UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
GEORGIA POWER COMPANY, *et al*.	)	Docket Nos. 50-424
	)	50-425
	)	
(Vogtle Electric Generating Plant, Units 1 and 2)	)	

AFFIDAVIT OF NORA A. BLUM

County of Los Angeles)
)
State of California)

I, Nora A. Blum, being duly sworn according to law, depose and say as follows:

1. My name is Nora A. Blum. I am employed by Bechtel Power Corporation in the position of Engineering Supervisor. My business address is Bechtel Power Corporation, 12440 East Imperial Highway, Norwalk, California 90650. Attached to this affidavit as Exhibit A is a summary of my professional qualifications.

2. The purpose of this affidavit is to support the Applicants' Motion for Summary Disposition of Joint Intervenors' Contention 12, which concerns salt and chlorine gas emitted from the natural draft cooling towers at the Vogtle Electric Generating Plant ("VEGP") as part of the drift from those towers. In this affidavit I will

describe estimates prepared by Bechtel Power Corporation ("Bechtel") on behalf of the Applicants of the drift deposition rate for the VEGP natural draft cooling towers and the expected environmental effects of drift deposition from those towers. I have personal knowledge of the matters set forth herein and believe them to be true and correct.

I. <u>Estimates of Drift Deposition for VEGP Developed Using a Bounding Technique.</u>

3. The Applicants first estimated the drift deposition rate for the VEGP natural draft cooling towers at the construction permit stage, as reported in section 5.3.2 of the Construction Permit Stage Environmental Report ("CP-ER") and discussed in paragraphs 15 through 19 of the Affidavit of Daniel H. Warren. In reviewing the Operating License Stage Environmental Report ("OL-ER") submitted by the Applicants, the Nuclear Regulatory Commission ("NRC") staff raised questions about that initial estimate. OL-ER, NRC Questions E290.3 and E451.17.

4. In response, the Applicants, through their contractor Bechtel Power Corporation, the architect and engineer for the VEGP project, reassessed the amount of drift deposition that would result from the operation of the natural draft cooling towers at VEGP. The Applicants then estimated the maximum on-site and off-site deposition rates for the VEGP cooling towers by using a bounding

methodology that utilized drift deposition rates estimated for other plants having similar cooling towers and located in similar meteorological environments to predict a conservative range of drift rates that could be expected at VEGP.

5. Initially, the Applicants identified four other plants for which modeling studies had been performed of cooling tower drift deposition rates and that had cooling towers with a similar design and operating characteristics to the VEGP cooling towers. Those four projects were Shearon Harris 1-4, Grand Gulf 1 and 2, Susquehanna 1 and 2, and Beaver Valley 1.

6. Using the drift deposition rates estimated for each of those plants, the Applicants sought to predict a maximum on-site drift deposition rate for VEGP based upon the ratio of the VEGP emission rate and wind rose frequency to those from each of the four plants. Those calculations produced a range of four deposition rates, of which the Applicants used the highest, which was 31 pounds per acre per year. The Applicants used the highest drift deposition rate produced by extrapolating modeling results from other plants to VEGP in order to bound the actual drift deposition rate that would be experienced at VEGP.

7. The same procedure was used to obtain a predicted maximum off-site drift deposition rate for VEGP of 21 pounds per acre per year, although the comparison was made

only with estimated deposition rates for Susquehanna 1 and 2, the only plant for which extensive deposition pattern information was available at that time. That off-site drift deposition rate was the highest of a range of three rates calculated for each of three different wind directions. These estimated off-site and on-site drift deposition rates were presented to the NRC staff in February 1984. OL-ER, Response to NRC Question E451.17.

8. In response to a subsequent question from the NRC staff concerning the calculation of these new estimated on-site and off-site drift deposition rates, the Applicants further revised those estimates to a maximum on-site rate of 17 pounds per acre per year and an off-site rate of 15 pounds per acre per year. OL-ER, Response to NRC Question E290.8. Those lower estimates resulted from a reduction in the expected drift rate for the VEGP cooling towers from 0.015% to 0.008% and the use of deposition pattern information from an additional plant, Beaver Valley 1 and 2.

9. In deriving its initial estimates of the maximum drift rate for VEGP using the bounding methodology, the Applicants had calculated the emission rate for the VEGP cooling towers using a drift rate of 0.015%, which was the expected drift rate set out in the 1973 contract proposal of Custodis-Cottrell (formerly Research-Cottrell), the supplier of the VEGP natural draft cooling towers. The

rates of 17 pounds per acre per year on-site and 15 pounds per acre per year off-site were determined on the basis of information received by the Applicants from Custodis-Cottrell in May 1984 advising them that 0.008% was a more realistic estimate of the expected drift rate for the VEGP cooling towers. The other factor causing the reduction in the estimated deposition rates was the use of predicted deposition rates and deposition pattern information from Beaver Valley 1 and 2 combined, which information had not been available when the Applicants first responded to the NRC staff's questions.

10. Using the same bounding methodology described above, the Applicants calculated for VEGP a maximum on-site drift deposition rate of 17 pounds per acre per year and a maximum off-site drift deposition rate of 15 pounds per acre per year. As with the prior estimates, the estimated maximum rates of 17 pounds per acre per year on-site and 15 pounds per acre per year off-site represent the highest of a range of figures calculated by comparing VEGP to other similar plants. The method by which the Applicants determined these estimated deposition rates is described in greater detail in the report attached to this affidavit as Exhibit B, which was submitted to the NRC staff in September 1984 as Attachment 3 to a letter from Mr. D.O. Foster of Georgia Power Company to Ms. Elinor G. Adensam, dated September 25, 1984.

11. The bounding methodology by which the Applicants derived the estimates described above did not entail actually modeling the drift deposition from the VEGP cooling towers, and that methodology was not intended to predict accurately for all conditions the salt drift deposition rates that will actually be experienced by the VEGP cooling towers. Instead, that methodology was intended to derive an estimate that would very likely exceed, and therefore provide an upper bound for, the maximum deposition rates that would be experienced at VEGP. The results of the subsequent computerized modeling study performed by NUS Corporation for the VEGP cooling towers, which is described in paragraphs 9 through 27 of the Affidavit of Morton I. Goldman, demonstrate that the Applicants' prior drift deposition estimates were overly conservative.

II. The Expected Environmental Effects of Drift Deposition from the VEGP Natural Draft Cooling Towers.

A. Scientific Studies Addressing the Effects of Salt and Cooling Tower Drift on Vegetation Have Not Found Any Harm to Be Caused to Vegetation by Salt in the Amounts that Will Be Emitted as Part of the Drift from the VEGP Natural Draft Cooling Towers.

1. The Chalk Point Studies.

12. While many studies have examined the potential damage to vegetation caused by soil salinity or salt aerosols, the most comprehensive information available for an

area climatologically similar to VEGP results from a major study conducted at Chalk Point in Maryland concerning the effects of cooling tower drift on crops and native vegetation. The Chalk Point study included controlled field experiments on soil, vegetation, and crops to determine the impact of drift deposition from an operating natural draft cooling tower using brackish makeup water. The published reports concerning the Chalk Point study provide a good basis for evaluating the potential impact upon vegetation of salt drift from the VEGP natural draft cooling towers because of the similarities in climatic conditions and soil types between the two sites. The drift deposition rates experienced at Chalk Point would be much higher than the drift deposition rate estimated for VEGP since Chalk Point uses brackish makeup water while VEGP will use fresh water.

13. Table 12-4 presents a general meteorological comparison of VEGP and Chalk Point. The parameters listed have been found to affect either foliar salt uptake or accumulation of salt in the soil. M. Simini and I. A. Leone, "Effect of Photoperiod, Temperature, and Relative Humidity on Chloride Uptake of Plants Exposed to Salt Spray," Phytopathology, 72:1163-1166, 1982. The major type of soil found at the VEGP site falls into the Lakeland Series, which is classified as a loamy sand. Construction Permit Stage Final Environmental Statement

("CP-FES"), at 2-30 to -31. The most representative types of soil found at Chalk Point are Lakeland loamy sand, Sassafras sandy loam, and Sassafras loam. R.W. McCormick. D.C. Wolf, G. McClung & J.E. Foss, "Movement of NaCl Through Three Soil Profiles and Its Effect on Soil Chemical Properties," in Cooling Tower Environment - 1978, Power Plant Siting Program - Chalk Point Cooling Tower Project ("PPSP-CPCTP)-22, Water Resources Research Center ("WRRC") Special Report No. 9, May 1978, pp. 111-130. Figure 12-9 is a generalized soil map of the United States and categorizes both Chalk Point and VEGP as "Ula," which is Aqualt or Wet Utisol.

14. In addition to the similarities between meteorological conditions and soil types at VEGP and Chalk Point, several types of vegetation studied in the Chalk Point experiments are found in the vicinity of VEGP. Among the types of vegetation studied at Chalk Point were corn, soybeans, dogwood, and grains, all of which are present in the area around VEGP. ER-OL § 2.1 and 2.2. Communication from Burke County Soil Conservation Service, 1983.

15. None of the studies performed at Chalk Point found any harm to vegetation from drift deposition rates in the range of the rates estimated by the Applicants for VEGP by using the bounding methodology described in paragraphs 3 through 11 above, much less the substantially lower rates estimated by the NUS Corporation's modeling

study for VEGP described in the Affidavit of Morton I. Goldman. For example, the field experiments from Chalk Point indicated that significant increases in leaf Na+ and Cl- levels occurred in corn at a deposition rate of 45 pounds per acre per year and in soybeans at a rate of 90 pounds per acre per year. A statistically significant yield reduction for both corn and soybeans occurred at a level of 319 pounds NaCl per acre per year. J.A. Armbruster, "Cooling Tower Effects on Crops and Soils; Response of Corn (Zea Mays L.) and Soybeans (Glycine Max L. Merr.) to Saline Aerosol Drift from Brackish Water Cooling Towers," Chalk Point Cooling Tower Project, Water Resources Research Center, University of Maryland, PPSP-CPCTP-31, WRRC Special Report 13, October, 1979 at pp. 43-49. Experiments on native tree species found that at a deposition rate of 59 pounds per acre per year leaf marginal necrosis was found only in dogwoods. C.R. Curtis, B.A. Francis, and T.L. Lauver, "Dogwood as a Bioindicator Species for Saline Drift," in Cooling Tower Environment - 1978, PPSP-CPCTP-22, WRRC Special Report No. 9, May, 1978, pp. 65-77; B.A. Francis, "Effects of Simulated Cooling Tower Drift on Woody Species," PPSP-CPCTP-17, WRRC Special Report No. 5, July 1977, pp. 38-43.

16. The Chalk Point experiments also demonstrated that drift deposition rates substantially higher than

those predicted for VEGP would be necessary to cause accumulation of salts in the soil. Soil studies performed at Chalk Point found that a salt (NaCl) deposition rate of 1070 pounds per acre per year could result in some accumulation of salts in the tested soils. Other experiments have shown that smaller deposition rates cause no salt accumulation in the soil, and the Chalk Point studies reported that deposition rates of less than 1070 pounds per acre per year did not cause sufficient salt accumulation in the soil to affect yields for corn and soybeans. B.A. Francis, "Effects of Simulated Cooling Tower Drift on Woody Species," PPSP-CPCTP-17, WRRC Special Report No. 5, July, 1977 at pp. 6-11, 37, 66; R.W. McCormick, D.C. Wolf, G. McClung & J.E. Foss, "Movement of NaCl Through Three Soil Profiles and Its Effect on Soil Chemical Properties," in Cooling Tower Environment - 1978, PPSP-CPCTP-22, WRRC Special Report No. 9, May 1978, pp. 111-130; E.A. Davis, "Environmental Assessment of Chalk Point Cooling Tower Drift and Vapor Emissions," Chalk Point Cooling Tower Project, Johns Hopkins University Applied Physics Laboratory, PPSP-CPCTP-28, March 1979 at p. VI-4.

17. Table 12-5 depicts in greater detail some of the results found in the Chalk Point studies. All of the drift deposition rates found to cause harm to vegetation in those studies greatly exceed the maximum drift deposition rate of less than three pounds per acre per year

predicted for the VEGP cooling towers by the NUS Corporation's FOG model, including the additions to the drift resulting from chlorination.

2. Other Studies.

18. A number of other studies of the effects of salt on vegetation have also been performed. While not representative of the conditions under which vegetation around the VEGP natural draft cooling towers would be exposed to salt drift, those studies involving plant species found near VEGP do have some value in demonstrating a dose-response relationship. Many of those experiments were conducted under temperature and humidity conditions that were higher than the conditions generally found at VEGP. Higher temperature and humidity conditions have been found to result in greater vegetation damage from salt. M. Simini and I. A. Leone, "Effect of Photoperiod, Temperature, and Relative Humidity on Chloride Uptake of Plants Exposed to Salt Spray," Phytopathology, 72:1163-1166, 1982. Therefore, the results obtained in these studies can be used to establish bounding conditions for expected damage to the vegetation surrounding VEGP from salt drift. Table 12-6 summarizes the results of those studies.

3. Expected Effects of Cooling Tower Drift Upon Vegetation At VEGP.

19. Figure 12-10 summarizes the data available from field and greenhouse studies concerning the amount of

drift necessary to cause various levels of damage to several plant species similar to those found in the vicinity of VEGP. This data represents the results of a wide variety of experimental conditions, including the cooling tower drift studies performed at Chalk Point.

20. For both crops and native trees, the predicted maximum drift deposition rate for VEGP of less than three pounds per acre per year (including the additions from chlorination) is well below the lowest reported values for leaf damage as well as the highest reported values for no effects. This conclusion applies to both total dissolved solids and NaCl.

21. The potential for damage to vegetation in the vicinity of VEGP from cooling tower drift would be even less than that indicated in Figure 12-10. The experimental results summarized in Figure 12-10 in many instances did not take into account the effect of rainfall, which would further dilute and prevent the accumulation of salt on plant foliage or in the soil. Also, the nearest land currently being cultivated is at a distance of 1.5 miles from the VEGP cooling towers (Communication from Burke County Soil Conservation Service, 1983), at which distance the drift deposition rate would be significantly less than the predicted maximum rate of less than three pounds per acre per year. Therefore, the available

scientific literature fully supports the Applicants' position that the operation of the natural draft cooling towers at VEGP will have no adverse impact on the surrounding environment.

Nora A. Blum

Nora A. Blum

Sworn to and subscribed before me this 10th day of July, 1985.

Joanne E. Henry

Notary Public

OFFICIAL SEAL
JOANNE E HENRY
NOTARY PUBLIC - CALIFORNIA
LOS ANGELES COUNTY
My comm. expires NOV 22, 1985

Table 12-4

Meteorological Comparison of Chalk Point and VEGP

PARAMETER (Annual Average)	VEGP(1)	CHALK POINT(2)
Data Collection Period	1941-1970	1976-1977
Temperature	63°F	56°F
Humidity	72%	61%
Rainfall	43 in/yr	41 in/yr(3)
Monthly Rainfall During Growing Season	19.6 in.	21.3 in.(3)
May	3.39	3.87
June	3.66	3.44
July	5.09	4.93
August	4.21	4.19
September	3.26	3.89

References:

1. Georgia Power Company, "Vogtle Electric Generating Plant, Unit 1 and Unit 2 - Final Safety Analysis Report," Vol. 3, Section 2.3, Table 2.3.2-1.

2. Davis, E. A., "Chalk Point Cooling Tower Project, Environmental Assessment of Chalk Point Cooling Tower Drift and Vapor Emissions," Report No. PPSP-CPCTP-28, prepared by Johns Hopkins University, Applied Physics Laboratory, March 1979, p. II-8.

3. Long-term averages from Mulchi, C. L. and J. A. Armbruster, "Response of Corn and Soybeans to Simulated Saline Aerosol Drift from Brackish Water Cooling Towers," J. Environmental Quality, Vol. 10, No. 4, October - December 1981.

Table 12-5
Chalk Point Studies
Part A - Vegetation

Plant	Equivalent Deposition Rate	Source of Salt Spray	Water Quality (TDS)	Experimental Conditions	Experimental Period	Results	Reference No.
Corn	45 lb/ac/yr (≈4 kg/ha/mo)	Brackish Cooling Tower Basin Water (CTBW)	11,300 ppm (Na^+ = 27%, Cl^- = 58%)	Field experiment	8 weeks	Under the study conditions, this is the minimum exposure levels to produce significant increase in leaf Na and Cl levels.	1
Corn	319 lb/ac/yr (≈30 kg/ha/mo)	Simulated NaCl Solution	NaCl Solution	Field experiment	8 weeks	25% yield reduction. This is the minimum dose level in the study to cause statistically significant yield reduction (P=0.05).	1
Soybean	90 lb/ac/yr (≈8 kg/ha/mo)	Brackish CTBW	11,300 ppm (Na^+ = 27%, Cl^- = 58%)	Field experiment	8 weeks	The minimum exposure level to produce significant increase in leaf Na and Cl levels.	1
Soybean	319 lb/ac/yr (≈30 kg/ha/mo)	Simulated NaCl Solution	NaCl Solution	Field experiment	8 weeks	The minimum exposure levels to produce statistically significant yield reduction by 13% (P=0.05).	1
Corn Soybean Wheat Barley	3 lb/ac/yr of Na^+ 6 lb/ac/yr of Cl^-	Cooling Tower Salt Drift	19,500 ppm (nominal value)	Field sampling of crops grown post-operation	1 growing season	No adverse vegetation damage or yield reduction due to salt deposition.	7
Dogwood Norway Spruce White Ash Tulip Tree Virginia Pine Calif. Privet	59 lb/ac/yr (≈5.58 kg/ha/mo)	Brackish CTBW	10,200 ppm (NaCl=92.7%)	Field experiment	59 days	Increase in leaf Cl^- concentration and some marginal necrosis found only in Dogwood.	2, 4
Dogwood Virginia Pine Tulip Tree Calif. Privet	79 lb/ac/yr (≈7.46 kg/ha/mo)	Brackish CTBW	13,900 ppm (NaCl=94%)	Field experiment	35 days	Increase in leaf Cl^- concentration and some marginal necrosis found only in Dogwood.	2, 4
Dogwood	210 lb/ac/yr (≈20 kg/ha/mo)	Simulated NaCl Solution	20,000 ppm	Field experiment	58 days	Severe leaf marginal necrosis.	2

Table 12-5 (Continued)
Part B - Soil

Soil Type	Equivalent Deposition Rate	Results	Reference No.
Loamy Sand Loam Sandy Loam	1070 lb/ac/yr (=100 kg/ha/mo)	Causes some accumulation of Na^+ in the soil. Less than this level causes no accumulation in the soil.	4, 6
Lakeland Loamy Sand	89 lb/ac (=100 kg/ha)	An increase in the soil exchangeable Na^+ content, but soluable salt levels return to normal in one month after treatment. Less than this level in the soil has no effect on yields of corn and soybeans.	3, 6
Chalk Point Soil Samples	>2500 ppm of NaCl in the soil	Inhibited microbial respiration.	5
	>5000 ppm of NaCl in the soil	Inhibited nitrification.	5

References for Table 12-5

1. Armbruster, J. A., "Cooling Tower Effects on Crops and Soils; Response of Corn (Zea Mays L.) and Soybeans (Glycine Max L. Merr.) to Saline Aerosol Drift from Brackish Water Cooling Towers," Chalk Point Cooling Tower Project, Water Resources Research Center, University of Maryland, PPSP-CPCTP-31, WRRC Special Report 13, October, 1979.

2. Curtis, C. R.; Francis, B. A.; and Lauver, T. L., "Dogwood as a Bioindicator Species for Saline Drift," in Cooling Tower Environment - 1978, PPSP-CPCTP-22, WRRC Special Report No. 9, May, 1978, pp. 65-77.

3. Davis, E. A., "Environmental Assessment of Chalk Point Cooling Tower Drift and Vapor Emissions," Chalk Point Cooling Tower Project, Johns Hopkins University Applied Physics Laboratory, PPSP-CPCTP-28, March, 1979.

4. Francis, B. A., "Effect of Simulated Cooling Tower Drift on Woody Species," PPSP-CPCTP-17, WRRC Special Report No. 5, July, 1977.

5. McCormick, R. W., and Wolf, D. C., 1976 "Effect of NaCl on Soil Microbiological Properties." In Cooling Tower Effects on Crops and Soils, Preoperational Report Appendix, PPSP-CPCTP-6, WRRC Special Report No. 1, April 1976, pp 77-79.

6. McCormick, R. W., D. C. Wolf, G. McClung & J. E. Foss, "Movement of NaCl through Three Soil Profiles and Its Effect on Soil Chemical Properties," in Cooling Tower Environment - 1978, PPSP-CPCTP-22, WRRC Special Report No. 9, May 1978, pp. 111-130.

7. Mulchi, C. L.; Wolf, D. C.; Foss, J. E.; and Armbruster, J. A., "Cooling Tower Effects on Crops and Soils, Post Operational Report No. 2," PPSP-CPCTP-19, WRRC Special Report No. 8, August, 1977.

Table 12-6
Other Studies

Plant	Equivalent Deposition Rate	Source of Salt Spray	Water Quality (TDS)	Experimental Conditions	Experimental Period	Results	Reference No.
Pepper	36 lb/ac of Cl^- (=40 kg/ha)	Simulated Saline Solution ($NaCl + CaCl_2$)	233,000 ppm	Greenhouse experiment T=13-25°C; 100% RH with dew, 100% RH w/o dew, and 70% RH	One application	8 days after exposure, leaf chlorosis, necrosis and curling observed on plants subject to dew formation.	1
Pepper	72 lb/ac of Cl^- (=81 kg/ha)	Simulated Saline Solution ($NaCl + CaCl_2$)	233,000 ppm	Greenhouse experiment T=13-25°C; 100% RH with dew, 100% RH w/o dew, and 70% RH	One application	No injury when RH=70%; mild symptoms observed when RH=100% w/o morning dew. For 100% RH with dew, leaf wilt occurred within 24 hrs of treatment and a day later necrosis and chlorosis developed.	1
Soybean	36 lb/ac of Cl^- (=40 kg/ha)	Simulated Saline Solution ($NaCl + CaCl_2$)	233,000 ppm	Greenhouse experiment T=13-25°C; 100% RH with dew, 100% RH w/o dew, and 70% RH	One application	7 days after exposure intervenial chlorosis occurred when RH=100% with morning dew.	1
Soybean	54 lb/ac of Cl^- (=61 kg/ha)	Simulated Saline Solution ($NaCl + CaCl_2$)	233,000 ppm	Greenhouse experiment T=13-25°C; 100% RH with dew, 100% RH w/o dew, and 70% RH	One application	Intercostal necrosis when subject to dew.	1
Soybean	72 lb/ac of Cl^- (=81 kg/ha)	Simulated Saline Solution ($NaCl + CaCl_2$)	233,000 ppm	Greenhouse experiment T=13-25°C; 100% RH with dew, 100% RH w/o dew, and 70% RH	One application	48 hours after exposure, slight chlorosis along leaf margin developed when subject to dew.	1
Tomato	36 lb/ac of Cl^- (=40 kg/ha)	Simulated Saline Solution ($NaCl + CaCl_2$)	233,000 ppm	Greenhouse experiment T=13-25°C; 100% RH with dew, 100% RH w/o dew, 70% RH	One application	72 hours after exposure, young leaves developed severe necrosis and older leaves developed slight chlorosis, when subject to dew.	1

Table 12-6 (Continued)

Plant	Equivalent Deposition Rate	Source of Salt Spray	Water Quality (TDS)	Experimental Conditions	Experimental Period	Results	Reference No.
Tomato	72 lb/ac of Cl^- (=81 kg/ha)	Simulated Saline Solution ($NaCl + CaCl_2$)	233,000 ppm	Greenhouse experiment T=13-25°C; 100% RH with dew, 100% RH w/o dew, 70% RH	One application	24 hours after treatment, leaves wilted, and 48 hrs. later severe necrosis and defoliation occurred when subjected to dew.	1
Beans	16,000 Cl^- lb/ac/yr (=1500 kg/ha/mo)	Simulated Saline Solution	11,100 ppm	Greenhouse experiment T=27.5°C; RH=85%	One application about 45 min.	Observable folior lesion developed after one hour of exposure.	2
Beans	22 Na^+ lb/ac (=25 kg/ha)	Sea Salt	Not Available	Greenhouse experiment RH=40%, 60%, 80%	One application about 20 min.	Leaf injury when RH=60%, 80%	3
Tomato	7690 lb/ac/yr of Na^+(719 kg/ha/mo) 5220 lb/ac/yr of Cl^- (=488 kg/ha/mo)	Simulated Salt Solution	10,000 ppm	Greenhouse experiment T=70-75°F; soil salinity from 2 to 14 mmhos/cm	4 days	No leaf injury, but reduced growth 15% to 50% on dry weight basis.	3
Tomato	15,000 lb/ac/yr of Na^+ (=1400 kg/ha/mo) 11,200 lb/ac/yr of Cl^- (=1050 kg/ha/mo)	Simulated Salt Solution	20,000 ppm	Greenhouse experiment T=21 to 24°C soil salinity from 2 to 14 mmhos/cm	4 days	Leaf injury occurred in 12 mmhos/cm soil with growth reduction from 20 to 55% dry weight basis.	3
Tomato	24,200 lb/ac/yr of Na^+ (=2260 kg/ha/mo) 17,400 lb/ac/yr of Cl^- (=1630 kg/ha/mo)	Simulated Salt Solution	30,000 ppm	Greenhouse experiment T=21 to 24°C; soil salinity from 2 to 14 mmhos/cm	4 days	Wilted leaves and necrotic spots. Injury severity increases with the increase in soil salinity. Growth reduction from 25 to 65%.	3
Bean	7690 lb/ac/yr of Na^+ (=719 kg/ha/mo) 5220 lb/ac/yr of Cl^- (=488 kg/ha/mo)	Simulated Salt Solution	10,000 ppm	Greenhouse experiment T=21 to 24°C; soil salinity from 2 to 14 mmhos/cm	4 days	Marginal chlorosis after treatment in soils with salinity >8 mmhos/cm. Growth reduction from 19 to 67%.	3

Table 12-6 (Continued)

Plant	Equivalent Deposition Rate	Source of Salt Spray	Water Quality (TDS)	Experimental Conditions	Experimental Period	Results	Reference No.
Bean	15,000 lb/ac/yr of Na^+ (=1400 kg/ha/mo) 11,200 lb/ac/yr of Cl^- (=1050 kg/ha/mo)	Simulated Salt Solution	20,000 ppm	Greenhouse experiment T=21 to 24°C; soil salinity from 2 to 14 mmhos/cm	4 days	3 days after treatment leaf burn occurred. Growth reduction from 27 to 70%.	3
Bean	24,200 lb/ac/yr of Na^+ (=2260 kg/hr/mo) 17,400 lb/ac/yr of Cl^- =1630 kg/ha/mo)	Simulated Salt Solution	30,000 ppm	Greenhouse experiment T=21 to 24°C; soil salinity from 2 to 14 mmhos/cm	4 days	1 day after treatment, marginal chlorosis occurred and leaves became yellow green. At treatment completion, leaf tissue desiccation, tip necrosis and leaf drop occurred. Growth reduction from 40% to 80%.	3
Barley	10 to 1000 lb/ac/yr (=0.9 to 89 kg/ha/mo) (nominal rates)	Simulated Saline Solution	376 to 42,667 ppm	Greenhouse experiment T=30°C(average maximum RH=75%	73, 86 days	No significant effect on leaf morphology except at the level of 1000 lb/ac/yr. No yield reduction at all levels.	4
Cotton	10 to 100 lb/ac/yr (=0.9 to 8.9 kg/ha/mo) (nominal rates)	Simulated Saline Solution	376 to 3,763 ppm	Greenhouse experiment T=30°C(average maximum) RH=75%	121, 132 days	No adverse effects on morphology and yield	4
Cotton	500 lb/ac/yr (=44 kg/ha/mo) (nominal rates)	Simulated Saline Solution	18,815 ppm	Greenhouse experiment T=30°C(average maximum) RH=75%	121, 132 days	Reduced plant height, leaf necrosis and chlorosis, but more seed cotton and lint per plant.	4
Cotton	1,000 lb/ac/yr (=89 kg/ha/mo) (nominal rates)	Simulated Saline Solution	42,667 ppm	Greenhouse experiment T=30°C(average maximum) RH=75%	121, 132 days	Reduced plant height, leaf necrosis and chlorosis. Significantly less flowers per plant.	4

Table 12-6 (Continued)

Plant	Equivalent Deposition Rate	Source of Salt Spray	Water Quality (TDS)	Experimental Conditions	Experimental Period	Results	Reference No.

References for Table 12-6

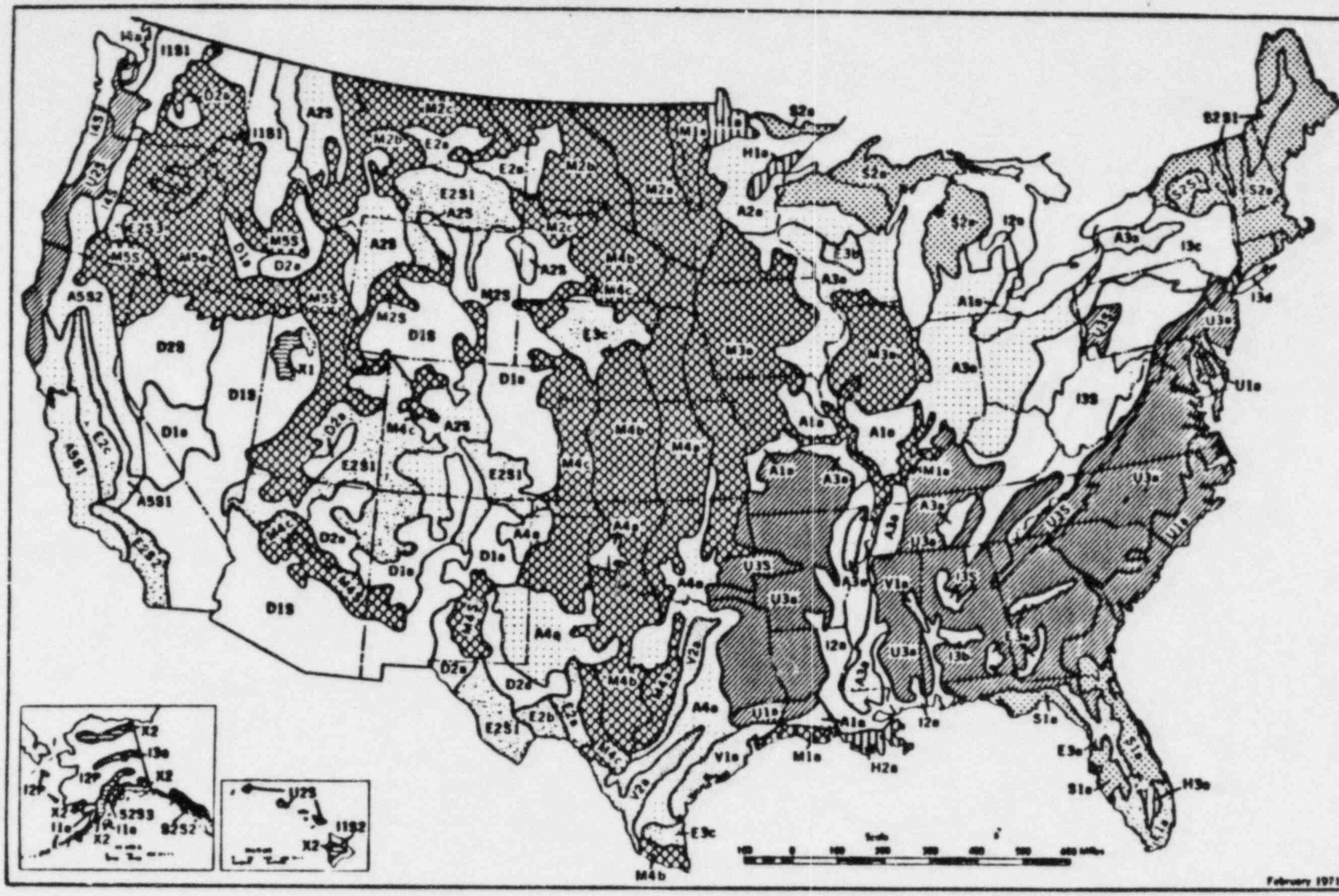
1. Grattan, S. R.; Maas, E. V.; and Ogata, G., "Foliar Uptake and Injury from Saline Aerosol," Journal of Environmental Quality, 10:406-409, 1981.

2. McCune, D. C., et al., "Studies on the Effects of Saline Aerosols of Cooling Tower Origin on Plants," presented at the 67th Annual Meeting of the Air Pollution Control Association, Denver, CO, June 1974.

3. Moser, B. C., Wilcox, G. E.; and Hassen, M. A. M., "Green House Experiments - The Effects of Airborne Salt and Soil Salinity on Vegetation, Phase 1," Purdue University, Pickard, Lowe and Garrick, Inc., Washington, D.C., November, 1978.

4. University of Arizona, "An Assessment of Salt Drift on the Productivity of Agricultural Crops in the Vicinity of the Palo Verde Nuclear Generating Station," Prepared for ANPP, August 1984.

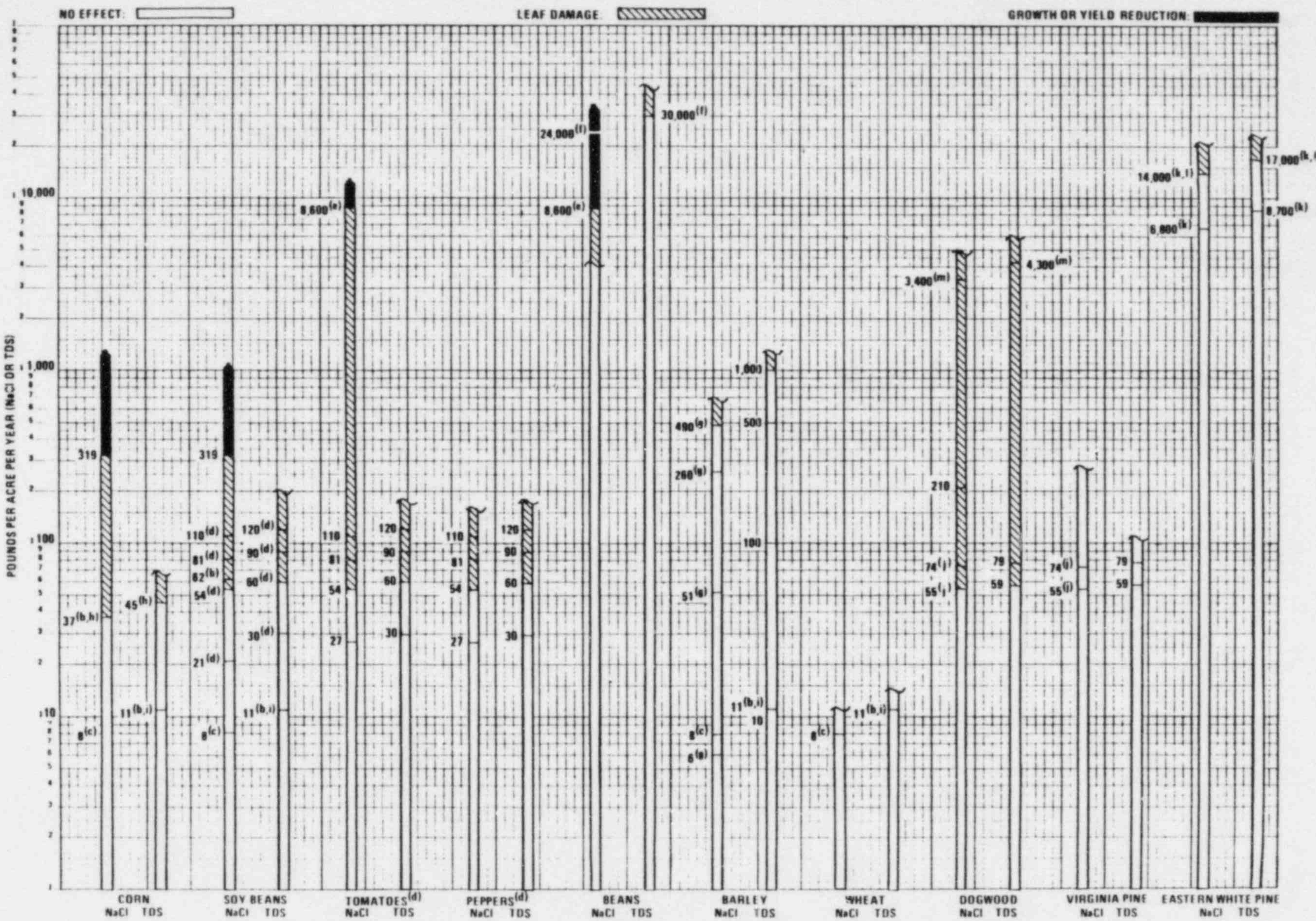
Figure 12-9
GENERAL SOIL MAP OF THE UNITED STATES*



*From pg. 412 of Soil Toxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys, U.S. Department of Agriculture, Soil Survey Staff, Agricultural Handbook No. 436, 1975.

Figure 12-10

SUMMARY OF REPORTED CROP AND NATIVE TREE DAMAGE LEVELS[a]



Notes for Figure 12-10

a. Values shown here have been derived from data reported in the literature. It should be noted that the threshold value for leaf damage is expected to be below the lowest reported leaf damage (at the bottom of the cross-hatched area) but above the highest reported value for no effects. The threshold value for growth or yield reduction would be determined in an analogous manner.

b. Value calculated based on the reported water quality that NaCl accounts for 69% of the TDS. Armbruster, J.A., "Cooling Tower Effects on Crops and Soils; Response of Corn (Zea Mays L.) and Soybeans (Glycine Max L. Merr.) to Saline Aerosol Drift from Brackish Water Cooling Towers," Chalk Point Cooling Tower Project, Water Resources Research Center, University of Maryland, PPSP-CPCTP-31, WRRC Special Report 13, October, 1979.

c. Values calculated according to the stoichiometric relationship between the NA^+ and Cl^- and provided data on ion concentrations. Mulchi, C.L.; Wolf, D.C.; Foss, J.E.; and Armbruster, J.A., "Cooling Tower Effects on Crops and Soils, Post Operational Report No. 2," PPSP-CPCTP-19, WRRC Special Report No. 8, August, 1977.

d. Values converted from mg Cl^-/cm^2 to lb/ac of TDS and NaCl based on the reported water quality that Cl^- concentration represents 61% of the TDS and 90% of the TDS is NaCl. It should be noted that only one significant digit was reported in the cited reference. Two significant digits, however, are used here to show the difference between TDS and NaCl. Grattan, S.R.; Maas, E.V.; and Ogata, G., "Foliar Uptake and Injury from Saline Aerosol," Journal of Environmental Quality, 10:406-409, 1981.

e. Values calculated from $ug/m^2/s$ dose data for Na^+ and Cl^- and the stoichiometric relationship between Na^+ and Cl^-. The actual salt sprayed during the experimental period of four 8-hour applications totalled 31 lb/ac of NaCl. Moser, B.C., Wilcox, G.E.; and Hassen, M.A.M., "Green House Experiments - The Effects of Airborne Salt and Soil Salinity on Vegetation, Phase 1," Purdue University, Pickard, Lowe and Garrick, Inc., Washington, D.C., November, 1978.

f. Values calculated from ug $Cl^-/cm^2/min$ based on the reported water quality that Cl^- concentration represents 54% of the TDS and 78% of the TDS is

Notes for Figure 12-10 (Continued)

NaCl. The actual deposition rates during the experimental period of 45 min were 2.6 lb/ac of TDS and 2 lb/ac of NaCl. McCune, D.C., et al., "Studies on the Effects of Saline Aerosols of Cooling Tower Origin on Plants," presented at the 67th Annual Meeting of the Air Pollution Control Association, Denver, Colorado, June 1974.

g. Values calculated based on the average NA^+ and Cl^- concentrations and their stoichiometric relationship. University of Arizona, "An Assessment of Salt Drift on the Productivity of Agricultural Crops in the Vicinity of the Palo Verde Nuclear Generating Station," Prepared for Arizona Nuclear Power Project, August 1984.

h. Values represent deposition rates at which statistically significant salt accumulation begins. Leaf damage at these levels were not explicitly mentioned in the reference.

i. It is assumed that the saline water used by Mulchi et al (1977) in this study was similar to that used by Armbruster (1979). Both experiments took test solutions from Chalk Point cooling tower basin water.

j. Values calculated based on the reported water quality that NaCl represents 92.7 to 94% of the TDS. Curtis, C.R.; Francis, B.A.; and Lauver, T.L., "Dogwood as a Bioindicator Species for Saline Drift," in Cooling Tower Environment - 1978, PPSP-CPCTP-22, WRRC Special Report No. 9, May, 1978, pp. 65-77.

k. Values calculated from ug Cl^-/cm^2/6 hrs and the reported water quality that Cl^- concentration represents 54% of the TDS and 78% of TDS is NaCl. McCune, D.C., D.H. Silberman, R. H. Mandl, L.H. Weinstein, P.C. Freudenthal, and P.A. Giardina, "Studies on the Effects of Saline Aerosols of Cooling Tower Origin on Plants," Journal of the Air Pollution Control Association, Vol. 27, 1977, pp. 319-324.

l. The actual deposition rates during the experimental period of 4-hours were 12 lb/ac of TDS and 10 lb/ac of NaCl (RH-85%) (McCune, et al; 1977).

m. Values calculated based on the reported water quality that Cl^- concentration represents 54% of the TDS and 78% of TDS is NaCl. The experimental period was 4 hours that resulted in an actual total deposition rate of 2 lb/ac of TDS and 1.5 lb/ac of NaCl (McCune, et al; 1977).

EXHIBIT A

June, 1985

NORA A. BLUM

Education:	BS, Civil Engineering, Worcester Polytechnic Institute, Massachusetts Graduate Study, Civil/Environmental Engineering, Northeastern University, Massachusetts

Summary:	Present:	Engineering Supervisor/Project Engineer
	12 Years:	Technical and managerial responsibility for energy projects; extensive experience in civil and environmental engineering and licensing.

Experience: Ms. Blum is an Engineering Supervisor in the Cogeneration and and Industrial Projects Group in Bechtel's Western Power Division where she is responsible for various new business and project development activities. She is currently the Project Engineer for the feasibility study for a proposed 50-80 MW cogeneration plant in Long Beach, California. Previously, she served as Engineering Supervisor of the environmental staff group for over three years, directing support personnel involved in environmental engineering and licensing for cogeneration projects as well as coal, nuclear and renewable resource power plants.

During 1983 Ms. Blum was Project Manager for feasibility engineering and licensing for a 66 MW waste-fired cogeneration plant in Southern California. She had overall responsibility for technical performance, schedule, and budget control, including direction of 25 team members and three subcontractors.

Other experience as Engineering Supervisor - Environmental includes air quality permitting and preliminary engineering for a 2000 MW coal plant (Nevada); feasibility studies for cogeneration plants ranging from 6 to 125 (California and Utah); environmental and licensing evaluation of 20 power development alternatives up to 1000 MW (California); permitting for a 12.5 MW solar plant (California); Environmental Impact Statement preparation for an 80 MW wind farm and 138 kv transmission line (Hawaii); and Environmental Report preparation and review for an 2200 MW nuclear plant (Georgia). Ms. Blum has also provided technical support during licensing interventions related to cooling tower salt drift impacts on vegetation for two nuclear power projects (Arizona and Georgia).

Before joining Bechtel in 1981, Ms. Blum was associated with Stone & Webster Engineering Corporation in Boston, where she was a Marketing Engineer managing proposal preparation for power, process, and industrial projects. Previously, as Lead Environmental Engineer, she was responsible for the environmental engineering, impact assessment, and licensing for various power projects. She prepared a site suitability report for a proposed 2,600 MW nuclear power station and directed a detailed engineering, economic, and environmental evaluation of high salinity closed-cycle cooling systems.

Earlier in her career, Ms. Blum was responsible for the design of a shore protection system, based on extensive physical model tests, to prevent flooding at a nuclear power plant on Lake Ontario. She also acquired other power plant design experience including alternative heat rejection system studies, hydraulic and water resources engineering, and preparation of environmental reports and state/federal permit applications.

Ms. Blum has coauthored several technical papers on power plant cooling systems, shore protection, and waste-to-energy projects.

Professional Affiliations:

Registered Professional Engineer, Rhode Island
Member, American Society of Civil Engineers
Member, Chi Espilon (National Civil Engineering Honor Society)
Alternatives & Renewables Section Sponsor/Vice Sponsor, Pacific Coast Electrical Association, 1985/6 Engineering & Operating Conferences

ATTACHMENT 3

EXHIBIT B

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

September 25, 1984

TABLE OF CONTENTS

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.

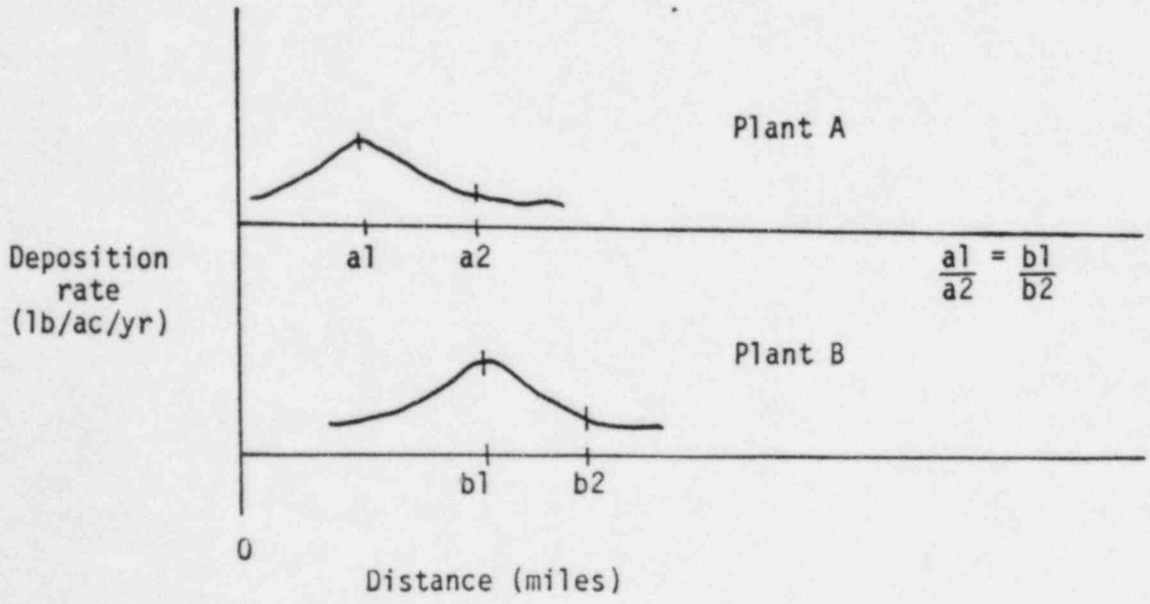
2. It is assumed that VEGP has the similar deposition patterns as the above mentioned four plants. On this basis the following should be true:

   (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 gpm x 60 min/hr x 24 hr/d x 3.75 l/gal x 0.03% x (76 mg/l x 8) x 10^{-6} kg/mg x 2.2 lb/kg
= 1050 lb/d

Total ER = 1040 lb/d x 2
= 2010 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 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 gpm x 60 min/hr x 24 hr/d x 3.75 l/gal x 0.008% (60 mg/l x 4) x 10^{-6} kg/mg x 2.2 lb/kg
= 110.5 lb/d

Total Emission Rate

TER = 110.5 lb/d x 2 towers
= 221 lb/d

This is about 1/10 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).

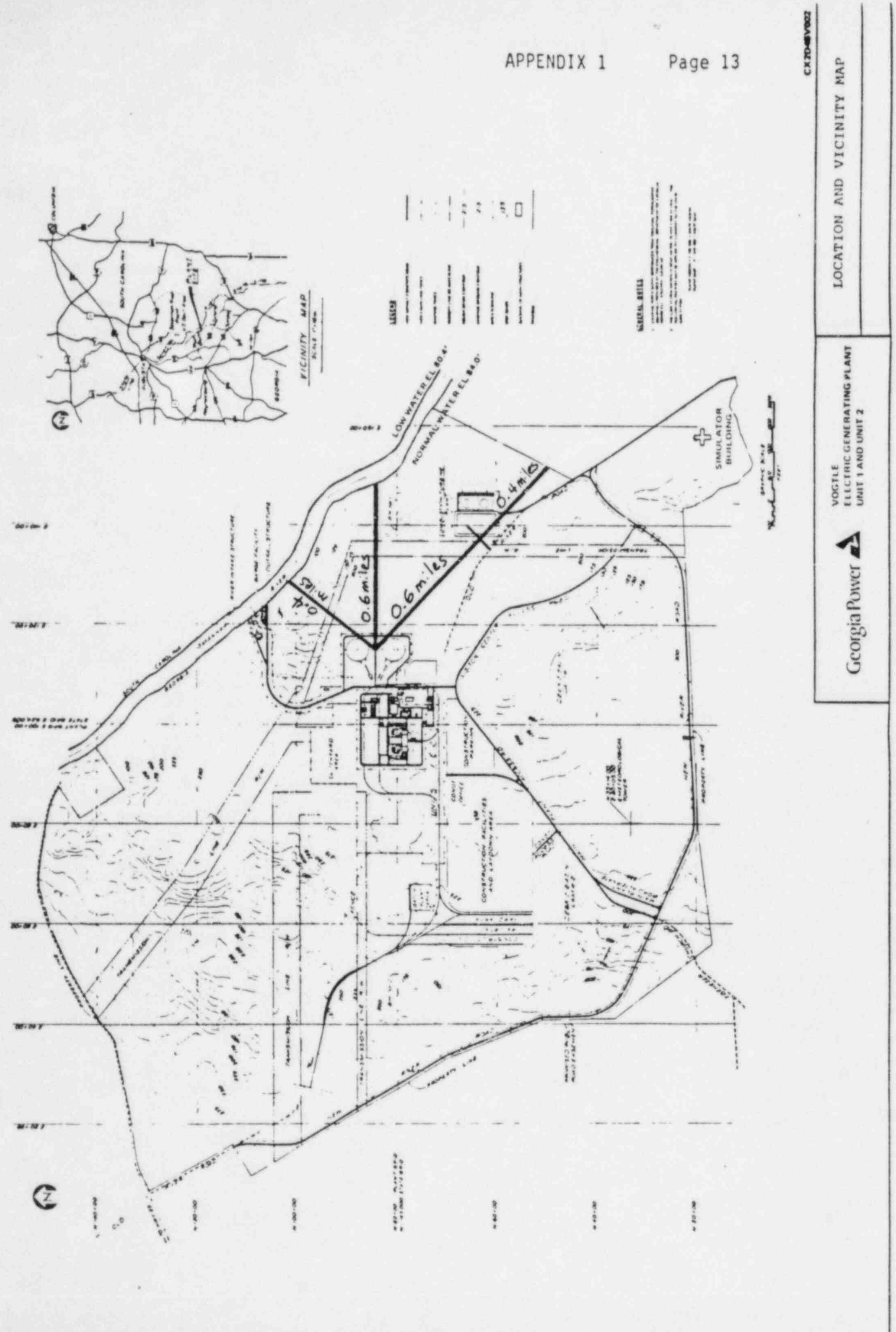
In summary, the off site peak deposition at VEGP, which follows Beaver Valley Unit 1 and 2's deposition pattern with the peak deposition at 0.9 miles from the cooling towers, would be approximately 14.7 lb/ac/yr at 1.0 miles SE of the cooling towers, immediately beyond the site boundary.

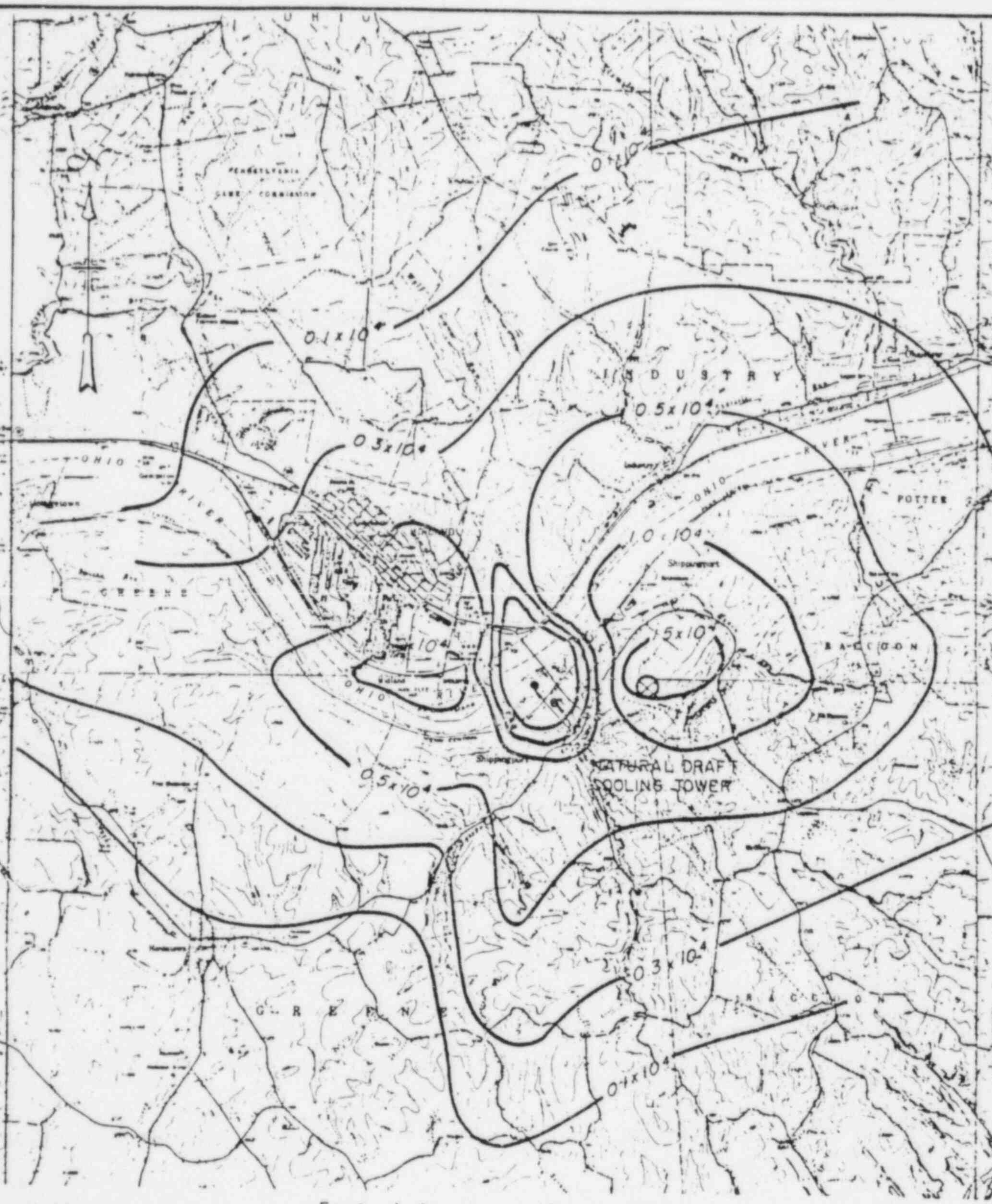
(3) Similar aproaches can be taken to calculate the other cases and Table 1 summarizes the offsite peak deposition based on the 4 cases described above. It can be noted from the table that the most conservative prediction for offsite peak deposition at VEGP would be provided by Case 3, having a deposition 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

Case Parameter	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	Beaver Valley
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


LOCATION AND VICINITY MAP
Georgia Power
VOGTLE
ELECTRIC GENERATING PLANT
UNIT 1 AND UNIT 2
VICINITY MAP
LOW WATER EL 80.4'
NORMAL WATER EL 84.0'
SIMULATOR BUILDING
0.6 miles
0.6 miles
0.4 miles
0.4 miles



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

COOLING TOWER DRIFT PARAMETERS FOR VOGTLE AND FOUR OTHER PLANTS

Plant/ Type of Cooling Tower		Vogtle/ Natural Draft	Susquehanna/ 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

Plant/ Type of Cooling Tower		Vogtle/ Natural Draft	Susquehanna/ 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.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	:	
	:	
GEORGIA POWER COMPANY, et al.	:	Docket Nos. 50-424
	:	50-425
(Vogtle Electric Generating	:	
Plant, Units 1 and 2)	:	

CERTIFICATE OF SERVICE

I hereby certify that copies of the Affidavit of Nora A. Blum, dated July 10, 1985, were served upon those persons on the attached Service List by deposit in the United States mail, postage prepaid, or where indicated by an asterisk (*) by hand delivery, this 11th day of July, 1985.

James E. Joiner
James E. Joiner
Attorney for Applicants

Dated: July 11, 1985

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of GEORGIA POWER COMPANY, et al. (Vogtle Electric Generating Plant, Units 1 and 2)	))))))	Docket Nos. 50-424 50-425

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