ATTACHMENT 3

EVALUATION OF DRIFT DEPOSITION RATES
AT THE
VOGTLE ELECTRIC GENERATING PLANT

Prepared by Georgia Power Company

for submittal to

the U.S. Nuclear Regulatory Commission

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A. Assumptions

1. It is assumed that Susquehenna, Beaver Valley, Shearon Harris and Grand Gulf Power Plants have similar salt drift characteristics and meteorological conditions as VEGP. This position is based on the available information on cooling tower parameters (i.e., type of cooling tower, tower height, circulating flow rate) and annual average meteorological parameters (See Appendix 3). Other unknwon parameters that will affect salt drift deposition are further assumed to be the same.

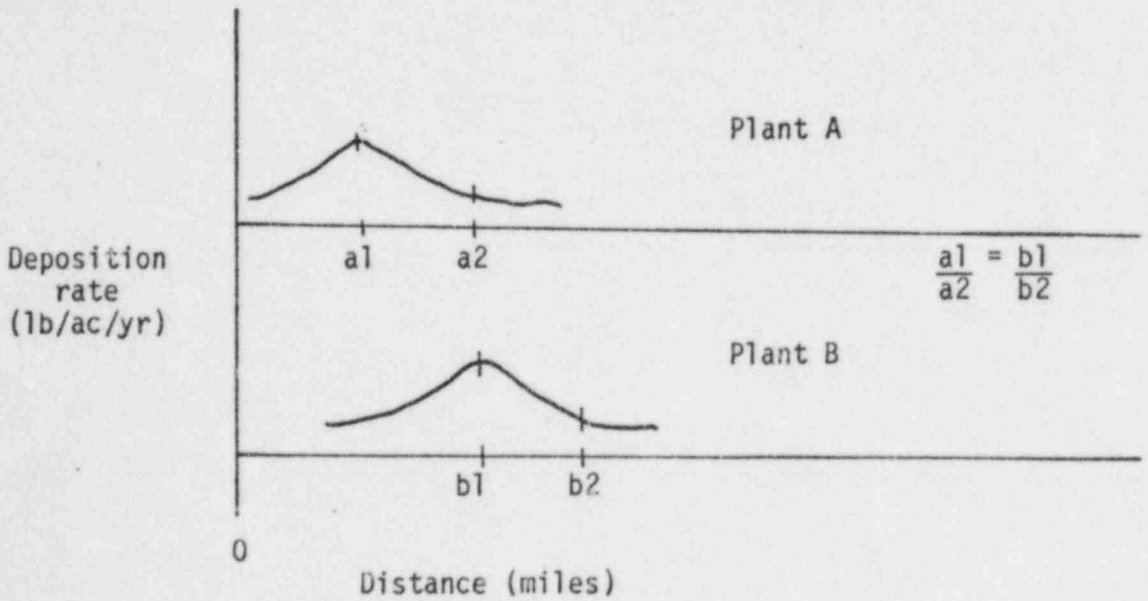
2. It is assumed that VEGP has the similar deposition patterns as the above mentioned four plants. On this basis the following should be true:

   (a) Peak depositions occurs at about the same distance in the predominant downwind direction for the cooling towers.

   (b) The relationship between peak deposition and decrease in deposition with distance is the same, and between two relatively close distances such relationship is linear.

   (c) Peak deposition rates are proportional to the emission rates and wind rose frequencies.

   (d) The ratio of distance at the peak deposition to the distance at a deposition other than the peak is equivalent. This relationship is illustrated below:



B. Original Estimate at VEGP

Emission Rate based on conservative design parameters:

Cooling Tower Units	= 2
Circulating Flow Rate	= 484,600 gpm
Drift Loss	= 0.03%
TDS in Makeup Water	= 76 mg/l
Cycles of Concentration	= 8
Operating Factor	= 0.8

Emission Rate (ER) from Each Tower:

$$ER = 484{,}600 \text{ gpm} \times 60 \text{ min/hr} \times 24 \text{ hr/d} \times 3.75 \text{ l/gal} \times 0.03\% \times (76 \text{ mg/l} \times 8) \times 10^{-6} \text{ kg/mg} \times 2.2 \text{ lb/kg}$$
$$= 1050 \text{ lb/d}$$
$$\text{Total ER} = 1040 \text{ lb/d} \times 2$$
$$= 2010 \text{ lb/d}$$

Deposition Rate based on uniform deposition within 1 mile radius:

$$Pu = \frac{2010 \text{ lb/d} \times 365 \text{ d/yr} \times 0.8}{(1 \text{ mile})^2 \times \pi \times 640 \text{ ac/mile}^2}$$

$$= 305 \text{ lb/ac/yr}$$

C. Revised salt drift emission rate for VEGP based on current expected operating conditions

Circulating Flow Rate	= 484,600 gpm
Drift Loss	= 0.008%
TDS in Makeup Water	= 60 mgl
Cycles of Concentration	= 4
Operating Factor	= 0.8
Units	= 2

Emission Rate from Each Tower:

$$ER = 484{,}600 \text{ gpm} \times 60 \text{ min/hr} \times 24 \text{ hr/d} \times 3.75 \text{ l/gal} \times 0.008\% \times (60 \text{ mg/l} \times 4) \times 10^{-6} \text{ kg/mg} \times 2.2 \text{ lb/kg}$$
$$= 110.5 \text{ lb/d}$$

Total Emission Rate

$$TER = 110.5 \text{ lb/d} \times 2 \text{ towers}$$
$$= 221 \text{ lb/d}$$

This is about 10% of the original estimated emission rate, mainly due to the reductions in drift loss, concentration factor and TDS in makeup water.

D. Estimated Peak Onsite Deposition Rates at VEGP (based on the ratio of the VEGP emission rate and wind rose frequency to those from the four power plants):

a) VEGP - Susquehanna

$$\frac{PVEGP}{3\ lb/ac/yr} = \frac{110.5\ lb/d/tower \times 2\ towers \times 12\%}{186\ lb/d/tower \times 2\ towers \times 14.5\%}$$

PVEGP = 1.5 lb/ac/yr

b) VEGP - Beaver Valley #1

(1) Based on Beaver Valley #1 ER-OLS

$$\frac{PVEGP}{80\ lb/ac/yr} = \frac{110.5\ lb/d/tower \times 2\ towers \times 12\%}{1050\ lb/d/tower \times 1\ tower \times 15.6\%}$$

PVEGP = 13 lb/ac/yr

(2) Based on Beaver Valley #2 ER-OLS
Total maximum deposition rate from 2 units = 9.9 lb/ac/yr

Emission ratio of Unit 1 to Unit 2

$$= \frac{1050\ lb/d - Unit\ 1}{286\ lb/d - Unit\ 2}$$

$$= 3.7$$

Therefore, the salt deposition contributed from Unit 1 is:

$$9.9\ lb/ac/yr \times \frac{3.7}{3.7+1} = 7.8\ lb/ac/yr$$

$$\frac{PVEGP}{7.8\ lb/ac/yr} = \frac{110.5\ lb/d/tower \times 2\ towers \times 12\%}{1050\ lb/d/tower \times 1\ tower \times 10.5\%}$$

PVEGP = 1.9 lb/ac/yr

c) VEGP - Beaver Valley #2

Salt deposition contributed from Unit 2 is:

9.9 lb/ac/yr - 7.8 lb/ac/yr = 2.1 lb/ac/yr

$$\frac{PVEGP}{2.1\ lb/ac/yr} = \frac{110.5\ lb/d/tower \times 2\ towers \times 12\%}{286\ lb/d/tower \times 1\ tower \times 10.5\%}$$

PVEGP = 1.9 lb/ac/yr

d) VEGP - Sheron Harris

(1) The daily salt emission based on 0.05% drift loss
= 1543 lb/d/tower

The corresponding peak deposition rate
= 100 lb/ac/yr per tower.

On this basis, the expected peak deposition at VEGP would be:

$$\frac{PVEGP}{100 \text{ lb/ac/yr}} = \frac{110.5 \text{ lb/d/tower} \times 2 \text{ towers} \times 12\%}{1543 \text{ lb/d/tower} \times 1 \text{ tower} \times 10.6\%}$$

PVEGP = 16.2 lb/ac/yr

(2) If based on the expected drift loss of 0.002% at Shearon Harris, the daily emission rate would be:

$$1543 \text{ lb/d/tower} \times \frac{0.002\%}{0.05\%} = 61.7 \text{ lb/d/tower}$$

The peak deposition rate would also reduce according to:

$$100 \text{ lb/ac/yr per tower} \times \frac{0.002\%}{0.05\%}$$

= 4 lb/ac/yr

On this basis the peak deposition rate at VEGP would be:

$$\frac{PVEGP}{4 \text{ lb/ac/yr}} = \frac{110.5 \text{ lb/d/tower} \times 2 \text{ towers} \times 12\%}{61.7 \text{ lb/d/tower} \times 1 \text{ tower} \times 10.6\%}$$

PVEGP = 16.2 lb/ac/yr

It can be seen that the peak deposition rate at VEGP would be 16.2 lb/ac/yr regardless of which drift loss for Shearon Harris is used, because with the reduction in drift loss the deposition rate at Shearon Harris would be reduced accordingly.

e) VEGP - Grand Gulf

$$\frac{PVEGP}{5.02 \text{ lb/ac/yr}} = \frac{110.5 \text{ lb/d/tower} \times 2 \text{ towers} \times 12\%}{1022 \text{ lb/d/tower} \times 2 \text{ towers} \times 9\%}$$

PVEGP = 0.7 lb/ac/yr

In summary, the peak deposition rate at VEGP ranges from 0.7 lb/ac/yr to 16.2 lb/ac/yr (for both units combined) in the predominent wind direction (SE) within 0.3 to 0.6 miles of the cooling towers with the possibility to reach as far as 0.9 miles from the cooling towers.

It should be noted that the earlier salt drift modeling (in early 70's) conducted at Beaver Valley #1 and Shearon Harris provides a peak deposition rate at VEGP between 13 to 16.2 lb/ac/yr, yet the recent modeling (late 70's and early 80's) at Susquehenna, Beaver Valley #2 and Grand Gulf provides a peak deposition rate at VEGP between 0.7 to 1.9 lb/ac/yr.

E. Estimated Offsite Peak Deposition Rates at VEGP (based on 2 deposition patterns from Susquehenna and Beaver Valley Units 1 and 2):

(1) The only available data on drift deposition patterns are provided by Susquehenna and Beaver Valley Unit 2. Susquehenna has a deposition pattern with two peaks and the maximum deposition occurs at 0.6 miles from the cooling towers in the predominant wind direction, whereas Beaver Valley Units 1 and 2 has a deposition pattern with one peak and it occurs at 0.9 miles from the cooling towers in the predominant wind direction (Appendix 2). Therefore by matching the deposition patterns with the locations of maximum deposition, there are four possibilities that could potentially be the case at VEGP:

Case 1: Following Susquehenna's deposition with maximum deposition at 0.6 miles from the cooling towers

Case 2: Following Susquehenna's deposition pattern with maximum deposition at 0.9 miles from the cooling towers

Case 3: Following Beaver Valley Unit 1 and 2's deposition pattern with maximum deposition at 0.9 miles from the cooling towers

Case 4: Following Beaver Valley Unit 1 and 2's deposition pattern with maximum deposition at 0.6 miles from the cooling towers.

The offsite peak deposition rates at VEGP would be estimated according to each case for three wind sectors: SE, NE and E. SE is the prodominant wind sector at VEGP, and the closest site boundaries with respect to cooling towers are in the NE and E wind sectors (Appendix 1).

(2) A sample calculation for Case 3 is presented below:

Case 3 - VEGP follows Beaver Valley Unit 1 and 2 Deposition Pattern with peak deposition at 0.9 miles from the cooling towers.

The deposition pattern from Beaver Valley Unit 1 and 2 has only one peak and the deposition beyond this peak would decrease with the increase in distance (Appendix 2).

(a) The peak deposition in the SE wind sector at VEGP would be 16.2 lb/ac/yr at 0.9 miles from the cooling towers. This peak would occur within the site boundary. The offsite peak deposition in this wind sector would occur just beyond the site boundary, approximately 1.0 mile from the cooling towers (Appendix 1).

Based on Appendix 2, the peak deposition for Beaver Valley Units 1 and 2 is at 0.9 miles E of the cooling towers and the predicted deposition of 5 lb/ac/yr in the same wind sector occurs about 1.75 miles from the cooling towers. Based on the Assumption 2(b) (page 1), the deposition rate at 1.0 mile E of the cooling towers would be:

$$9.9 \text{ lb/ac/yr} - \frac{9.9 \text{ lb/ac/yr} - 5 \text{ lb/ac/yr}}{1.75 \text{ miles} - 0.9 \text{ miles}} \times (1.0 \text{ mile} - 0.9 \text{ miles})$$

$$= 9.3 \text{ lb/ac/yr}$$

A fall off ratio of deposition rates between 0.9 miles and 1.0 mile at Beaver Valley Unit 1 and 2 is:

$$\frac{9.9 \text{ lb/ac/yr}}{9.3 \text{ lb/ac/yr}} = 1.1$$

Applying the same fall off ratio at VEGP, the deposition rate at 1.0 mile SE of the cooling towers would be:

$$16.2 \text{ lb/ac/yr} \times \frac{1}{1.1} = 14.7 \text{ lb/ac/yr}$$

Therefore, the offsite peak deposition at VEGP in the SE wind sector would be approximately 14.7 lb/ac/yr at 1.0 mile from the cooling towers, just beyond the site boundary.

(b) The peak deposition in the NE wind sector of VEGP would be:

Wind frequency in the NE wind sector = 6%
Wind frequency in the SE wind sector = 12%

$$\frac{16.2 \text{ lb/ac/yr}}{x} = \frac{12\%}{6\%}$$

$$x = 8.1 \text{ lb/ac/yr}$$

This peak would occur at 0.9 miles NE of the cooling towers, which is 0.5 miles beyond the site boundary (Appendix 1).

(c) The peak deposition in the E wind sector of VEGP would be:

Wind frequency in the E wind sector = 8.3%

$$\frac{16.2 \text{ lb/ac/yr}}{x} = \frac{12\%}{8.3\%}$$

$$x = 11.2 \text{ lb/ac/yr}$$

This peak would occur at 0.9 miles E of the cooling towers, which is about 0.3 miles beyond the site boundary (Appendix 1).

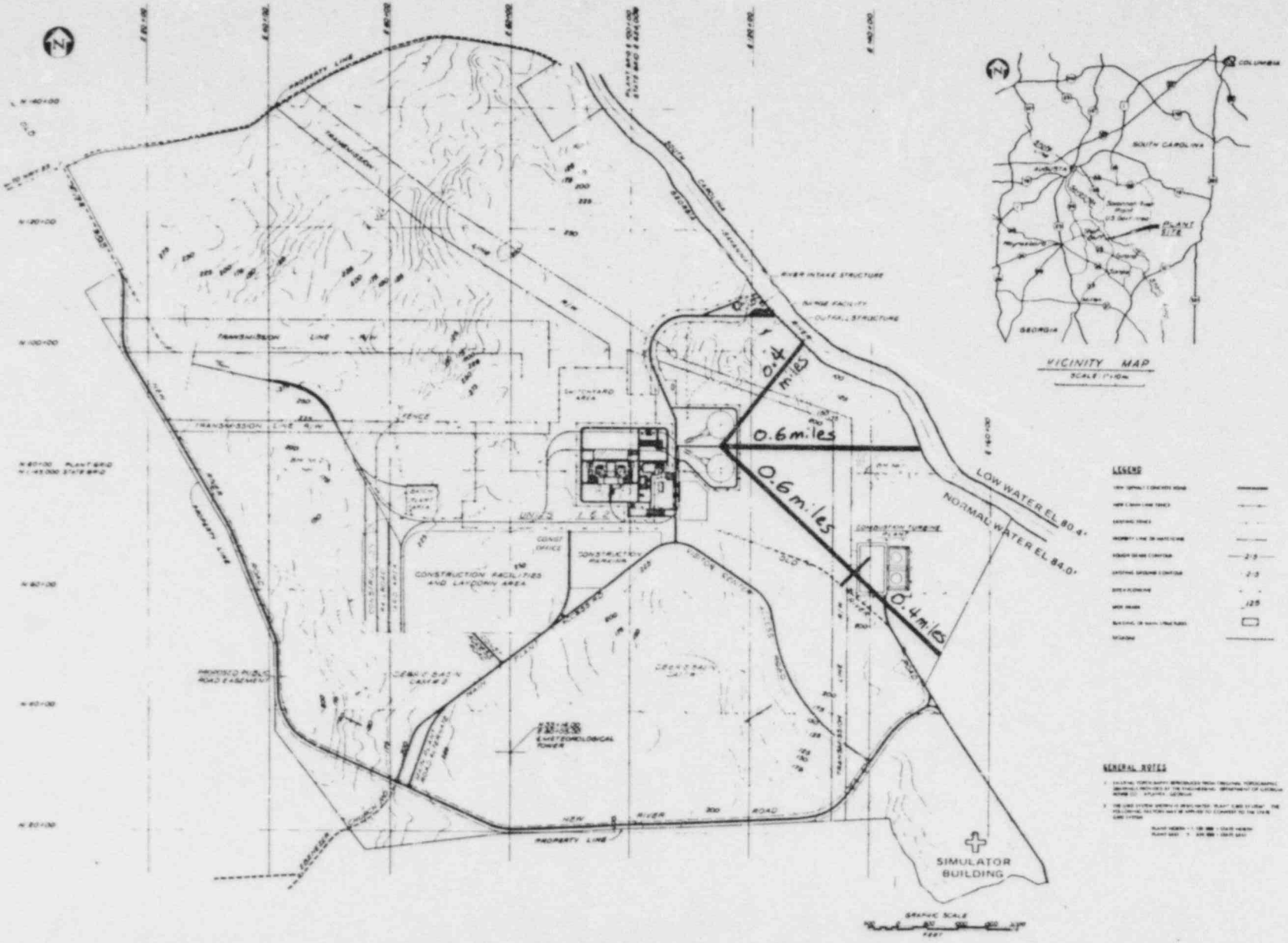
In summary, the off site peak deposition at VEGP, which follows Beaver Valley Unit 1 and 2's deposition pattern with the peak deposition at 0.9 miles from the cooling towers, would be approximately 14.7 lb/ac/yr at 1.0 miles SE of the cooling towers, immediately beyond the site boundary.

(3) Similar aproaches can be taken to calculate the other cases and Table 1 summarizes the offsite peak deposition based on the 4 cases described above. It can be noted from the table that the most conservative prediction for offsite peak deposition at VEGP would be provided by Case 3, having a deposition rate of about 14.7 lb/ac/yr at 1.0 mile SE of the cooling towers. However, even with this number the offsite peak deposition concentrations are expected to be below the guideline levels for vegetation damage provided by NUREG-0555 and Reg. Guide 4.11.

Table 1

Summary of Predictions of Offsite Peak Deposition Rates at VEGP

Parameter \ Case	1	2	3	4
Assumptions				
Location of the peak deposition from cooling towers (miles)	0.6	0.9	0.9	0.6
Deposition Patterns	Susquehanna	Susquehanna	Beaver Valley 2	Beaver Valley 1
Offsite Peak Deposition Expected	0.6 miles E of the CT	0.9 miles E of the CT	1.0 miles SE of the CT	0.6 miles E of the CT
Site Boundary in the Corresponding Direction	0.6 miles E of the CT	0.6 miles E of the CT	1.0 miles SE of the CT	0.6 miles E of the CT
Estimated Offsite Peak Deposition Rate (lb/ac/yr)	11.2	11.2	14.7	11.2



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Georgia Power	VOGTLE ELECTRIC GENERATING PLANT UNIT 1 AND UNIT 2	LOCATION AND VICINITY MAP

NOTE:

⊗ MAXIMUM VALUE OF 20,300 LB/ACRE/YR 4,000 FT EAST

East wind sector:mile	0.18	0.3	0.45	0.9	1.75	2.95
lb/ac/yr	1	3	5	9.9	5	3

0 0.5 1

SCALE-MILES

FIGURE 3B-5

ANNUAL WATER DEPOSITION (LB/ACRE/YR)

BEAVER VALLEY POWER STATION-UNIT 2
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

	Plant/ Type of Cooling Tower	Vogtle/ Natural Draft	Susquehenna/ Natural Draft	Beaver Valley/ Natural Draft Unit 1	Beaver Valley/ Natural Draft Unit 2	Shearon Harris/ Natural Draft	Grand Gulf/ Natural Draft
Max offsite drift deposition	Rate	15 lb/acre/yr [g]	3 lb/acre/yr [g]	NA	9.9 lb/acre/yr [g]	NA	5.02 lb/acre/yr [g]
	Distance from cooling tower	1.0 miles [i]	0.6 miles	NA	0.9 miles	NA	0.6 miles
	Wind sector deposited in	SE	SSW	NA	E	NA	E
Meteorological conditions, annual avg	Humidity	72%	70%	69% [e]	73.5% [f]	71%	76%
	Temperature	63.4°F	49°F	50.3°F	49.1°F	60°F	65.5°F
	Wind speed in predominant direction	6.6 miles/hr [b]	8.7 miles/hr	5.6 [b] miles/hr	6.6 [b] miles/hr	8.7 miles/hr	6.4 miles/hr [c]
	Frequency of dominant wind	12%	14.5%	15.6%	10.5%	10.6%	9.0%
	Dominant Pasquil stability class	E	D	E	D	E-F	D-E

a. Design maximum values were used in salt drift modeling.

b. Average wind speed in the dominant wind direction is not available, local average wind speed is applied. The actual wind speed is expected to be higher.

c. Wind speed has been adjusted from 33 ft to 150 ft by the following equation: $V/V = (Z/Z)$, with V = wind speed at a given level, Z = reference height, and P = 0.45.

d. Although droplet size distribution for Unit 1 cooling tower was not provided in the environmental reports, it is expected to be similar to that for Unit 2.

e. Based on the data collected onsite between September 5, 1969 to September 5, 1970.

f. Based on the data collected onsite between January 1, 1976 to December 31, 1980.

g. Deposition rate represents the contribution from both units.

h. The drift loss used in drift deposition modeling as indicated in the references.

i. The peak deposition will occur within 0.3 to 0.9 miles of the cooling tower.

j. Deposition rate represents the contribution from four units.

COOLING TOWER DRIFT PARAMETERS FOR VOGTLE AND FOUR OTHER PLANTS

Plant/ Type of Cooling Tower		Vogtle/ Natural Draft	Susquehenna/ Natural Draft	Beaver Valley/ Natural Draft Unit 1	Beaver Valley/ Natural Draft Unit 2	Shearon Harris/ Natural Draft	Grand Gulf/ Natural Draft
Number of cooling towers		2	2	1	1	4	2
Height of cooling tower		550 ft	540 ft	501 ft	501 ft	520 ft	522 ft
Drift Rate	Guaranteed	0.03%	0.02%	0.05% [h]	0.013% [h]	0.05% [h]	0.008% [h]
	Expected	0.008% [h]	0.002% [h]	0.005%	NA	0.002%	NA
Circulating water flow rate		484,600 gpm	478,000 gpm	480,400 gpm	507,400 gpm	482,000 gpm	572,000 gpm
Concentration in makeup		60 mg/l (avg)	432 mg/l [a] (max)	204 mg/l (avg)	203 mg/l (avg)	70 mg/l (avg)	376 mg/l (avg)
Concentration factor		4 (avg)	3.8 (avg)	1.8 (avg)	1.8 (avg)	7.7 (avg)	5 (max) [a]
Concentration in blowdown		240 mg/l (avg)	1640 mg/l (max)	368 mg/l (avg)	365 mg/l (avg)	539 mg/l (avg)	1880 mg/l [a] (max)
Evaporation rate		3.0%	2.3%	1.5%	2.0%	1.5%	1.8%
Plant capacity		0.8	0.8	0.8	0.8	0.8	0.8
Droplet size distribution	100	45%	20%	NA	35%	NA	45%
	100-300	50%	70%	NA [d]	65%	NA	55%
	300	5%	10%	NA	0%	NA	0%
	Rate	17 lb/acre/yr [g]	3 lb/acre/yr [g]	80 lb/acre/yr	3 lb/acre/yr	400 lb/acre/yr [i]	NA
Max onsite drift deposition	Distance from CT	0.9 miles [i]	0.6 miles	0.3 miles	0.75 miles	0.3 miles	NA
	Wind sector deposited in	SE	NE	SE	SW	SW	NA