.55	1.46	1.14	1.01	1.34	1.49	1.45	1.32	1.51	1.44	1.74	1.43	.00	21.06
(2)	1.15	.88	1.02	1.12	1.55	1.46	1.14	1.01	1.34	1.49	1.45	1.32	1.51	1.44	1.74	1.43	.00	21.06
8-12	175	74	84	114	98	121	141	145	128	230	359	410	411	479	327	188	0	3484
(1)	2.10	.89	1.01	1.37	1.18	1.45	1.69	1.74	1.54	2.76	4.31	4.92	4.93	5.75	3.93	2.26	.00	41.83
(2)	2.10	.89	1.01	1.37	1.18	1.45	1.69	1.74	1.54	2.76	4.31	4.92	4.93	5.75	3.93	2.26	.00	41.83
13-18	70	34	84	38	25	18	41	50	46	95	193	253	335	446	226	71	0	2025
(1)	.84	.41	1.01	.46	.30	.22	.49	.60	.55	1.14	2.32	3.04	4.02	5.35	2.71	.85	.00	24.31
(2)	.84	.41	1.01	.46	.30	.22	.49	.60	.55	1.14	2.32	3.04	4.02	5.35	2.71	.85	.00	24.31
19-24	5	16	29	19	26	3	9	7	10	23	28	16	89	174	70	11	0	535
(1)	.06	.19	.35	.23	.31	.04	.11	.08	.12	.28	.34	.19	1.07	2.09	.84	.13	.00	6.42
(2)	.06	.19	.35	.23	.31	.04	.11	.08	.12	.28	.34	.19	1.07	2.09	.84	.13	.00	6.42
GT 24	5	5	18	18	27	0	4	0	2	8	4	1	19	48	4	3	0	166
(1)	.06	.06	.22	.22	.32	.00	.05	.00	.02	.10	.05	.01	.23	.58	.05	.04	.00	1.99
(2)	.06	.06	.22	.22	.32	.00	.05	.00	.02	.10	.05	.01	.23	.58	.05	.04	.00	1.99
ALL SPEEDS	379	223	326	303	323	289	315	305	325	502	727	806	1008	1290	783	425	0	8329
(1)	4.55	2.68	3.91	3.64	3.88	3.47	3.78	3.66	3.90	6.03	8.73	9.68	12.10	15.49	9.40	5.10	.00	100.00
(2)	4.55	2.68	3.91	3.64	3.88	3.47	3.78	3.66	3.90	6.03	8.73	9.68	12.10	15.49	9.40	5.10	.00	100.00

(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)

Enclosure 3

Radiation Dose Assessment

SEABROOK STATION
RADIOLOGICAL EFFLUENT IMPACT ASSESSMENT FOR 2013
(Annual Radioactive Effluent Release Report)

Prepared for

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Seabrook Station
Radiological Effluent Impact Assessment For 2013
(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 that 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	1.5 mrem	3 mrem
	Max. Organ	5 mrem	10 mrem
NOBLE GAS (10CFR50, APP. I)	Gamma Air	5 mrad	10 mrad
	Beta Air	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	---	25 mrem
	Thyroid		75 mrem

Technical Specification 6.8.1.4 and the Seabrook Offsite Dose Calculation Manual (ODCM) Part A, Section 10.2, provide 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 2013 were calculated in accordance with Method II as defined in the Station ODCM. 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 Iodine, Tritium, Carbon-14 and particulate radionuclides with half-lives greater than eight days, and maximum offsite beta air and gamma air doses from airborne noble gases. Calculated dose impacts from airborne effluents included atmospheric dispersion estimates utilizing concurrent meteorology recorded by the Station's on-site meteorological tower. In addition, the potential direct dose from fixed radiation

sources from both plant operations and dry fuel storage were 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 (per the ODCM) 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 (current public access to this location is restricted for security reasons).

All calculated liquid and gaseous pathway doses for the 2013 reporting period are well below the dose criteria of 10 CFR Part 50, 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 liquid and gaseous effluents and direct radiation from fixed plant and dry fuel storage sources was below the dose standards of 40 CFR Part 190.

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 multi-port 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 discharge nozzles for each 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 offshore. 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 the effluent 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 (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 (F) of the liquid effluent 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 in each of the sixteen principle compass directions of estimated highest off-site ground level air concentration of radioactive material, site boundary (or closest 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. 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/Qs 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^{γ}] (Reference 6) and the replacement of the undepleted X/Q in the infinite cloud dose equation by [X/Q^{γ}].

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 (Reference 4). 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, Carbon-14 and Particulates with T 1/2 Greater than 8 Days in Gaseous Releases

Regulatory Guide 1.109 (Reference 1) dose models are applied in the calculation of the critical organ doses from Iodines, Tritium, Carbon-14 and particulate radionuclides released into the atmosphere during the 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 & B.7.3.3 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) 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 2013 Annual Land Use Census as required by ODCM Control C.9.2.1 (see Table F). Conservatism in the dose estimates was maintained by assuming that the vegetable garden pathway was active at each milk animal location. 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.

In June 2009, the NRC issued Revision 2 of Regulatory Guide 1.21 (Reference 7) which introduced the term "principal radionuclide" in a risk informed or dose context. A radionuclide can be considered a principal radionuclide if it contributes either (1) greater than 1 percent of the 10 CFR Part 50, Appendix I design objective dose for all radionuclides in the type of effluent being considered, or (2) greater than 1 percent of the activity of all radionuclides in the type of effluent being considered. In addition to natural production in the environment, Carbon-14 is also produced in nuclear reactors as a function of power output, but at amounts much less than those generated naturally or from past weapons testing. Since the time of the earlier publication of Regulatory Guide 1.21 (Revision 1) in 1974, commercial nuclear power plants have decreased total radioactive effluents (other than Carbon-14) through improved fuel performance and waste management practices to the point today that Carbon-14 could be considered a principal radionuclide under today's definition, and therefore has been included in the assessment of dose to the public from gaseous effluent releases for 2013.

The primary exposure pathways associated with Carbon-14 include inhalation and ingestion of food products that have incorporated Carbon-14 (in the form of CO_2) via photosynthesis. A full year's consumption of food products are assumed to be grown from the highest impacted garden during the growing season (2^{nd} and 3^{rd} quarters). It is also assumed that the garden grows sufficient mass to support ingestion throughout the year (i.e., the annual dose to the individual is from consumption during all four quarters).

The maximum organ doses from all radionuclides in this category of gaseous effluents 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 at the location of the maximally exposed individual are reported in Table A.

The estimated organ doses from Iodines, Tritium, Carbon-14 and Particulates in gaseous effluents are well below the 10 CFR Part 50, Appendix I dose criteria for the reporting period. (See Table C for calculated dose as a percentage of annual limits.)

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 station fixed sources to the maximum receptor location. This includes the addition of spent fuel storage in a new Dry Fuel Storage (DFS) facility that began operations in July 2008 with the first transfer of spent fuel assemblies into storage arrays. A second transfer of spent fuel assemblies to the DFS occurred between August and September, 2013. The DFS facility is located on Seabrook Station property approximately 0.38 miles West-Southwest of the Unit 1 Containment Building. Since there are no other uranium fuel cycle facilities within five miles of Seabrook Station, 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 plant and dry fuel storage fixed sources, was 5.66E-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 2.39E-01 mrem.

Table B illustrates the total dose projections from all station sources to the maximum potential off-site individual for the year 2013 and demonstrates compliance with the EPA's environmental radiation standard for the uranium fuel cycle per 40 CFR Part 190. (See Table C for total dose as a percentage of annual limits.)

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 Program Manual: Offsite Dose Calculation Manual (ODCM), Revision 36.

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.

7. Regulatory Guide 1.21, Revision 2, "Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste", USNRC, June 2009.

Table A

Seabrook Station
2013 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] 2013
Liquid Effluents:					
Total Body Dose	3.89E-05 (1)	1.21E-05 (1)	5.40E-06 (1)	4.86E-05 (1)	1.05E-04
Max Organ Dose	4.50E-05 (2)	1.53E-05 (2)	7.98E-06 (2)	5.00E-05 (2)	1.18E-04
Airborne Effluents: Organ Dose from Carbon-14, Iodines, Tritium, and Particulates ($T_{1/2}$ > 8 days)	5.87E-02 (3)	5.99E-02 (3)	6.22E-02 (3)	5.77E-02 (3)	2.39E-01
Noble Gases Beta Air (mrad)	5.70E-07 (4)	3.94E-06 (5)	8.80E-07 (6)	3.29E-06 (7)	8.68E-06
Gamma Air (mrad)	9.97E-07 (4)	7.26E-06 (5)	2.15E-06 (6)	1.44E-05 (7)	2.48E-05
Direct Dose Offsite From Station Operation[e]					0
Doses (mrem) at Receptor Locations Inside Site Boundary[d]:					
Science and Nature Center (SW, 488m): Max Organ Dose (mrem)	4.42E-06	9.15E-06	8.53E-06	5.29E-06	2.74E-05
The "Rocks" (NE/ENE, 244m): Max Organ Dose (mrem)	2.76E-04	3.23E-04	8.31E-04	7.71E-04	2.20E-03

Table A (continued)

Seabrook Station
2013 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 critical receptor, where appropriate, based on the most limiting radionuclide dose contributor (C-14).

(1) Adult
(2) GI-LLI of an Adult
(3) Bone of a child, W 1315 m
(4) ESE 2276 m
(5) NNW 914 m
(6) ENE 2276 m
(7) E 2438 m.

(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"). The most limiting on-site location with respect to dose is estimated to be the "Rocks" area.

(e) Only station sources (both plant and dry fuel storage) are considered since there are no other fuel cycle facilities within five miles of Seabrook Station site. Dosimeter data collected in 2013 for the closest off-site environmental TLD locations in each sector (as listed in Tables B.4-1 and B.4-2 of Seabrook's ODCM) were compared to preoperational data for the same locations. No statistical difference above random background variability which could be attributed to station sources was identified.

Table B

Seabrook Station
2013 Annual Radioactive Effluent Release Report

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

Release Source	Total Body (mrem)	Maximum Organ[(a)] (mrem)
Liquids	1.05E-04	1.18E-04
Noble Gases	1.65E-05	1.65E-05
Gaseous Iodines, Tritium, C-14 & Particulates ($T_{1/2}$ > 8 days)	5.65E-02	2.39E-01
Direct Radiation	0	0
Annual Total	5.66E-02	2.39E-01

(a) Maximum organ includes consideration of the thyroid.

Table C

Seabrook Station
2013 Annual Radioactive Effluent Release Report

Calculated 2013 Maximum Doses versus Applicable Limits

Receptor	Applicable ODCM Control	ODCM Annual Limit		Calculated Annual (2013) Dose		Percent of Limit
Offsite						
Liquid Effluents						
Whole Body Dose	C.6.2.1	3	mrem	1.05E-04	mrem	0.0035%
Organ Dose	C.6.2.1	10	mrem	1.18E-04	mrem	0.0012%
Airborne Effluents						
Organ Dose (iodines, H-3, C-14 and part.)	C.7.3.1	15	mrem	2.39E-01	mrem	1.59%
Gamma Air Dose (noble gases)	C.7.2.1	10	mrad	2.48E-05	mrad	0.0002%
Beta Air Dose (noble gases)	C.7.2.1	20	mrad	8.68E-06	mrad	0.00004%
All Station Sources [a]						
Whole Body Dose	C.8.1.1	25	mrem	5.66E-02	mrem	0.226%
Organ Dose	C.8.1.1	25	mrem	2.39E-01	mrem	0.95%
Onsite (Science and Nature Center, 488m SW)						
Organ Dose (iodines, H-3, C-14 and part.)	C.7.3.1[b]	15	mrem	2.74E-05	mrem	0.00018%
Onsite (The "Rocks", 244m NE/ENE)						
Organ Dose (iodines, H-3, C-14 and part.)	C.7.3.1[b]	15	mrem	2.20E-03	mrem	0.0147%

(a) The "all station sources" doses are the sum of the whole body doses and maximum organ doses from liquid, noble gas, and gaseous iodines/tritium/carbon-14/particulate releases as well as direct radiation from fixed station sources (both plant facilities and dry fuel storage).

(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 & C.7.3.1) 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
2013 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
2013 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]	Atmospheric dispersion factor (non-depleted)	Calculated following Reg. Guide 1.111
$[X/Q]^D$	Atmospheric dispersion factor (depleted)	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

Table E (continued)

Seabrook Station
2013 Annual Radioactive Effluent Release Report

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

Factor	Definition	Source
F_m	Stable element transfer coefficient from feed to milk	Tables E-1 and E-2, Reg. Guide 1.109
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
2013 Annual Radioactive Effluent Release Report

Receptor Locations* for Seabrook Station

Sector	Nearest Resident km (miles)	Nearest Garden km (miles)	Milk Animals within 5 Mile Radius km (miles)
N	2.73 (1.69)	3.97 (2.47)	---
NNE	3.09 (1.92)	3.35 (2.08)	---
NE	2.92 (1.82)	4.20 (2.61)	---
ENE	2.31 (1.44)	2.44 (1.52)	---
E	2.56 (1.59)	---	---
ESE	2.43 (1.51)	---	---
SE	2.36 (1.46)	---	---
SSE	1.65 (1.02)	---	---
S	1.21(0.75)	1.25 (0.77)	---
SSW	1.12 (0.69)	1.22 (0.76)	---
SW	1.13 (0.70)	1.72 (1.07)	4.52 (2.81)
WSW	1.87 (1.16)	4.55 (2.83)	---
W	1.32 (0.82)	1.55 (0.97)	---
WNW	1.11 (0.69)	1.52 (0.94)	---
NW	1.22 (0.76)	1.27 (0.79)	6.93 (4.30)
NNW	1.04 (0.64)	1.18 (0.73)	---

* Locations based on 2013 Land Use Census.