September 17, 1988

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

before the

ATOMIC SAFETY AND LICENSING BOARD

In the Matter of PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE, et al. (Seabrook Station, Units 1 and 2)	Docket Nos. 50-443-OL 50-444-OL (On-Site Emergency Planning and Safety Issues)

AFFIDAVIT OF GEORGE A. HARPER

I, George A. Harper, being on oath, depose and say as follows:

1. I am a Senior Civil Engineer in the Environmental Sciences Group at Yankee Atomic Electric Company (YAEC) in Framingham, Massachusetts. At YAEC over the last 8 years, I have performed both probabilistic and deterministic evaluations of extreme external events including wind, snow, and ice for several nuclear power plants. A statement of my professional qualifications is attached hereto and marked "A".

2. In the Affidavits of Donald E. Johnson and Edward B. Lieberman, information regarding wind speed, ice and snowfall was required to support their respective analyses.

The purpose of this affidavit is to discuss in more detail the analyses I performed to provide the necessary inputs.

3. As provided in the Affidavit of Donald E. Johnson, I provided fastest-mile wind speed data used in the structural analysis of the VANS truck/crane combination. The following paragraphs discuss the analysis I performed to develop this fastest-mile wind speed data.

4. In regards to maximum wind speeds, the objective of my analysis was to determine for that portion of the Seabrook Station plume exposure pathway EPZ within Massachusetts (i.e., northeast Massachusetts) the probability that a given wind speed would not be exceeded during random one-hour, one-day, and three-day periods. The following paragraphs discuss in detail the analysis performed and the results.

5. The wind speed data used in the analysis was obtained from NUREG/CR-2639, "Historical Extreme Winds for the United States - Atlantic and Gulf of Mexico Coastlines." This report provides statistical analyses of long term fastest-mile wind records at various locations, where fastest-mile wind is defined as the average wind speed over the time required for a one-mile length of air to pass a given location.

6. Four of the stations in this report, two in Boston, Massachusetts, and two in Portland, Maine, were selected as being representative of the northeastern area of Massachusetts containing the Seabrook Station EPZ. The

information from these four stations was averaged to produce a fastest-mile wind speed probability curve. The annual probability of exceeding various wind speeds was obtained from this curve.

7. Using this information, I determined the probability that various fastest-mile wind speeds would be exceeded for random one-hour, one-day and three-day periods. This was done by using the Poisson distribution, a statistical distribution used to model random events. The Poisson distribution is commonly used to model the probability of occurrence of weather related phenomena.

8. Using the Poisson distribution and the annual probabilities of exceeding various wind speeds (see paragraph 6 above), I calculated the expected number of times per year a specific wind speed would be exceeded for each of the wind speeds under consideration. I shall refer to this as the annual exceedence rate. Given the annual exceedence rate, I next calculated the hourly exceedence rate. I did a similar calculation to determine the exceedence rate per day and the exceedence rate per three-day period. Using the Poisson distribution and the hourly, one-day, and three-day rates, I then calculated the probability that a specific fastest-mile wind speed would be exceeded for random one-hour, one-day, and three-day periods, respectively.

9. The above analysis provided the following results:

Fastest-Mile Wind speed	Probability (as a percent) that wind speed will not be exceeded during interval		
(MPH)	1-Hour	1-Day	3-Day
62	99.999%	99.971%	99.913%
57	99.997%	99.939%	99.817%
51	99.992%	99.810%	99.432%
45	99.980%	99.531%	98.600%

10. As indicated in the Johnson Affidavit, I also provided information regarding ice and wind conditions used in the structural analysis of the VANS vehicle. The following paragraphs discuss the development of these data.

11. The ice load and an associated maximum wind speed gust used in the analysis were obtained from "Estimated Glaze Ice and Wind Loads at the Earth's Surface for the Contiguous United States" which was published by the U.S. Air Force Cambridge Research Laboratories. This report presents a statistical evaluation of ice accumulation for various severities. The report presents annual probabilities of icing occurrence for different regions of the country. The report also presents frequency data on maximum wind gusts associated with ice storms.

12. To be consistent with the exceedence probabilities for fastest-mile wind speeds used in the structural analysis of the VANS truck/crane combination, my analysis identified the ice/wind load which would have a corresponding 3-day probability of non-exceedence of at least 99.8% (i.e., the

probability that the load would not be exceeded during any 3 day period.)

13. The ice load which would correspond to the 99.8% probability of non-exceedence from the report referred to in paragraph 11 above is 0.6 inches. The accompanying wind load of 45 mph (maximum gust) was also chosen from this report such that the probability of the combined (i.e., wind and ice) event of non-occurrence during a random 3-day period would be greater than about 99.8%.

14. Finally the Affidavit of Edward B. Lieberman uses information I provided regarding expected snowfalls. The following paragraph discusses how this information was developed.

15. Information was obtained from the U.S. Air Force Air Weather Service at Pease Air Force Base, located in Portsmouth, New Hampshire. This air base is located approximately 12 miles north of Seabrook Station. This information provided the daily percentage frequency of snowfall from daily observations. The following tabulation was derived from this data.

Snowfall (depth)	Snowfall % Days/Year	Snowfall Days/Year
0.5" ≤ d <1.5"	2.1	7.7
1.5" ≤ d <2.5"	1.0	3.7
2.5" ≤ d <3.5"	.8	2.9
3.5" ≤ d <4.5"	.4	1.4
4.5" ≤ d <6.5"	.4	1.5
6.5" ≤ d <10.5"	.5	1.8
10.5" ≤ d <15.5"	.2	0.7
15.5" ≤ d <25.5"	.1	0.4
d ≥ 25.5"	0.0	0.0
TOTAL	5.5	20.1

George A. Harper

September 16, 1988

The above-subscribed George A. Harper appeared before me and made oath that he had read the foregoing affidavit and that the statements set forth therein are true to the best of his knowledge.

Before me,

Notary Public
My Commission Expires:

MARY T. BATTAGLIA, Notary Public
My Commission Expires September 16, 1994

GEORGE A. HARPER
Senior Civil Engineer

Education

B.S. Civil Engineering, University of Massachusetts, Amherst, Massachusetts, 1975

M.S. Civil Engineering, University of Massachusetts, Amherst, Massachusetts, 1978

Experience

Mr. Harper joined Yankee Atomic Electric Company in April 1979 as an Associate Engineer in the Environmental Sciences Group of the Environmental Engineering Department. He is a Registered Professional Engineer in the States of Massachusetts and New Hampshire. His areas of responsibility include civil engineering, hydrology, wind engineering, geotechnical and probabilistic risk assessments for extreme external events. He has performed probabilistic and deterministic evaluations of weather related phenomena including wind, snow and ice.

In wind engineering he has been involved in the determination of design wind speeds and the associated wind capacities of buildings and structures. He was a key contributor on a multi-disciplined probabilistic risk assessment for winds and tornados at a nuclear power plant. He has also performed extreme wind evaluations in support of the station blackout issue at several plants. In 1984, he attended a short course "Wind Loads on Buildings and Structures" given by Texas Tech University. Mr. Harper is quite familiar with the use of the wind loading requirements in ANSI A58.1, 1982, "Minimum Design Loads for Buildings and Other Structures".

Mr. Harper came to Yankee Atomic from DuBois & King, Inc. in Randolph, Vermont where he was employed from 1977 - 1979. He held the position of Engineer and was responsible for various hydrologic, hydraulic and civil engineering evaluations.