50-413/414 OL S-5 5/25/84 Staff #5

April 16, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
DUKE POWER COMPANY, ET AL.) Docket Nos. 50-413 OL
) 50-414 OL
(Catawba Nuclear Station,)
Units 1 and 2))
(Emergency Planning)))

NRC STAFF TESTIMONY OF LEONARD SOFFER, JAMES E. FAIROBENT AND PERRY ROBINSON ON CONTENTION 11

Q1. Mr. Soffer, please state your full name, and by whom you are employed?

A1. My name is Leonard Soffer. I am Section Leader of the Accident Risk Section, Reactor Risk Branch, Division of Risk Analysis, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission. A copy of my professional qualifications is attached.

Q2. Mr. Fairobent, please state your full name and by whom you are employed?

A2. My name is James E. Fairobent. I am a meteorologist in the Meteorologist Section, Meteorology and Effluent Treatment Branch, Division of Systems Integration, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. A copy of my professional qualifications is attached.

U.S. NUCLEAR REGULATORY COMMISSION

EXHIBIT No. EP5

Applicant ____ Staff X Intervenor ____

Identified X Received X Rejected ____

Date: 5-25-84

Reporter: BURNS

Q3. Mr. Robinson, please state you full name and by whom you are employed?

A3. My name is Perry D. Robinson. I am employed as an Emergency Preparedness Specialist in the Emergency Preparedness Licensing Branch, Division of Emergency Preparedness, Office of Inspection and Enforcement. A copy of my professional qualifications is attached.

Q4. What is the purpose of this testimony?

A4. (Soffer, Fairobent, Robinson) The purpose of this testimony is to respond to Contention 11 which reads as follows:

> The size and configuration of the northeast quadrant of the plume exposure pathway emergency planning zone (Plume EPZ) surrounding the Catawba facility has not been properly determined by State and local officials in relation to local emergency response needs and capabilities, as required by 10 CFR 50.47(c)(2). The boundary of that zone reaches but does not extend past the Charlotte City limit. There is a substantial resident population in the southwest part of Charlotte near the present plume EPZ boundary. Local meteorological conditions are such that a serious accident at the Catawba facility would endanger the residents of that area and make their evacuation prudent. The likely flow of evacuees from the present plume EPZ through Charlotte access routes also indicates the need for evacuation planning for southwest Charlotte. There appear to be suitable plume EPZ boundary lines inside the city limits, for example, highways 74 and 16 in southwest Charlotte. The boundary of the northeast quadrant of the plume EPZ should be reconsidered and extended to take account of these demographic, meteorological and access route conditions.

Q5. What Commission regulation is applicable to Contention 11?

A5. (Soffer, Robinson) The applicable regulation is 10 CFR 50.47(c)(2) which provides in pertinent part:

> Generally, the plume exposure pathway EPZ for nuclear power plants shall consist of an area about 10 miles (16 km) in radius.... The exact size and configuration of the EPZs surrounding a particular nuclear power reactor shall be determined in relation to local emergency response needs and capabilities as they are affected by such conditions as demography, topography, land characteristics, access routes, and jurisdictional boundaries.

Q6. Why is meteorology not specifically included as one of the above factors that may be used to modify the 10 mile radius to obtain the exact size and configuration of the EPZ?

A6. (Soffer) These factors (demography, topography, land characteristics, access routes, and jurisdictional boundaries) are mentioned in NUREG-0396[1/] (on page 17), where in connection with the recommendations of 10 miles as the plume exposure EPZ, it states in a footnote that "[j]udgement should be used in adopting this distance based upon considerations of local conditions such as demography, topography, land characteristics, access routes and local jurisdictional boundaries."

1/ The recommendations in NUREG-0396 form the basis for the size of "about 10 miles" of the EPZ.

Meteorology is not mentioned as one of the factors that may be used to modify the 10 mile radius because meteorological considerations were already employed in the first place by the authors of NUREG-0396 in determining that about 10 miles was appropriate for the plume exposure EPZ.

Q7. What consideration was given to meteorology in determining the size of the plume exposure pathway emergency planning zone (plume EPZ), as given in 10 CFR 50.47(c)(2)?

A7. (Soffer) NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in support of Nuclear Power Plants," a report issued in October 1980 jointly by the NRC and FEMA, provides a succinct basis of the considerations that led to the determination of the size of the plume exposure pathway EPZ. Quoting from page 12 of that document it states as follows:

The size (about 10 miles radius) of the plume exposure EPZ was based primarily on the following considerations:

a. projected doses from the traditional design basis accidents would not exceed Protective Action Guide levels outside the zone;

b. projected doses from most core melt sequences would not exceed Protective Action Guide levels outside the zone;

c. for the worst core melt sequences, immediate life threatening doses would generally not occur outside the zone;

d. detailed planning within 10 miles would provide a substantial base for expansion of response efforts in the event that this proved necessary.

Since dose considerations or accident consequences enter into 3 of these factors, meteorology (which enters directly into the determination of doses and thus consequences) was a major consideration in the determination of the size of the plume EPZ.

Q8. Can you provide more detail with regard to the kinds of meteorological analyses performed, especially in the areas of atmospheric dispersion characteristics, and how wind direction was considered, that would give insight as to whether the selection of the plume EPZ size of about 10 miles was conservative, or not?

A8. (Soffer, Fairobent) The consequences of two classes of accidents were considered in NUREG-0396. The first class considered was the traditional design basis accidents postulated for licensing purposes. These analyses employed very conservative assumptions with regard to meteorological dispersion in that they make use of site specific dispersion data that is not expected to be exceeded more than 5 percent of the time. Hence, doses computed with this methodology are also conservatively high since they would not be expected to be exceeded more than 5 percent of the time. In addition, these analyses are also wind-direction independent, that is, the doses are calculated assuming the observer to be directly downwind of any release. NUREG-0396 states (page I-27) with regard to the outcome of this class of analyses that "[t]he results of the conservative licensing calculations for the DBA-LOCA vary from plant-to-plant because of plant design and variation in meteorology. For this reason a large number of plants were analyzed in order to report the likely range of the conservative DBA-LOCA doses. Data from seventy safety analysis reports were collected and used for this purpose. The seventy plants consisted of 129 separate nuclear units." NUREG-0396 also states (page I-5) that "The higher PAG plume exposures of 25 rem (thyroid) and 5 rem (whole body) would not be exceeded beyond 10 miles for any site analyzed. Even under the most restrictive PAG plume exposure values of 5 rem to the thyroid and 1 rem whole body, over 70 percent of the plants would not require any consideration of emergency responses beyond 10 miles."

Q9. Before you discuss the second class of accidents considered in NUREG-0396, can you provide any indication as to how the Catawba site would fit in comparison to the 70 sites examined in NUREG-0396?

A9. (Soffer) Although we believe that the Catawba site was one of the 70 sites considered in the DBA-LOCA analysis of NUREG-0396, we were unable to confirm this. Consequently, we performed a DBA-LOCA analysis specifically for the Catawba site to examine the consequences at a distance of 10 miles. This analysis was performed specially for this testimony to examine how the Catawba site fit in with the 70 sites examined. The analysis made use of the dose consequences of design basis accidents as reported in the AEC Staff's Safety Evaluation Report (SER) of October 12, 1973 and also made use of the 5 percentile meteorological atmospheric dispersion characteristics of the Catawba site. It also assumed that the observer was directly downwind of the release. Hence, this analysis used the same assumptions as was originally performed in NUREG-0396.

Q10. What were the results of this analysis?

A10. (Soffer, Fairobent) At a distance of 10 miles from the Catawba site, the consequences of a DBA-LOCA would be a two-hour dose of about 4.8 rem to the thyroid and about 0.3 rem whole body. These doses are below the lower PAG values of 5 rem (thyroid) and 1 rem (whole body).

Q11. What do you conclude as a result of this analysis?

A11. (Soffer, Fairobent) We conclude, as a result of this analysis, that even if the Catawba site was not one of the 70 original sites analyzed in NUREG-0396, nevertheless its plant design and site meteorological characteristics are such that it falls within the group of plants that was considered, and consequently that its characteristics are not so unique as to imply that a 10 mile plume exposure EPZ is inappropriate.

Q12. Please discuss the second class of accidents considered in NUREG-0396.

A12. (Soffer) The second class of accidents considered in NUREG-0396 in determining the size of the EPZ were those beyond the design basis accidents, also referred to as "Class 9 Accidents." For these accidents, a spectrum of degraded core and core-melt accidents was considered, using the release categories given in the reactor Safety Study, WASH-1400. A range of meteorological conditions was employed representing one year of meteorological data at a particular site. A large number of accidental releases were then postulated to occur throughout the year. Some releases th efore occurred under relatively good dispersion conditions that would yield low doses, while others occured under poor dispersion conditions that would yield high doses.

These doses can then be tabulated and plotted vs. distance so as to show the probability of exceeding a given dose vs. distance. An example of this is Figure I-11 which has been taken from NUREG-0396 and is reproduced here for convenience. (See Attachment 1) From Figure I-11, the variation in distance at which a dose of a given value can be received is due to the variation in meteorological conditions over the course of a year's time.

Those portions of the curves towards the left-hand side of Figure I-11 represent doses that are more likely to occur, and hence are representative of typical or average meteorological conditions, while those toward the right-hand side of the figure represent doses that are less likely to occur, and hence are representative of infrequent meteorological conditions associated with adverse dispersion.

As stated earlier, two of the considerations leading to the selection of about 10 miles as the size of the plume exposure EPZ were that:

(a) projected doses from most core-melt sequences would not exceed Protective Action Guide levels outside the zone; and

(b) for the worst core-melt sequences, immediate life-threatening doses would generally not occur outside the zone;

and that meteorology was accounted for in a conservative manner in arriving at these doses.

Figure I-11 shows that there is a rapid fall off of dose vs. distance beyond about 10 miles. It is therefore clear from an examination of Figure I-11 that selection of about 10 miles represented use of conservative meteorological conditions representing generally poor or adverse dispersion conditions, which would produce doses that would be unlikely to be exceeded at that distance because of variations in meteorological conditions.

Q13. Are you saying that high doses could not be experienced beyond 10 miles?

A13. (Soffer) No, not at all. Rather, that it would be unlikely, even in the event of a core-melt accident. As NUREG-0396 notes (page I-37), given a core-melt accident, there is only about a 30 percent chance of exceeding the PAG doses at 10 miles from a power plant.

Q14. How was wind direction or the fraction of the time that the wind blows in a given direction considered in these analyses involving Class 9 accidents?

A14. (Soffer) As was done for the DBA-LOCA analyses, the Class 9 accident analyses assumed that the observer is directly downwind of the release.

Q15. Are you saying that the fact that the wind may blow more towards one direction rather than another at a site has no bearing on the selection of 10 miles as the plume EPZ distance?

A15. (Soffer) Correct. If one imagines a hypothetical site where the wind blew in a single direction 100 percent of the time, the shape of the EPZ for such a site would logically be a long, rather narrow, cigar-shaped outline aligned in the direction of the wind. However, the length or extent of such a cigar-shaped EPZ would still be 10 miles since the accident analyses performed in NUREG-0396 assumed the wind to be blowing in the direction of interest and concluded that the consequences for a spectrum of accidents would be such as not to require planning beyond this distance. The rule requires roughly circular EPZ's because (a) at real sites the wind does not blow only in one direction and (b) we do not know which way the wind will blow in advance of an accident and consider it prudent to plan for any eventuality.

Q16. Was the meteorological data for a specific site used for the Class 9 accident analyses in NUREG-0396, and, if so, what was the site?

A16. (Soffer) Yes. A year of meteorological data for the Indian Point site was used for these analyses in NUREG-0396.

Q17. How would you characterize and compare with other sites the atmospheric transport and diffusion conditions in the vicinity of the Catawba site?

A17. (Fairobent) Before comparing the Catawba site with Indian Point, it may be useful to compare Catawba with other nuclear power plant sites in the southeastern U.S. Atmospheric transport and diffusion conditions in the vicinity of the Catawba facility are typical of those observed at other nuclear power plants in the southeastern United States. Stable atmospheric conditions accompanied by low wind speeds occur frequently in this region, and are reflected in meteorological measurements made at nuclear power plant sites. For example, based on measurements made at the Catawba site for the period December 17, 1975 - December 16, 1977, stable atmospheric conditions (Pasquill types "E", "F", and "G") occurred about 41 percent of the time. Most of these stable conditions (about 75 percent) occurred with wind speeds less than or equal to 2 meters/second. Similar conditions were observed at the Shearon Harris facility for the period February 1979 - January 1980. Stable atmospheric conditions were observed about 56 percent of the time at the Shearon Harris site, with about 80 percent of these conditions occurring with wind speeds less than or equal to 2 meters/second. At the V.C. Summer facility for the period January 1975 - December 1977, stable atmospheric conditions were observed about 60 percent of the time, with about 40 percent of these conditions occurring with wind speed less than or equal to 2 meters/second. The atmospheric stability and wind speed characteristics for a "Southeast River Valley [site] influenced by [the] Bermuda High" identified as site "G", in the Reactor Safety Study, indicate that stable atmospheric conditions for this type of site occurred about 66 percent of the time, with about 40 percent of these conditions occurring with wind speeds less than or equal to 2 meters/second.

Q18. How would you characterize and compare wind direction conditions in the vicinity of the Catawba site?

A18. (Fairobent) Frequencies of wind direction vary considerably from site to site. Prevailing wind direction at any site is a function of local topography and the movement of large-scale weather systems. At Catawba, the prevailing wind direction is from the southwest, with winds from the south-southwest, southwest, and west-southwest occurring a total of about 33 percent of the time for the period December 17, 1974 - December 16, 1977. Meteorological observations at many other nuclear power plant sites indicate total frequency of winds in three 22½° sectors in excess of 25 percent. For example, winds from the north, north-northeast, and northeast occurred about 26 percent of the time at the Shearon Harris facility for the period February 1979 - January 1980. Winds from the south-southwest, southwest, and west-southwest occurred about 28 percent of the time at the V.C. Summer facility for the period January 1974 - December 1977. Winds from the west, west-northwest, and northwest occurred about 29 percent of the time at the Hope Creek facility in New Jersey for the period January 1977 - December 1981. At the Limerick site in Pennsylvania, winds from the west, west-northwest, and northwest occurred about 36 percent of the time for the period January - December 1974.

Q19. What is your overall characterization, then, of the meteorology of the Catawba site?

A19. (Fairobent) Atmospheric transport and diffusion conditions in the vicinity of the Catawba facility, as indicated by comparisons of atmospheric stability, wind speed, and wind direction with data available from other nuclear power plant sites, are typical of those observed at plant sites in the southeastern United States.

Q20. Since you previously indicated that the Class 9 accident analyses performed in NUREG-0396 were performed for the Indian Point site meteorology, can you compare the meteorological conditions at Catawba with those at Indian Point?

A20. (Soffer, Fairobent) For the Indian Point site stable atmospheric condictions (Pasquill type "E", "F" and "G") occur about 48 percent of the time vs. 41 percent for Catawba, with most of these stable conditions (about 60 percent vs. 75 percent for Catawba) occurring with wind speeds less than or equal to 2 meters per second. We consider these conditions to be comparable. We conclude therefore that selection of the Catawba meteorology would also lead to a selection of a plume EPZ distance of about 10 miles.

Q21. Do you have any other information, based on calculation of severe accidents using actual Catawba site meteorology, that would also support this conclusion?

A21. (Soffer) Yes. The NRC Staff has assessed the individual risk of early fatality from severe accidents in the vicinity of the Catawba site at distances beyond 10 miles, making use of actual Catawba site meteorological conditions. This was discussed on page 9-9 of the

Staff's Final Environmental Statement (FES) for Catawba (NUREG-0921) where, in response to a comment, the Staff notes that based on the Staff's calculations for severe accidents, the expectation value for individual risk of early fatality in the interval between 10 and 12.5 mi from Catawba is 6.8×10^{-9} per reactor year and for individual risk of latent cancer is 5.0×10^{-9} per reactor year. The calculations assume evacuation of the 10-mile EPZ only. Additional unpublished results for this same calculation show that the expectation value of individual risk of early fatality is very small at all distances beyond 10 miles, as shown below:2/

Distance Interval (Miles)	Individual Risk of Early Fatality
10 - 12.5	6.8×10^{-9}
12.5 - 15	1.6×10^{-9}
15 - 17.5	4.5×10^{-11}
17.5 - 20	1.4×10^{-10}
>20	0

As noted above, this calculation assumed evacuation of the 10-mile EPZ only. As can be seen, the risk is very low at all distances beyond 10 miles, and generally decreases with distance. The risk is shown to be somewhat higher in the interval from 17.5 to 20 miles from the Catawba site for this particular calculation, because of the occurrence of a severe rainfall sequence which washed out a

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2/ This information is taken from a printout of CRAC data entitled "Individual Acute Fatality Risk Versus Distance with Protective Actions - Catawba". The printout has been reproduced, and is available for inspection and copying.

significant fraction of the remaining cloud radioactive inventory onto the ground at this location. Since such severe rainfall events can occur at any location, of course, the fact that the probability is higher at one particular distance is a peculiarity which does not affect our general conclusion. The calculations also conservatively assumed that all of the washed-out activity deposited onto the ground remains on the surface without being further washed away, and that individuals beyond 10 miles carry out their daily activities for an additional 24 hours after the activity is deposited, without any protective actions.

Q22. How does this information support your conclusion that use of Catawba site meteorology would also lead to a selection of a plume EPZ of about 10 miles?

A22. (Soffer) Figure I-11 from NUREG-0396 shows that, given a core-melt event, there is less than one chance in a hundred of exceeding life-threatening doses (200 rem or more, whole body) at distances beyond 10 miles. Since the probability of a core-melt for each of the Catawba reactors was estimated by the staff in the FES to be about 5 x 10^{-5} per reactor-year, we can divide the data in the table in Answer 21 by this value to obtain the individual probability of early fatality at distances beyond 10 miles from the Catawba site, given that a core-melt has occurred. This is shown below:

Distance Interval (Miles)	Individual Risk of Early Fatality, Given That A Core-Melt Has Occurred
10 - 12.5	1.4×10^{-4}
12.5 - 15	3.2×10^{-5}
15 - 17.5	9.0×10^{-7}
17.5 - 20	2.8×10^{-6}
> 20	0

This shows that, for the Catawba site meteorology, given a core-melt accident, there is less than one chance in a hundred of exceeding life-threatening doses at distances beyond 10 miles. This provides additional information, therefore, that use of the Catawba site meteorology would also lead to a selection of a plume EPZ distance of about 10 miles.

Q23. What are your overall conclusions with regard to meteorology in the selection of "about 10 miles" as the plume EPZ and how Catawba compares?

A23. (Soffer, Fairobent) Our previous testimony has shown that:

(a) meteorology was a major consideration in the regulatory determination (10 CFR 50.47) of the approximate size of the plume EPZ,

(b) two classes of accidents (DBA-LOCA and Class 9 accidents) were used to determine the size of the plume EPZ (about 10 miles),

(c) conservative or adverse dispersion characteristics were used for both classes,

(d) the wind was assumed to blow directly toward the observer for both classes,

(e) for the DBA-LOCA class of accidents a group of 70 sites was analyzed,

(f) a specific DBA-LOCA analysis performed for this testimony shows that the meteorological characteristics of the Catawba site fits within the characteristics of the 70 sites originally considered as a basis for the regulations,

(g) for the Class 9 accidents the meteorology for the Indian Point site was used,

(h) the adverse dispersion characteristics for the Catawba site are generally similar to those for the Indian Point site, and

(i) the risks beyond 10 miles of the Catawba site, given a core-melt event, are generally similar to the Indian Point site, and are very low.

As a result, we conclude:

(1) that meteorology was employed in a conservative fashion in the development of the about 10 miles plume EPZ requirement of 10 CFR 50.47 and that therefore it is not a separate modifying factor to be considered in determining site-specific EPZ configurations, and

(2) that the local meteorological conditions in the vicinity of the Catawba site are such that they are encompassed within those that formed the basis for the regulatory requirement of a plume EPZ of about 10 miles.

Q24. What is the staff's interpretation of the "about 10 miles...in radius" language in 10 CFR 50.47(c)(2) with respect to the size and configuration of the plume EPZ?

A24. (Robinson) The Staff interprets the "about 10 miles...in radius" language as allowing for leeway of a mile or two in either direction. Although the term "radius" implies a circular area for the EPZ, the actual size and configuration, within the mile or two variation, depends upon the characteristics of a particular site as indicated in the regulations. In practice, the Staff tends to place greater emphasis on extending the EPZ boundary outward rather than inward.

Q25. What is the relationship of the planning within the plume EPZ and response efforts beyond the plume EPZ?

A25. (Robinson) The basis for the 10-mile radius plume exposure pathway EPZ is presented in NUREG-0396, "Planning Basis For The Development Of State And Local Government Radiological Emergency Response Plans In Support Of Light Water Nuclear Power Plants", and as further discussed in NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants." As indicated in these documents, the choice of the size of the plume EPZ represents a judgment in the extent of detailed planning which must be performed to assure an adequate response base. The Staff considers that detailed planning within 10 miles provides a substantial base for expansion of response efforts in the event that this proved necessary.

Q26. What information have you reviewed in the course of your evaluation of the adequacy of the size and configuration of the Catawba plume exposure EPZ, in particular, the northeast quadrant of the EPZ?

A26. (Robinson) I have reviewed the information in the Catawba Nuclear Station Emergency Plan, Revision 3, dated June 1983; the Catawba Nuclear Station Evacuation Analysis by PRC Voorhees, dated April 1983; information provided by the Applicants in response to Board inquiries and orders; and additional information provided by the Applicants concerning the development of the EPZ boundary provided on March 15, 1984.

I have examined USGS topographic maps of the area. I have also toured the general area comprising the northeast quadrant EPZ. In addition, I met with the Applicants and members of the Charlotte-Mecklenburg Emergency Management Office during which time I discussed their mutual roles in developing the EPZ boundaries.

Q27. What are the results of your review regarding the Applicants' use of the factors found in 10 CFR 50.47(c)(2) with respect to determining the boundary in the northeast quadrant of the EPZ?

A27. (Robinson) Based on my review of the above indicated information and my discussions with onsite and offsite emergency planners, I have determined that the configuration of the EPZ boundary around the Catawba site was a cooperative effort between the Applicants and State and local authorities. Each of the factors indicated in 10 CFR 50.47(c)(2) were considered by the Applicants in determining the plume EPZ boundary. The primary factors used were demography, jurisdictional boundaries, and land characteristics (i.e., State and local roads). There were no particularly dominant topographical features which, by themselves, could serve as portions of the EPZ boundary. Access routes were considered by the Applicants to ensure that adequate evacuation routes were available.

Jurisdictional boundaries were considered in conjunction with demography so as to extend the EPZ outer boundaries to include within the EPZ any incorporated areas that had major portions of their population in the 10 mile area. The objective was to prevent any such areas from being divided and, in fact, no incorporated area is divided by the EPZ boundary. Around the Catawba site and within the EPZ there are six incorporated areas (i.e., Clover, Fort Mill, York, Pineville, Rock Hill, and Tega Cay); all but Fort Mill required a small extension of the EPZ boundary beyond the 10 mile radius. In each case, the extension of the EPZ boundary amounted to the inclusion of an area totaling just a few square miles, and the additional populations included were a small portion of the total population contained within the EPZ.

Demography was also specifically considered by the Applicants in that special populations (i.e., schools, day-care centers, nursing homes, hospitals, and penal institutions) lying near the 10 mile radius were included within the EPZ boundary. As indicated above, while the boundaries of the six incorporated areas served as identifiable borders, the additional population of these areas were a consideration for extension of the EPZ.

With regard to the EPZ boundaries in the northeast quadrant, they are made up primarily of jurisdictional borders and improved public roads. The jurisdictional boundaries are composed of the Charlotte city limits and the corporate limits of Pineville, beginning at the intersection of Sugar Creek and Arrowood Road and continuing in a general southeasterly direction. Sugar Creek serves at various points not only as a jurisdictional boundary, but as a topographical one as well. The remaining portion of the northeast quadrant of the EPZ is composed of improved public roads. Starting at the intersection of Sugar Creek and Arrowood Road, this portion of the northeast quadrant of the EPZ follows a general northeasterly direction, continuing approximately to the Catawba River.

From my review of the information pertinent to this issue and from my tour of the general area, I find the EPZ boundaries in the northeast quadrant to be easily recognizable and distinct.

Q28. What is the Staff's conclusion of this review?

A28. (Robinson) Based on the information provided by the Applicants as a part of their emergency plan, and on my personal inspection of the general area comprising the plume exposure EPZ boundary in the northeast quadrant, the Staff finds the size and configuration of the plume exposure pathway EPZ as defined in the emergency plan, including the EPZ boundary in the northeast quadrant, to have adequately considered the factors enumerated in 10 CFR 50.47(c)(2). Therefore, the Staff concludes that the Catawba EPZ including the northeast quadrant establishes a suitable boundary for planning for a nuclear emergency at the Catawba nuclear facility.

Q29. What role does the Federal Emergency Management Agency (FEMA) play in the determination of the plume exposure pathway EPZ?

A29. (Robinson) The plume exposure pathway EPZ is also included in offsite emergency plans which are reviewed by FEMA. Consistent with the express language of 10 CFR 50.47(c)(2), the Staff believes that the size and configuration of the EPZ must be determined in response to local needs and capabilities. Consequently, the Staff regards the determination of the EPZ boundaries to be a cooperative effort between the Applicants and the offsite authorities. Therefore, the Staff looks to FEMA to ensure that the EPZ as defined in the offsite plans is appropriate and compatible with the EPZ described in the onsite plan. FEMA's efforts in this regard are necessary to avoid any possible confusion in emergency planning and response.

Q30. Have you looked at any other potential boundaries beyond the current EPZ to determine if they were more suitable?

A30. (Robinson) I have driven the roads suggested in Contention 11 as an EPZ boundary which extend into Charlotte, approximately 17 miles from the Catawba plant at their farthest point.

Q31. What is the Staff's conclusion regarding whether these boundaries are or are not more suitable?

A31. (Robinson) Because there has been no formal submittal to revise the EPZ as defined in the emergency plan, the Staff has not formed a conclusion with regard to any other EPZ boundary. However, in that the staff regards the determination of the EPZ to be dependent on local needs and capabilities, should the Applicants and the offsite authorities decide that some other boundary (than that currently established) will better serve their mutual needs, the Staff would take such a proposal under consideration. It should be again noted that the Staff finds the Applicants' determination of the current EPZ boundary in the northeast quadrant to comply with 10 CFR 50.47(c)(2). Consequently, the Staff, at this time, finds no compelling reason for extending the EPZ boundary into the city limits of Charlotte.

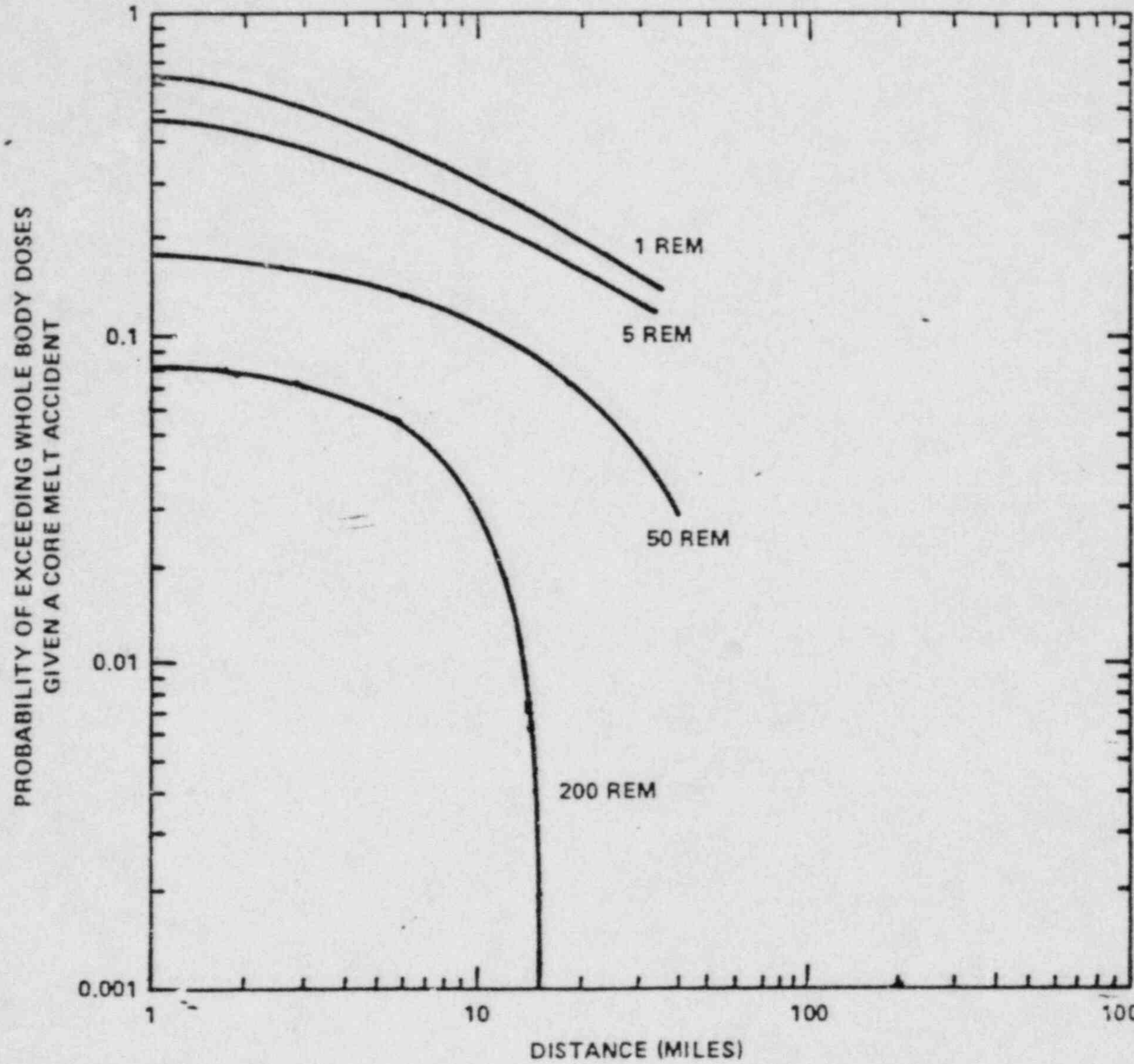

Figure I-11. Conditional Probability of Exceeding Whole Body Dose Versus Distance. Probabilities are Conditional on a Core Melt Accident (5×10^{-5}).

Whole body dose calculated includes: external dose to the whole body due to the passing cloud, exposure to radionuclides on ground, and the dose to the whole body from inhaled radionuclides.

Dose calculations assumed no protective actions taken, and straight line plume trajectory.

LEONARD SOFFER

PROFESSIONAL QUALIFICATIONS

REACTOR RISK BRANCH

DIVISION OF RISK ANALYSIS

OFFICE OF NUCLEAR REGULATORY RESEARCH

I am Section Leader of the Accident Risk Section, Reactor Risk Branch, Division of Risk Analysis, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission. My duties in this position include supervising research on severe reactor accident sequences and the offsite consequences of such accidents. My duties include not only the assessment of reactor risk, but also examination of the possible impact of such risk on the development of NRC regulations and criteria.

I am also presently on detail to the Accident Source Term Program Office, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, where I serve as Acting Assistant Director for Policy Development and Implementation. In this position my duties include responsibility for developing and coordinating agency-wide policy recommendations for emergency response, siting criteria and plant accident mitigation features based upon severe accident and source term research.

In the event of a reactor emergency, I also serve on the NRC Incident Response Team where my position is Deputy Director of the Protective Measures Team. This group performs independent assessments of the consequences of possible releases and makes recommendations to the NRC Executive Team on protective actions to be taken.

I received a B.S. Degree (with honors) in Physics from the City College of New York in 1952 and attended graduate school at Case Western Reserve University in Cleveland, Ohio.

Before joining the Commission, I was employed for 21 years as a Physicist and Nuclear Engineer with the National Aeronautics and Space Administration (NASA) at the Lewis Research Center in Cleveland, Ohio. In this capacity, I performed analyses on radiation shielding and nuclear safety requirements for nuclear power systems intended for lunar and space applications. I assisted in the radiation shielding design of the NASA Plum Brook reactor, served on an agency-wide study team investigating the radiological safety aspects of using radioisotopes for space power generation, and was section leader of a group responsible for research on radiation shielding and radiological safety concerns. I also monitored contracts and occasionally lectured on radiological physics and shielding to others within NASA.

I joined the Commission staff in 1973, first as a member, and, beginning in 1976, as Section Leader of the Accident Analysis Branch within the Office of Nuclear Reactor Regulation. I have participated in the detailed safety and environmental review of over 20 nuclear power plants. My responsibilities included evaluation of the demographic characteristics of nuclear power reactor sites and the hazards posed by nearby man-related activities as well as the independent assessment of the likelihood and consequences of various postulated accidents. In my capacity as Section Leader, I was responsible for reviewing the results of similar efforts by others. I have prepared and presented testimony at hearings on the population density and use characteristics of nuclear power reactor sites as well as the radiological consequences of accidents.

In 1980 I became Section Leader within the Siting Analysis Branch in the Office of Nuclear Reactor Regulation. My section had responsibility for review and evaluation of the population characteristics of nuclear power reactor sites as well as the hazards posed by nearby man-related activities.

I was detailed to the Accident Source Term Program Office when it was formed in January 1983 and assumed my present position as Acting Assistant Director in August 1983.

I assumed my present permanent position as Leader of the Accident Risk Section in January 1984.

Pertinent experience has also included participation in development of a draft standard entitled "Guidelines for Estimating Present and Forecasting Future Population Distributions Surrounding Power Reactor Sites," membership in the NRC Working Group that wrote the "Report of the Siting Policy Task Force" (NUREG-0625), and extensive technical participation in the reactor accident consequence analyses contained in the so-called Sandia Siting Report "Technical Guidance for Siting Criteria Development" (NUREG/CR-2239).

I have also lectured widely at numerous courses sponsored by the IAEA and elsewhere on radiological consequences of severe accidents, dose calculation methodology, accident risk considerations relating to siting and emergency planning and probabilistic risk assessment. I was also a member of an IAEA Siting Mission to Greece to assist that Government in the development of demographic criteria for nuclear power plants, and have lectured, as well, on severe accident risk considerations at IAEA courses held in Korea and Egypt.

I have written about 12 technical papers and reports on various topics related to radiological safety aspects of nuclear reactors. I am a member of the American Nuclear Society and the Population Association of America, which is the professional society of U.S. demographers.

James E. Fairobent
Professional Qualifications
Meteorology and Effluent Treatment Branch
Division of Systems Integration

I am a meteorologist in the Meteorology Section, Meteorology and Effluent Treatment Branch, Division of Systems Integration, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission. My duties include evaluation of the meteorological aspects of nuclear reactor siting and operation.

I received a Bachelor of Science degree in meteorology and oceanography from the University of Michigan in 1970, and a Master of Science degree in meteorology from the University of Michigan in 1972. While at the University of Michigan, I performed as a research assistant on a rain scavenging project, weather observer, and teaching assistant.

In 1973, I joined the U.S. Atomic Energy Commission, Division of Technical Review. I was responsible for the evaluation of the meteorological aspects of nuclear power plant siting and design for Construction Permit and Operating License applicants. In addition, I performed evaluations of the meteorological aspects related to license amendments for operating reactors. I served as the senior NRC meteorologist at the Incident Response Center during the Three Mile Island accident (March 1979) where I coordinated all relevant meteorological information and disseminated it to NRC officials and representatives of other Federal Agencies.

In 1979, I joined the staff of the National Commission on Air Quality (NCAQ) as the only meteorologist. I participated in the review of the Clean Air Act and in the making of recommendations for legislative improvements for revision of the Act. My particular responsibilities included atmospheric dispersion modeling, long-range transport of air pollutants, and climatic change due to increased anthropogenic emissions to the atmosphere.

I returned to the position of meteorologist with the U.S. Nuclear Regulatory Commission in 1981 after the NCAQ submitted its report to Congress. I resumed my former duties related to evaluations of the meteorological aspects of nuclear power plant siting and operation.

I am a professional member of the American Meteorological Society (AMS), the National Weather Association (NWA) and the Air Pollution Control Association. I have participated on the Meteorological Aspects of Air Pollution committee of the AMS and the Industrial Meteorology Committee of the NWA. I have co-authored several technical papers and chapters of textbooks related to atmospheric dispersion. I have participated in the development of regulatory guides and standard review plans related to the meteorological aspects of nuclear power plant siting and operation. I have provided expert testimony at hearings conducted by the Atomic Safety and Licensing Board and made presentations to the Advisory Committee on Reactor Safeguards.

Perry D. Robinson
Emergency Preparedness Licensing Branch
Division of Emergency Preparedness
Office of Inspection and Enforcement

Personal Qualifications

I am employed as an Emergency Preparedness Specialist in the Emergency Preparedness Licensing Branch, Division of Emergency Preparedness, Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission. I have responsibility for the review and evaluation of radiological emergency plans submitted by reactor applicants and licensees to assure proposed plans meet the regulatory requirements, and guidance of the Commission. In addition, I serve as a team member on Emergency Preparedness Teams engaged in the onsite inspections of the implementation phase of licensee/applicant emergency programs. I observe nuclear power plant emergency drills and exercises involving State and local government response agencies and participate in interagency critiques. As part of my job I am required to coordinate and interface with members of the Federal Emergency Management Agency (FEMA) with regard to offsite issues.

I received a B.S. degree in Biology in 1975 from Virginia Polytechnic Institute and S.U. Shortly after graduation I began employment as a Research Health Physicist for the Department of Army. My duties primarily involved providing technical assistance in support of the radiation safety program at the research facility, USAMERADCOM, Fort Belvoir, Virginia. The research being conducted made use of both ionizing and non-ionizing radiation sources. Calibration, quality control, radiation surveys, waste disposal, and training were among my specific duties.

In the spring of 1977 I attended a graduate study course in Basic Radiological Health at University of Lowell, Lowell, Massachusetts. In 1979 I received an incentive scholarship from the Department of Army to attend graduate school at Rutgers University for one year. Combining graduate studies in Health Physics from Catholic University in Washington, D.C. with that completed at Rutgers University, I completed my course work requirements for a M.S. degree in Radiation Science. I successfully completed my thesis and oral examination in 1982.

After returning in 1980 to the Department of Army, I continued in employment until 1981 where I took a position with Battelle, Pacific Nowthwest Laboratories in Richland, Washington. As a Research Scientist in the Health Physics Technology Section, I participated in numerous onsite emergency preparedness appraisals of nuclear power plants as a contractor to the Nuclear Regulatory Commission. My duties also included participating as an evaluator in power plant emergency exercises.