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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
DUKE POWER COMPANY, et al.	)	Docket No. 50-413
	)	50-414
(Catawba Nuclear Station	)	
Units 1 and 2)	)	

TESTIMONY OF MARK A. CASPER
REGARDING PALMETTO ALLIANCE
AND CESG CONTENTION 17

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Mark A. Casper. My business address is Duke Power Company, 422 South Church Street, Charlotte, North Carolina 28242.

Q. WHAT IS YOUR CURRENT POSITION WITH DUKE POWER COMPANY?

A. I am a meteorologist for the Design Engineering Department of Duke Power Company. In this position I conduct various meteorological analyses associated with Duke Power Company's fossil and nuclear generation facilities. My professional qualifications are attached to this testimony.

Q. WHAT IS THE PURPOSE OF THIS TESTIMONY?

A. This testimony addresses the allegations expressed in Palmetto Alliance and CESG's Contention 17 that the Staff's environmental analysis is flawed in that in assessing the potential consequences of accidents the Staff failed to consider adverse meteorological conditions.

Q. IN THE STAFF'S FINAL ENVIRONMENTAL STATEMENT ("FES") AND SAFETY EVALUATION REPORT ("SER") ON CATAWBA, THE STAFF STATES THAT IN EVALUATING THE POTENTIAL CONSEQUENCES OF DESIGN BASIS ACCIDENTS AND SERIOUS ACCIDENTS

BEYOND THE DESIGN BASIS, THE STAFF USED METEOROLOGICAL CONDITIONS FROM THE CATAWBA SITE DURING A TWO YEAR PERIOD FROM DECEMBER 1975 TO DECEMBER 1977. CAN YOU EXPLAIN WHAT RELEVANT METEOROLOGICAL PARAMETERS WERE MEASURED AT THE CATAWBA SITE DURING THIS PERIOD?

A. Onsite meteorological measurements, made from December 17, 1975 through December 16, 1977, include wind direction and speed, ambient and dew point temperatures, vertical temperature gradient, and precipitation. All meteorological measurement at Catawba complied with the recommendations contained in NRC Regulatory Guide 1.23.

Q. IS THIS TWO YEAR PERIOD REPRESENTATIVE OF METEOROLOGICAL CONDITIONS WHICH HAVE OCCURRED IN THE PAST AND ARE ANTICIPATED TO OCCUR IN THE NEXT 40 YEAR PERIOD BARRING CATASTROPHIC CLIMATIC CHANGES?

A. Yes. I have researched records of the relevant meteorological conditions near the Catawba site for the 14 year period for which pertinent data are available, and, in my professional opinion, the meteorological conditions used by the Staff from this two year period (including the frequency and extent of worst case, stable air inversion, low wind speed conditions) are clearly representative of past conditions and, absent catastrophic climatic changes (which are not expected to occur), reflect conditions which will occur over the next 40 years.

Q. PLEASE EXPLAIN, IN SIMPLE TERMS, THE RELATIONSHIP BETWEEN SIGNIFICANT METEOROLOGICAL VARIABLES AND DOWNWIND CONCENTRATIONS.

A. Simply stated, the less stable the air and the greater the windspeed, the greater the dispersion of the hypothetical radioactive plume from an

assumed accident. Thus, from a practical perspective, to postulate a radioactive plume traveling to a major population center would necessitate meteorological conditions (such as wind) which would cause significant dispersion in the postulated plume. An equation expressing downwind concentration as a function of the amount of contaminant released, the wind speed, the stability of the atmosphere and the downwind distance is as follows:

$$X/Q = \frac{1}{\sqrt{2\pi}\ \sigma_y\ \sigma_z\ U}$$

In this expression, X is the downwind contaminant concentration, Q is the source strength, σ_y and σ_z are parameters which reflect the lateral and vertical plume spreads, respectively, and U is the wind speed.

Because X/Q is inversely proportional to σ_y, σ_z and U, a high X/Q value is the result of stable conditions and low wind speeds.

Q. IN THE STAFF'S FES AND SER REGARDING CATAWBA, THE STAFF STATES THAT IN EVALUATING THE POTENTIAL IMPACTS OF A DBA IT EMPLOYED TWO ANALYTICAL PROCESSES, ONE USING "AVERAGE" METEOROLOGICAL CONDITIONS AND ONE USING "VERY POOR" METEOROLOGICAL CONDITIONS. WHAT ARE "AVERAGE" AND "VERY POOR" METEOROLOGICAL CONDITIONS IN RELATION TO INVERSION STABILITY CHARACTERISTICS AND WIND SPEED AROUND THE CATAWBA SITE?

A. The meteorological conditions in the vicinity of the Catawba site frequently are characterized by stable air (<u>i.e.</u>, inversion conditions) and low wind speeds. During the two year period used by the Staff, which as

previously stated is reflective of historical and anticipated future conditions, the predominant meteorological conditions in terms of joint frequency was one of stable air (inversion conditions) and low wind speed, i.e. adverse meteorological conditions. Accordingly, "average" meteorological conditions (50 percentile or median) used by the Staff is reflective of conditions which are skewed toward the adverse conditions of stable air and very low wind speeds.

With regard to the Staff's use of "very poor" meteorological conditions, the Staff based its analysis of DBAs on a extremely adverse meteorological conditions characterized by inversion (stable air) conditions and low wind speeds. While these conditions are associated with a mathematical value of X/Q which would not be exceeded more than 5% of the time, as a practical matter, given the conservatisms inherent in the calculation of X/Q, the likelihood of meteorological conditions which would result in a greater actual ambient concentration is very remote. Examples of these conservatisms in calculating X/Q are as follows:

1. The mathematical analysis assumes no time variation in meteorological parameters such as wind speed and direction except on a hourly basis.

2. The mathematical analysis assumes no spatial variation in atmospheric conditions, i.e., the analysis assumes the exact same conditions will exist over the entire travel distance of the hypothetical plume.

3. The mathematical analysis assumes no mechanical dispersion caused by downwind obstructions (e.g. trees and buildings).

4. The mathematical analysis assumes that the centerline, worst case concentration of the hypothetical plume will continuously be at ground level.

Diffusion studies comparing measured to modeled downwind concentrations have shown the mathematical model to be conservative.

In conclusion, extreme adverse meteorological conditions were considered and factored into the evaluation of the potential consequences of DBAs.

Q. HOW DID THE NRC STAFF FACTOR IN UNFAVORABLE METEOROLOGICAL CONDITIONS INTO ITS ANALYSIS OF THE CONSEQUENCES OF HYPOTHETICAL SEVERE ACCIDENTS BEYOND THE DESIGN BASES?

A. The model used in the severe accident analysis calculates sets of consequences from all of the combinations of effluent release magnitudes, population groupings and samplings of <u>actual meteorological conditions</u>.

Actual meteorological conditions used were onsite meteorological data reflecting 91 meteorological start times, starting every four days on 13 hour intervals. This sampling technique represents diurnal and seasonal variations in the meteorological data, and produces data which is entirely representative of historical and expected future conditions. Within the 91 start times individually analyzed by the Staff, several examples of "worst case" meteorological conditions of very stable air (inversion)

and very low wind speed are represented. For example, the May 12-13 sequence starting at 2100 hours begins with very stable (inversion) conditions and very low wind speeds for a distance of 17 miles (the approximate distance to the center of Charlotte, North Carolina) followed by a virtual stagnation (wind speeds less than 1 meter per second) for a six hour period. This condition was raised by Palmetto Alliance and CESG as one of the two major conditions which it viewed as worst case conditions. The other adverse meteorological condition of concern to the intervenors is illustrated by the May 20 sequence starting at 2200 hours which also begins with stable conditions and low wind speed. The radioactive cloud travels approximately 16 miles (again the approximate distance to Charlotte) when it begins to rain, washing out part of the radioactive cloud under stable and very low wind conditions.

In short, the 91 start times which were each used by individual assessments of potential consequences of serious accidents, includes the extreme adverse meteorological conditions which the intervenors raised as the two worst case conditions reflecting their concerns.

Attachment

MARK A. CASPER

PROFESSIONAL QUALIFICATIONS

DESIGN ENGINEERING DEPARTMENT

DUKE POWER COMPANY

I have been a Meteorologist with Duke Power Company, Design Engineering Department, Civil/Environmental Section, since January 1981.

I received a BS degree in Meteorology from the University of Michigan in 1979. While an undergraduate, I participated in a study of the environmental impact of the once through cooling systems and subsequent emissions of waste heat and moisture into the atmosphere at the Cook and Palisades Nuclear Power Plants on Lake Michigan. My responsibilities included the processing and analysis of the meteorological data acquired near the plants.

I entered the graduate program at the University of Michigan in 1979, and was awarded an MS degree in Meteorology in 1980. In addition to continuing my association with the Cook and Palisades project, I participated in the solar and meteorological measurement program conducted at the University of Michigan under contract by the Solar Energy Research Institute. I was also a teaching assistant for a senior level meteorological synoptic lab class.

I accepted my present position in January 1981. In this position I conduct various meteorological analysis associated with Duke Power Company's electric generation operations at all facilities, both nuclear and fossil. Such meteorological aspects typically involve (a) diffusion applications involving estimates of atmospheric transport/diffusion of pollutants related to both coal-fired and nuclear electric generation including the development of transport/diffusion models for nuclear emergency response, and (b) synoptic applications involving estimates of specialized short-term weather forecasts. Diffusion applications also involve the transport/diffusion of excess water vapor associated with cooling tower and cooling pond releases.

I am a member of the American Meteorological Society, the Air Pollution Control Association, and the Utility Air Regulatory Group's Atmospheric Modeling Committee.

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CERTIFICATE OF SERVICE

I hereby certify that copies of "Applicants' Testimony of Mark A. Casper Regarding Palmetto Alliance and CESG Contention 17" in the above captioned matter have been served upon the following by deposit in the United States mail this 2nd day of December, 1983.

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*Designates hand delivery on December 2, 1983.

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Docket No. 50-413 Official Exh. No. 94

In the matter of Catawba

Staff ______ IDENTIFIED ✓

Applicant ✓ RECEIVED ✓

Intervenor ______ REJECTED ______

Cont'g Off'r ______

Contractor ______ DATE 12/14/83

Other ______ Witness ______

Reporter Mary [illegible]