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December 23, 1985

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
CAROLINA POWER AND LIGHT COMPANY AND	)	
NORTH CAROLINA EASTERN MUNICIPAL	)	Docket Nos. 50-400 OL
POWER AGENCY	)	50-401 OL
	)	
(Shearon Harris Nuclear Power Plant,	)	
Units 1 and 2)	)	

NRC STAFF/FEMA PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW ON EDDLEMAN CONTENTION 57-C-3 (NIGHTTIME NOTIFICATION)

I. INTRODUCTION

1. Pursuant to 10 C.F.R. § 2.754 of the Commission's regulations, and the schedule adopted by the Board (Tr. 10,188-189), the NRC Staff/FEMA submit herewith proposed findings of fact and conclusions of law concerning Eddleman Contention 57-C-3 (Nighttime notification). 1/

II. PROCEDURAL BACKGROUND

2. In this Partial Initial Decision, the Board considers emergency planning issues pertaining to the application of the Carolina Power &

1/ The Staff and FEMA orally moved the Board for an extension of time to respond to Wells Eddleman's Proposed Findings of Fact and Conclusions of Law on Eddleman Contention 57C.3 (Nighttime Notification). The Staff's request was necessitated by Mr. Eddleman's failure to file these findings by express mail. On December 19, 1985 Judge Kelley granted the Staff and FEMA until January 6, 1986 to respond to Mr. Eddleman's findings and granted the Applicants until January 6, 1986 to respond to all Proposed Findings of Fact and Conclusions of Law.

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Light Company and North Carolina Eastern Municipal Power Agency (Applicants) for an operating license for Unit 1 of the Shearon Harris Nuclear Plant.

3. Numerous contentions were filed by the Intervenors, Wells Eddleman, Conservation Council of North Carolina (CCNC), Chapel Hill Anti Nuclear Group Effort (CHANGE), Dr. Richard Wilson and Dr. Phyllis Lotchin. Twenty six of the proffered contentions were admitted. 2/ In addition, the Board, on November 5, 1985 orally admitted two additional contentions sponsored by Wells Eddleman that arose out of the Emergency Planning Exercise for Shearon Harris held on May 17-18, 1985. (Tr. 9973). Applicants filed motions for summary disposition on all of the initially admitted contentions. The Board granted summary disposition on all but three of the twenty six contentions. 3/ The two remaining contentions (EPX-2 and EPX-8) are the subject of ongoing discovery. The initial contentions remaining for litigation were: Emergency Planning Joint (EPJ) Contention 4(b), Eddleman Contention 57-C-3 and Eddleman Contention 57-C-10. A hearing on Contentions EPJ-4(b) and Eddleman 57-C-10 was held on June 24 and 25, 1985. The Board has issued its

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2/ The twenty six initially admitted contentions were sponsored by CCNC, CHANGE, Mr. Eddleman, and Dr. Wilson. A number of these admitted contentions were joint contentions for which the Board designated lead intervenors. All of Dr. Lotchin's contentions were rejected.

3/ See Memorandum and Order (Ruling on Eleven Summary Disposition Motions), (February 27, 1985) and Memorandum (Ruling on Remaining Summay Disposition Motions), (April 24, 1985). In those orders the Board presented only its rulings on Applicants' Motions. The reasons for the grant of summary disposition are discussed in the Board's Order of August 14, 1985.

decision on these two contentions. "Partial Initial Decision on Emergency Planning and Safety Contentions" (December 11, 1985). The hearing on 57-C-3 was held on November 4 and 5, 1985.

4. Both the Applicants and the Federal Emergency Management Agency (FEMA) provided prefiled testimony and witnesses on this contention. Intervenor Eddleman filed no testimony and proceeded by cross examination of the Applicants' and FEMA's witnesses. On November 4, 1985 Mr. Eddleman requested the Board subpoena Dr. M. Reada Bassiouni of Acoustic Technology Incorporated (ATI) to testify as a Board witness or in the alternative on his behalf. On November 12, 1985 Mr. Eddleman filed a Motion to Subpoena Dr. Reada M. Bassiouni. Pursuant to a telephone conference called arranged by the Board prior to the adjournment of the hearing on November 5, 1985, Dr. Bassiouni's associate read a statement on Dr. Bassiouni's behalf concerning the nighttime notification issue. Dr. Bassiouni's statement primarily focused on the ATI Computer model's accuracy of siren coverage. Dr. Bassiouni criticized Dr. Kryter's derivation of awakening percentages for the Harris siren system as based on studies of noise annoyance for transmission line corona discharge noise to simulate percentages for a siren alerting signal. (Tr. 9877). Dr. Bassiouni stated that a study that he believed to be more applicable to nighttime alerting was a study performed in 1962 by the Institute for Phonetics and Communications Research of the University of Bonn (German Study). (Tr. 9877).

5. Dr. Bassiouni also criticized FEMA's reliance on informal alerting, stating that ATI does not believe that informal alerting should

be heavily relied upon to validate the effectiveness of nighttime notification. (Tr. 9878).

6. On December 4, 1985, the Board denied Mr. Eddleman's Motion but admitted into evidence Dr. Bassiouni's statement, the German Study and an article authored by Dr. Bassiouni entitled "Prompt Notification of 100% of People in the EPZ" which had been appended to the Applicants' response to Mr. Eddleman's Motion and referred to by the NRC Staff/FEMA in its response to Mr. Eddleman's Motion. (Tr. 10225).

III. REGULATORY REQUIREMENTS

7. The regulatory requirements for emergency planning are found in 10 C.F.R. Part 50. These regulations provide that no operating license for a nuclear power plant will be issued unless the NRC finds that there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. 10 C.F.R. § 50.47(a)(1). Regarding the adequacy of offsite emergency measures, the NRC must base its findings on a review of the FEMA findings and determinations as to whether there is reasonable assurance that the emergency plans can be implemented. 10 C.F.R. § 50.47(a)(2). The Commission's regulations further provide that the following standards must be met: "...means to provide early notification ... to the populace within the Plume Exposure Pathway EPZ have been established. 10 C.F.R. 50.47(b)(5).

8. 10 C.F.R Part 50 Appendix E, IV.D.3. requires that "The design objective of the prompt public notification system shall be to have the capability to essentially complete the initial notification of the public

within the plume exposure pathway EPZ within about 15 minutes." (emphasis added).

9. Guidance as to how these regulatory standards can be satisfied is provided in a regulatory guidance document, NUREG-0654/FEMA-REP-1, Rev. 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants" (November 1980), the use of which was formally approved by the Commission in the 1980 Emergency Planning Rulemaking. 49 FR 27733 (July 6, 1984). The Criteria set forth in NUREG-0654 are intended for use in drafting and reviewing emergency plans, and are the criteria against which FEMA determines the adequacy of offsite emergency plans. Duke Power Company, et. al. (Catawba Nuclear Station, Units 1 and 2), LRP-84-37, 20 NRC 933, 939 (1984). NUREG-0654 is given "considerable weight" by NRC licensing boards in evaluating emergency plans. Long Island Lighting Company (Shoreham Nuclear Power Station, Unit 1), LBP-85-12, 21 NRC 644, 653 (1985); Duke Power Company et al. supra; Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2), LBP-83-32A, 17 NRC 1170, 1177, 1177 n.5 (1983).

10. Appendix 3 of NUREG-0654 provides:

> The design objective for the (notification) system shall be to meet the acceptance criteria of Section B of this Appendix. This design objective does not, however, constitute a guarantee that early notification can be provided for everyone with 100% assurance or that the system when tested under actual field conditions will meet the design objective in all cases.

Section B of Appendix 3, NUREG-0654 provides:

> 2. The minimum acceptable design objectives for coverage by the system are:

a) Capability for providing both an alert signal and an informational or instructional message to the population on an area wide basis throughout the 10 mile EPZ, within 15 minutes.

b) The initial notification system will assure direct coverage of essentially 100% of the population within 5 miles of the site.

c) Special arrangements will be made to assure 100% coverage within 45 minutes of the population who may not have received the initial notification within the entire plume exposure EPZ.

3. Sirens

Whenever proposed as part of a system, subject to later testing by statistical sampling, the design concept and expected performance must be documented as part of plans submitted by licensees, States and local governments. . . .

As an acceptable criteria at most locations, 10 db above average daytime ambient background should be a target level for the design of an adequate siren system. . . .

e. For areas with population densities below 2000 persons per square mile, the siren system must be designed to produce a minimum of 60 db(c) (for organizations proposing systems without field surveys).

11. Design objectives do not guarantee that early notification can be provided throughout the EPZ with 100% assurance. In the Matter of Pacific Gas and Electric Company (Diablo Canyon Nuclear Power Plant, Units 1 and 2), LBP-82-70, 16 NRC 756, 774 (1982).

On June 18, 1980 the Commission met with the Staff and discussed at length, the feasibility of a 15 minute notification time. . . Public Meeting, Staff Presentation of Final Rulemaking to the Nuclear Regulatory Commission, pages 17-42 (June 18, 1980). . . . The Commission decided at the June 18, 1980 meeting, after reviewing the rulemaking record. . .

(3) that the final rule expressly recognized that an absolute (100% effective notification) of every individual within the emergency planning zone is not required and is probably impossible; but that the NRC's objective is to come as close to that as possible.

In the Matter of Final Rule of Emergency Planning, CLI-80-40, 12 NRC 636, 642 (1980).

The Commission noted that: "the Federal Emergency Management Agency (FEMA) would make determinations on the adequacy of the offsite notice system to meet the criteria and that the NRC would rely on that judgment." Id.

The final regulation was published in the Federal Register on August 19, 1980 (45 FR 55402 (August 19, 1980). The Final Rules included an explanation in the Supplementary Information that reflected the significant deliberations concerning the 15 minute notification capability requirement:

> ". . . The Commission recognizes that not every individual would necessarily be reached under all conditions of system use. However, the Commission believes that provision of a general alerting system will significantly improve the capability for taking protective actions in the event of an emergency."

In the Matter of Final Rule on Emergency Planning, CLI-80-40, 12 NRC 636, 644 (1980).

12. Licensing Boards have previously ruled on the issue of whether or not individuals that are indoors will be able to hear a siren alert system. Duke Power Company et al. supra at 973. In Catawba, the Licensing Board found that:

> There may be situations where the ambient noise inside a building may exceed the siren volume; however these do not make the siren system inadequate. The requirements of FEMA-43 and NUREG 0654 were not intended as a guarantee that 100% of the population in the EPZ will actually hear the sirens in an emergency but rather were meant to establish a design objective for the siren system. (See FEMA-43, at E4 to E5). We find Catawba sirens meet this objective and are in compliance with the acceptance criteria.

13. A Licensing Board has also recognized that sirens may not be able to be heard by some of the populace that are asleep.

> The best of siren systems presumably will fail to reach some people for a variety of reasons, including for example, unusually high ambient noise levels in some places, individual hearing defects, being asleep, etc. But we think it reasonable to assume that a carefully engineered system will be heard by the great majority of the people in the EPZ and that virtually all those who do not hear the sirens will be warned soon thereafter (emphasis added).

Southern California Edison Company, et al. (San Onofre Nuclear Generating Station, Units 2 and 3), LBP-82-46, 15 NRC 1531, 1534.

14. In 1983, FEMA published interim guidance in FEMA-43 "Standard Guide for the Evaluation of Alert and Notification Systems for Nuclear Power Plants which organized the acceptance criteria of NUREG-0654/ FEMA-REP-1, Rev. 1 into a format that could be used by the utilities to document their alert and notification system for review and approval under FEMA's 44 C.F.R 350 process. FEMA-43 did not change the design criteria established in NUREG-0654/FEMA-REP-1, Rev. 1.

15. The above-described regulations, guidance and case law form the framework within which the Applicants and FEMA design and evaluate the Harris siren system.

IV. FINDINGS OF FACT

16. Eddleman Contention 57-C-3 was initially advanced and was admitted as a contention in this proceeding in the Board's Memorandum and Order of June 14, 1984. As admitted by the Board, the contention reads as follows:

> The plan does not have provisions for notification at night, e.g. in the hours between 1 a.m. and 6 a.m. when most people living near the plant would normally be asleep, nor does the plan assure that they would be timely awakened to take sheltering action, as e.g. on a summer night when many might have windows open or air conditioners on. The plan should provide automatic phone dialing equipment to transmit an emergency message to all households in the EPZ for Harris, asking people to alert their phoneless neighbors.

17. Subsequently, in ruling on the Applicants' Motion for Summary Disposition of Eddleman Contention 57-C-3, November 2, 1984, the Board framed the basic issue raised by the contention thusly:

> Will the Harris sirens wake up sleeping people in the EPZ, particularly those using air conditioning, in fifteen minutes.

The Board also went on to state:

> At the evidentiary hearing, the Applicants should address whether the sirens can wake up virtually all the people sleeping in the EPZ between 1 a.m. and 6 a.m. particularly those with windows closed and air conditioners running. The Applicant should address whether the presently planned means of back up mobile notification could and should be augmented to meet the "about" 15 minute standard in Appendix E, if necessary. 4/

18. Applicants presented the testimony of Mr. David N. Keast, Dr. Dennis S. Mileti, and Mr. Alvin H. Joyner to address this contention. Mr. Keast is Vice President and Senior Project Manager with HMM Associates, Inc. Mr. Keast has an M.S. in Electrical Engineering and specializes in public warning system studies in his role as Project Manager for HMM Associates. Mr. Keast was retained by the Applicants to analyze the alert and notification system in response to Eddleman Contention 57-C-3. Mr. Keast estimated that 72% of the households would be directly alerted by the Harris siren system. (Keast, ff. Tr. 9375 at 9). Dr. Mileti, Professor in the Department of Sociology and Director of the Hazards Assessment Laboratory at Colorado State University addressed the informal notification process that occurs in the event of an emergency. (Keast, ff. Tr. 9375 at 28). Dr. Mileti conservatively estimated that 80% of the EPZ populace would be alerted within the first 15 minutes. (Keast, ff. Tr. 9375 at 35). Dr. Mileti also estimated that a facili-

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4/ Memorandum and Order (Ruling on Eleven Summary Disposition Motion), February 27, 1985 pp. 3-4 (unpublished).

tated rate of informal notification through encouragement of informal notification by incorporating a message into the emergency broadcast system (EBS) would lead him to conclude that 88% of the total EPZ population would be alerted within 15 minutes. (Keast, ff. Tr. 9375 at 38). Mr. Joyner is the lead planner for fixed nuclear facilities within the Division of Emergency Management ("DEM") of the North Carolina Department of Crime Control and Public Safety. Mr. Joyner's testimony addressed the mobile alerting that takes place in addition to the fixed siren system in the event of an emergency at Shearon Harris. Mr. Joyner indicated that mobile alerting through the utilization of vehicles with flashing lights, sirens, and/or public address systems will be well underway though not completed within the initial 15 minute period. He further indicated that the warning times could be reduced somewhat by concentrating identified mobile alerting resources in smaller operational areas. (Keast, ff. Tr. 9375, pp. 26-28).

19. The Federal Emergency Management Agency (FEMA) called upon a panel of four experts under contract to FEMA (Jiri Nehnevajsa, Thomas F. Carter, Karl D. Kryter, and Van M. Lee) to present testimony on Eddleman Contention 57-C-3.

20. Mr. Carter is Vice-President, Consulting Services Group, International Energy Associates Limited (hereafter "IEAL"). ("Testimony of Thomas F. Carter regarding Eddleman Contention 57-C-3", at 1) (hereafter "Carter"). Mr. Carter held various management positions with the NRC from 1975 to 1982. In his last position (Deputy Director, Division of Fuel Cycle and Material Safety), he had the responsibility for formulating the emergency planning policy for all fuel cycle facilities. He

also was Chairman of NRC's "Three Mile Island" Task Force on Emergency Planning. (Carter, at 2.)

21. Under subcontract to Argonne National Laboratory, Mr. Carter was the principal author of FEMA-43, "Standard Guide For The Evaluation Of Alert And Notification Systems For Nuclear Power Plants". He is currently Manager of IEAL's project to support FEMA in the evaluation of alert and notification systems at nuclear power plants. (Carter, at 2.)

22. Under FEMA contract, Mr. Carter convened a panel of experts to prepare testimony in response to Eddleman Contention 57-C-3. He engaged the professional services of Drs. Lee, Kryter, and Nehnevajsa for this purpose. (Carter, at 2-3.)

23. Mr. Carter prepared this panel of experts by providing them with copies of the principal documents relating to Contention 57-C-3 (which he enumerated in his testimony). (Carter, at 3-5.)

24. Dr. Lee was asked to predict the acoustical performance of the Shearon Harris siren system. Dr. Kryter was asked to address the arousal of people from sleep in response to the operation of the siren system. Dr. Nehnevajsa was asked to address some of the key issues which arise in the context of behavioral implications of possible nighttime emergencies at the Shearon Harris Nuclear Power Plant. Working sessions were held with all panel experts to discuss the background material and their individual responsibilities in the context of the other experts' responsibilities. (Carter, at 5-6.)

25. Mr. Carter's testimony summarized: 1) the NRC and FEMA requirements and guidance for EPZ siren systems; 2) IEAL's review of the Shearon Harris siren system under its FEMA contract; and 3) the conclusions

reached by the panel of experts regarding Eddleman Contention 57-C-3. (Carter, at 6.)

26. The FEMA and NRC staff use the criteria in NUREG-0654/FEMA-REP-1 Rev. 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants" and FEMA-43 "Standard Guide For The Evaluation of Alert Notification Systems For Nuclear Power Plants" to determine whether a prompt public notification system meets these requirements. Both NUREG-0654/FEMA-REP-1, Rev. 1 and FEMA-43 were subject to public comment. (Carter, at 7.)

27. Specifically, Appendix 3, Section C.3 of NUREG-0654/FEMA-REP-1 addresses siren systems. Basically it presents, as an acceptance criterion, that the target level for the design of an adequate siren system should be 10dB (decibel) above average daytime ambient background levels. It is further stated that the 10dB dissonant differential is a conservative use of the 9dB differential which is presented in FEMA document CPG-1-17, "Outdoor Warning Systems Guide", and that the 10dB differential is meant to provide a distinguishable signal inside of average residential construction under average conditions. Appendix 3 then states that for areas with population densities below 2,000 persons per square mile, the siren system must be designed to produce a minimum of 60 dBC or, alternatively, 10dB above a measured average daytime ambient background noise level. (Carter, at 7.)

28. Among other things, FEMA-43 organizes the criteria of NUREG-0654/FEMA-REP-1 into a format that can be used by utilities to document their siren system installations. FEMA-43 states that wherever proposed as

part of an alert system, a siren system design shall be documented in a design report. Maps must be included that delineate: (1) areas where the population exceeds 2,000 persons per square mile and areas virtually unpopulated, (2) unique siren identifiers and siren locations, and (3) siren sound contours for C-weighted sound pressure levels (SPL) of 60dBC and 70dBC. In addition, should the design report choose to show that the siren sound level exceeds an average measured outdoor daytime (period between 7 a.m. and 10 p.m.) ambient sound level(s) by 10 dB, the maps must include appropriate siren sound level contours for the SPL that is 10 dB above the average outdoor daytime ambient sound level(s). The design report, in accordance with FEMA-43, should include a description of how the sound contours were calculated, accounting for, at a minimum, the effects of topographical features, temperature, relative humidity, wind direction, wind magnitude, measured siren sound output, and siren location/height. (Carter, at 7-8.)

29. FEMA-43 also states that the NUREG-0654/FEMA-REP-1 criteria are satisfied when the design report shows that, for those geographical areas to be covered by fixed sirens, either (a) the expected siren sound level generally exceeds 70 dBC where the population density exceeds 2,000 persons per square mile and 60 dBC in other inhabited areas, or (b) the expected siren sound level generally exceeds the average measured daytime ambient sound levels by 10 dB. (Carter, at 8.)

30. Under the contract to provide technical support to FEMA for a series of reviews of alert and notification systems under NUREG-0654/ FEMA-REP-1, Rev. 1 and FEMA-43, IEAL received from FEMA a report prepared by Carolina Power and Light Company entitled, "Shearon Harris Nuclear

Power Plant Alert/Notification System Report" (hereinafter referred to as the Design Report) which described the public alert and notification system. Section 2.3 and Attachment 13 of this Design Report contain a description of, and supplementary information for, the physical means of alerting for the Shearon Harris Nuclear Power Plant. The system as presented consisted of sixty-two Federal Signal (FS) Thunderbolt Model 1000 rotating sirens rated at 125 dBC by the siren manufacturer. (Carter, at 9.)

31. IEAL's evaluation results are documented in a draft report entitled "Shearon Harris Nuclear Power Plant Site-Specific Offsite Radiological Emergency Preparedness Alert And Notification System Quality Assurance Verification" dated June 12, 1985. (Carter, at 9.)

32. The evaluation of the siren system design calculation procedure was conducted by:

- Verifying the licensee's computer modeling results as presented in Attachment 13 to the Design Report against the 10 dB loss per distance doubled attenuation rate in the absence of special conditions; and

- Ascertaining the adequacy of the licensee's computer-predictive coverage in the presence of site-specific topographical and meteorological conditions through comparisons of the licensee's results with IEAL's Outdoor Sound Propagation Model (OSPM) results for specific sirens.

(Carter, at 9-10.)

33. The Design Report's Attachment 13 stated that the Shearon Harris Nuclear Power Plant siren warning system design took into consideration meteorological and topographical factors and land surface conditions that affected the propagation of sound generated by each siren. The computer model utilized to design the system, as described, calculates sound attenuation with distance due to hemispherical wave divergence, atmospheric absorption, absorption due to vegetation and other types of ground cover, propagation of sound over water, propagation of sound through urban and suburban areas, upwind sound shadow, and topographical barriers. The Design Report, however, did not provide any discussion of the assumptions used, the methodologies employed, or the calculations performed to generate the final sound contours. Therefore, IEAL's review was based on an evaluation of the presented predictions of acoustical coverage (Map 1 of the Design Report) and sought to ascertain whether the computer model used in the siren system design adequately accounted for site-specific terrain and weather conditions. (Carter, at 10-11.)

34. Eleven FS 1000 sirens, representative of the site-specific topographical conditions within the Shearon Harris Nuclear Power Plant EPZ, were selected for the review. These 11 sirens also cover the relatively more populated areas within the EPZ. (Carter, at 11.)

35. The overall conservatism in estimating the 60 and 70 dBC ranges was further supported by comparison of individual siren coverages in terms of the area within the 70 dBC and 60 dBC contours. Area integrations were performed on the individual OSPM siren predictions. The average area with 60 dBC or higher was 21.00 square miles and, for 70 dBC, was 7.12

square miles. The resulting average effective ranges were estimated to be over 10,000 feet and 7,900 feet, respectively, for 60 dBC and 70 dBC. Area computations using data from the Design Report resulted in average area coverages that corresponded to effective ranges of 7,137 feet and 5,056 feet for 60 dBC and 70 dBC, respectively. (Carter, at 12.)

36. The results of the eleven OSPM runs were combined to generate representative contours around the selected sirens. A surface interpolation and contouring program utilizing the output results of the eleven sirens was used to generate a sound pressure level contour overlay. Comparison of the OSPM-predicted 60 dBC and 70 dBC countours with the 60 dBC and 70 dBC contours presented in Map 1 of the Design Report indicated that the Design Report's estimated coverage by the 11 sirens was very conservative. (Carter, at 12.)

37. The Design Report's Attachment 13 stated that there were geographical areas inside the EPZ boundary that were predicted to be below 60 dBC. The design criteria for these areas was chosen to be a 10 dB dissonant level above the ambient. The Design Report established the summer daytime average background noise level through a random spot survey process. No monitoring location selection, sample record length, or sampling frequency methods were described; thus, no judgement on the appropriateness and representativeness of the data could be made and the alternate design criteria of 50 dBC (10 dB above an ambient of 40 dBC) was rejected. However, based on the conservatism of the Design Report's predictive results, it was considered likely that some of the areas would experience siren sound pressure levels of 60 dBC or greater. (Carter, at 12-13.)

38. Therefore, IEAL recommended that the Shearon Harris Nuclear Power Plant siren warning system be found conditionally acceptable. Although the design procedure was found to be conservative, the licensee had not fully demonstrated that the system met FEMA-43 specific design criteria throughout the 10-mile EPZ. The licensee was subsequently requested by FEMA to: (1) ascertain that those geographical areas below 60 dBC coverage, as depicted on Map 3 of the Design Report, were either unpopulated or were exposed to actual sound pressure levels of greater than 60 dBC, (2) establish appropriate ambient noise levels in those geographical areas through a statistically valid sampling plan, or (3) provide another primary alerting mechanism (such as route alerting) in those geographical areas. (Carter, at 13.)

39. Carolina Power and Light Company responded to FEMA's request by letter dated October 7, 1985. The letter stated that personnel had visited each of the areas identified as being outside of predicted 60 dBC coverage to determine if resident housing existed. On the basis of these visits, thirteen areas were determined not to contain dwellings or commercial buildings and therefore did not require 60 dBC coverage. The letter identified six locations where additional sirens would be added because of high ambient background readings. Five of these six sirens are intended to cover areas previously identified as being outside of 60 dBC coverage. Additional field testing was performed by Carolina Power and Light Company personnel to ascertain siren coverage for five additional areas. One of these areas was identified as being covered by less than 60 dBC. Carolina Power and Light Company stated that an additional

siren would be installed to ensure adequate coverage for this area. (Carter, at 14.)

40. Based upon an analysis of the information presented in this letter, Mr. Carter concluded that the Shearon Harris Nuclear Power Plant siren system, when augmented with the additional sirens, will satisfy the design criteria of FEMA-43. The Shearon Harris siren system is considered adequate in that it conservatively meets the intent of NRC and FEMA guidance, specifically NUREG-0654/FEMA-REP-1 which presents definitive guidelines for the design of siren systems. 5/ (Carter, at 14.)

41. Dr. Van M. Lee, President and principal consultant of Analysis & Computing, Inc. of New York, testified as a member of the FEMA panel on Eddleman Contention 57-C-3. Dr. Lee's areas of specialization are noise assessment and acoustical design, communication and warning system design and evaluation, and computer modeling. ("Testimony of Van M. Lee Regarding Eddleman Contention 57-C-3" at 1) (hereafter Lee).

42. Dr. Lee has a Ph.D. degree from New York University majoring in Noise and Acoustics with a minor in Applied Mathematics. (Lee, at 1.)

43. Dr. Lee described the conditions he used in evaluating the Shearon Harris siren system under NUREG-0654 and FEMA-43, and why he used those

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5/ The Background section of NUREG-0654/FEMA-REP-1, Rev. 1 states in part that the guidance, after being commented upon by interested parties during a formal public comment period, is classified as final guidance; the guidance will be used by Federal agencies in their review of the preparedness of NRC facility licensees; and that the document is supportive of the NRC Final Rule on Emergency Planning (45 Fed. Reg. 55402) and is referenced therein. (Carter, at 14-15.)

conditions. He used average summer daytime conditions. NUREG-0654/ FEMA-REP-1, Appendix 3, Section C-3, provides the design criteria against which siren alert and notification systems are evaluated. The design rationale is to achieve a target level of 10 dB above average daytime ambient background, and the siren system's acoustical design may use average daytime conditions. The choice of summer versus other seasons is intended to provide an added margin of conservatism in the design since (1) the average ambient background which is dominated by human activities, primarily traffic, is usually higher in summer than in other seasons (Safeer 1973), and daytime ambient background noise levels are typically 6 to 10 db higher than nighttime levels (U.S. EPA, 1974), and (2) the siren sound may be additionally attenuated by the fuller summer vegetative covering. (Lee, at 19.)

44. Dr. Lee also described the work he did in connection with Eddleman contention 57-C-3. To assess the nighttime alerting capability of the Shearon Harris siren system, the OSPM was applied repeatedly to each of the 68 sirens in the final system (sixty-two in the original system and six additional sirens in the supplementary submittal) with nighttime weather conditions from on-site meteorological tower data. Siren data consisting of siren power levels in octave bands from 31.5 to 8,000 hertz, siren locations and mounting heights above ground elevation were input. Topographical profiles for each siren along sixteen compass bearings out to 12,000 feet were extracted from U.S. Geological Survey maps; input information consisted of receptor coordinates, dominant ground type between the siren-receptor pair, any line-of-sight obstructions and distance from siren to, and relative height of, the

obstruction, significant foliage penetration and distance thereof, if any. (Lee, at 22.) Dr. Lee indicated that no dense forestation was evidence in the EPZ (Tr. 9728).

45. The output of each siren run, consisting of estimated siren sound pressure levels in dBC at each one of the 112 polar grid points is fed individually into a surface interpolation and mapping program to generate a finer mesh (at grid interval of 150 meters) over the entire EPZ. Since the sirens are of the rotating type, the individual siren sound levels at a given receptor cannot be reliably synchronized to achieve the logarithmic additive effect; instead, the maximum of multiple siren sound level contributions is selected. This maximal selection process was performed at each of the grid mesh points (215 x 215 points). And final contours were drawn through this mesh at intervals of 5 dB increments using a standard least-square weighted contouring routine. The resulting contour map was scaled and overlaid on a household location map supplied by Carolina Power & Light. The number of houses located within 10 dB increment contours was then counted. The distribution of houses in the Shearon Harris EPZ versus siren sound levels was tabulated as follows:

TABLE 1

DISTRIBUTION OF HOUSEHOLDS BY SIREN SOUND LEVELS IN DBC

SIREN LEVEL	AVERAGE DBC	AVERAGE DBA	PERCENT
100-110	105	102.4	7.42
90-100	95	92.2	15.24
80-90	85	81.9	33.61
70-80	75	71.8	39.83
60-70	65	61.8	3.90

(Lee, at 23.)

46. The siren contours were generated in dBC since NUREG-0654 specifies dBC. However, the A-weighted sound pressure levels are commonly used for human hearing purposes. To properly convert the siren sound levels from dBC to dBA for awakening assessment, the following process was performed in lieu of simply using the difference of 3.2 dB from A-weighting to C-weighting for the 500 hertz octave band containing the fundamental siren frequency. This additional cautionary step was taken to account for the possible non-uniform frequency dependent attenuations over distances. Four sirens (#63, #65, #66, and #67) were re-run in OSPM, and this time the output was calculated in dBA at each of the same polar grid points as previously done. The paired dBC and dBA values were stratified, and statistics computed.

47. The mean differences from the above analyses were used in Table 1 to convert the C-weighted siren sound levels to corresponding A-weighted levels. (Lee, at 25.)

48. From Table 1, it is noted that the Shearon Harris siren system provides full coverage of all populated areas in the EPZ under summer nighttime conditions in that it provides at least 60 dBC to 100 percent of the population (the minimum of 70 dBC does not apply since no area within the EPZ is identified as having population density of more than 2,000 persons per square mile). As shown through Dr. Kryter's and Dr. Nehnevajsa's testimony, such a physical acoustic coverage meets the NRC 10 CFR 50 Appendix E design objective for prompt public notification systems. (Lee, at 26.)

49. Dr. Karl Kryter analyzed the arousal of people from sleep in response to the operation of the siren system. Dr. Karl D. Kryter is a

Staff Scientist at the Sensory Sciences Research Center, Stanford Research Institute (SRI). He is also President of the Acousis Company. 6/ ("Testimony of Karl D. Kryter Regarding Eddleman Contention 57-C-3" at 1-2) (hereafter Kryter).

50. He has done extensive research which is pertinent to Eddleman Contention 57-C-3. He has served as the principal investigator, or as the supervisor of investigators, of research on a broad range of problems concerned with basic auditory system functions, with the relations between the acoustical characteristics of sound and physiological, psychological, and social reactions tc sound and noise. This work has been conducted under contracts and grants from the military services, the National Institutes of Health, the National Aeronautics and Space Administration (NASA), Federal Aviation Administration (FAA), U.S. Environmental Protection Agency (EPA), National Sonic Boom Office of the President's Office of Science and Technology, Port Authority of New York and New Jersey (PANYNJ), as well as industrial organizations and other governmental bodies. (Kryter, at 2.)

51. Dr. Kryter has conducted research on and developed procedures and models for the assessment of the effects of sound and noise on sleep and annoyance. Recently (in 1984), he prepared an "Analysis of Laboratory and Field Data on Awakening from Noise" (P.O. L60744B, NASA Langley Research Center); and under sponsorship of NASA, EPA, and the U.S.

6/ Dr. Kryter has a B.A. Degree (1939) from Butler University, and a Ph.D. Degree (1943) in Psychology, with a minor in Physiology, from the University of Rochester, Rochester, New York. (Kryter at 1.)

Department of Transportation authored "The Effects of Noise on Man, 2nd. Edition", Academic Press (1985). (Kryter, at 2.)

52. Dr. Kryter was retained by IEAL to prepare testimony on the arousal of people from sleep in response to the operation of the siren system for the Shearon Harris Nuclear Power Plant EPZ.

53. Dr. Kryter's testimony discusses the probability that a member of a household within the Shearon Harris Nuclear Power Plant EPZ would be aroused from sleep by the sounding of the alerting sirens. (Kryter, at 6.)

54. He described the major factors which determine whether a sound will arouse a sleeper. The primary determiners of the arousal of normal persons from sleep by sound or noise are:

1. The audibility of the sound. This is a function of how far the intensity of different sound frequencies exceed their threshold intensity in the quiet;

2. The temporal duration of, or energy in, the sound;

3. The stage, from light to deep, of sleep which an individual is in at the time the sound occurs; and

4. The age of the individual.

(Kryter, at 6-7.)

55. It has been generally surmised that whether persons are habituated, or "used", to certain sounds, and whether certain sounds have special meanings (such as a warning of danger) are also important factors in determining how arousing a particular sound may be. However, it has been found that these factors of habituation and meaning appear to be more significant in determining how strongly a person reacts to a sound after the sound has become audible to the person when asleep. Physiological data indicate that when a sound is of sufficient energy to exceed the threshold of audibility for a given stage of sleep it will always cause some incipient arousal in an individual regardless of its meaning or familiarity, but that behavioral actions, including going back to sleep, will depend on the nature of the information conveyed by sound or noise. (Kryter, at 7.)

56. Fig. 1 of Dr. Kryter's testimony shows the cyclic variability in sleep stages during normal sleep, ranging from deep sleep, characterized by little rapid eye movement (REM) to light, dreaming sleep characterized by higher REM levels. (Kryter, at 7.) When a person is in deep stages of sleep, sounds, to be awakening, must be at least 30 dB or so above the levels required for arousal by the same sound when the person is in a light stage of sleep. Nearly all people go through nearly all stages of sleep at least once every forty-five minutes or so. (Kryter, at 8-9.)

57. The ear has its greatest sensitivity to sound in the mid-to-high frequency region, as is shown by the A-weighting function (presumably reflecting equal loudness for the different frequency bands) on the first set of graphs in Fig. 3A of Dr. Kryter's testimony. (Kryter, at 15.)

58. Dr. Kryter presented the results of a study by Horonjeff et al. that had considerable face validity with respect to sleep arousal by sounds (simulated transformer, test transmission line, air conditioner, and distant traffic) under real life conditions that provided fundamental data suitable for predicting sleep arousal by siren alerting systems. It is seen that the spectra of the simulated transformer, air conditioner, and distant traffic fall considerably below the relative loudness or audibility shown by the A-weighting curve in the mid-to-high frequencies; at the same time, for these noises, their low-frequency band levels were about equal in loudness, accord to A-weighting. However, the test transmission line (corona) and siren noise spectra more or less parallel the A-weighting function in the mid-to-high frequency region. (Kryter, at 15.)

59. The fact that the siren noise is lacking in components below the 500 Hz band is probably of little consequence for arousability, in view of the relatively great strength (and audibility) in its mid-to-high frequency bands. This is attested to by the fact that for the low frequency content of the four noises used by Horonjeff et al., all had fairly similarly strong and similarly shaped spectra below 500 Hz, when at a given equal overall level in dBA. However, the test transmission line noise, as will be shown, was the only one of the four noises with greater sleep arousal effects. This occurred when all four noises were of about equal overall level in dBA and must be attributed, it would appear, to the greater audibility and arousability of the mid-to-higher frequency energy than is predicted by A-weighting. Indeed, there is a substantial amount of research showing the ear to be about 10 dB more

sensitive in regards to loudness and noisiness of sound in the region of about 1000 to 4000 Hz than is reflected in the A-weighting function. (Kryter, at 15-16.)

60. The three very low frequency spectra noises should be equal to each other in these regards because of the similarity of their respective spectra. However, these latter three noises might be expected to be less audible and arousing than the corona noise and siren not only because of the generally greater audibility of tonal and varying spectra noises at mid-to-high frequencies, but also because one-third octave band levels at low frequencies, below about 500 Hz, over-estimate the effective sound energy as far as the ear is concerned. This occurs because the so-called critical (equal) bandwidths of the ear remain about constant below 500 Hz, whereas, the one-third octave bandwidths used for the spectra levels in Fig. 3A progressively decrease in width at lower frequencies. (Kryter, at 16.)

61. These considerations are borne out by the results of the sleep arousal data obtained by Horonjeff, et al. The very low frequency noises (air conditioner, distant traffic and simulated transformer noises) are similarly less arousing than the test transmission line corona noise. Because of their similarity in spectra, the sleep arousal effectiveness for the test transmission line noise is to be equated, in terms of dBA level, to that to be expected from the siren signals. Figure 4A of Dr. Kryter's testimony plots the probability of arousal for both the transient and steady-state temporal patterns as a function of maximum A-weighted (i.e. dBA) sound level and single event sound energy level (SEL). The curves were obtained as a least square fit of the points,

with the value of r (the coefficient of correlation) indicating the goodness of fit, and with r=1 indicating a "perfect fit". (Kryter, at 17-18.)

62. The results of the Horonjeff, et al., study also demonstrate that sound energy, rather than peak dBA level, of an exposure should be used for estimating the arousability of sounds or noises of different durations. (Kryter, at 18.)

63. Dr. Kryter explained the significance of sound energy in arousing a sleeper. The steady-state temporal pattern is more effective than the transient temporal pattern in arousing sleepers, for a given maximum A-weighted sound level, because of its longer duration. Thus in analyzing the effectiveness of a particular sound in arousing individuals, it is useful to have a measure of the combined effect of sound level and duration. The appropriate measure turns out to be the single event level (SEL) sound energy in dBA. (Kryter, at 18.)

64. The A-weighted SEL of the Horonjeff, et al., noises have been calculated from the temporal patterns shown in Fig. 2A of Dr. Kryter's testimony. Because the transient signals were increased in 10 dB steps until a response was obtained and then immediately stopped, the SEL of the single transient, of the transient causing arousal, was taken as representing the effective SEL for that sequence; that is to say, that the lower level transients preceding the one causing an arousal were not contributory to the effective energy, because they were at a minimum 10 dB below the transient causing the arousal. In general, the single event level sound energy in dB is given by:

> $10 \log_{10} [(p^2/p_o^2).(t/t_o)]$ where "p" is the average pressure in Pascals, "p_o" is 20 micro pascals, "t" is the time in seconds, and "t_o" is one second. Thus the SEL for the 15 minute steady-state noises can be calculated by adding 30 dB to the peak dBA level. (15 minutes = 900 seconds.)

(Kryter, at 19.)

The steady-state and transient temporal pattern sounds are, for a given SEL, approximately equally effective in arousing an individual from sleep. (Kryter, at 19.)

65. For each of the two types of noises involved (the very low frequency spectra noise and the more intense, higher frequency test transmission line corona noise) SEL, or equal energy, provides a unifying measure for predicting sleep arousal from different temporal patterns of exposure. The difference between these two types of noises reflects the inadequacy of overall A-weighted sound pressure level for assessing the arousability from sleep by very low frequency sounds, as compared to mid-to-high frequency sounds, as mentioned earlier. Low frequency, broad band noises, whose one-third octave band spectra fall off at the rate of 10 dB or more per octave above 125 Hz through 2000 Hz or so, are approximately 15 dB or so less effective in causing arousal from sleep. (Kryter, at 19-20.)

66. Dr. Kryter also discussed the effect age has on arousability from sleep. It has been consistently found that younger people are more resistant to being awakened by sounds or noise than are older persons. Fig. 6A of Dr. Kryter's testimony shows the general relation that has been found between age and awakening, and non-awakening, by noise. For present purposes, curves representing the arousability from sleep of the

age group 18-34 years, the age group 35-54 years, and the group over 55 years, (estimates average 65 years) are derived from the Horonjeff, et al., data. This is done by accepting the Horonjeff, et al., data to represent the 35-54 year olds, and adjusting those data downwards, in accordance with the function shown on or in Figure 6A, by five percentage points, and upwards by ten percentage points to represent the 18-34 year group and the 55 year and older group, respectively. (Kryter, at 20.)

67. In houses with windows closed, the siren signal in the 60 to 70 dBA areas will be inaudible to some percentage of persons in the age range above about 55 years. This occurs because the sensitivity, or threshold, of hearing declines with aging: so-called presbycusis. Table 1A of Dr. Kryter's testimony shows the relation between the sound pressure levels, indoors with windows closed, of the siren when at 60 and 70 dB outdoors. Also shown are the levels required for audibility for the 50th percentile (median) and 90th percentile of the U.S. population at the ages of 50 to 70 years. (Kryter, at 22-23.)

68. The general results of this analysis of sleep arousal data (showing the relationship between SEL and the probability of sleep arousal) are presented in Fig. 7A. It is believed Fig. 7A depicts, in so far as the present state of research knowledge permits, the probabilities of sleep arousal from sounds and noise measured in terms of SEL and having spectra whose loudness is determined primarily by sound energy in the mid-to-high frequency region, such as the test transmission line corona noise and the siren alerting signal. (Kryter, at 23.)

69. Dr. Kryter discussed how these findings relate to the siren system in the Shearon Harris EPZ. In order to predict, on the basis of Fig. 7A,

the effectiveness of the siren alert system for sleep arousal in the Shearon Harris EPZ, it is necessary to take into account a number of house sound attenuation and demographic conditions present in that area. (Kryter, at 23.)

70. Dr. Kryter explained how the sound level inside the residences in the EPZ differs from the sound level outside. Obviously, the arousability of the siren signal will depend on the degree to which its intensity is reduced by a house during outdoor-to-indoor transmission. Attenuation, or reduction, of sound levels is measured in decibels. Figure 8A of Dr. Kryter's testimony presents some of the data available on the attenuation of sound levels during the passage from outdoors to indoors. (Kryter, at 26.)

71. It is noted that this data from Young are for houses at Wallops, Virginia, an area probably similar in climate and housing to that present in the Shearon Harris EPZ. In any event, for purposes of this analysis, with all windows closed there will be 27.5 dB sound attenuation afforded by a typical house in the Shearon Harris EPZ, 15 dB when a bedroom window is open, and if the bedroom windows are partly open, the attenuation is approximately 21.25 dB. (Kryter, at 26.)

72. Dr. Kryter also explained how the dBA level of the siren is translated into indoor SEL. The SEL can be calculated from the siren dBA levels as follows: The time period between 10 dB downpoints of a siren rotating at 4 RPM is 4.2 seconds. Dividing this by two to average the rising and falling sound pressure gives an equivalent operating time of 2.1 seconds/revolution. Thus, during the first three minutes that the siren is on, it has an equivalent operating time of 25.2 seconds,

equivalent to 14 dB of energy. This yields the following results for the three siren activations expected to take place during the 15 minutes after activation is initiated:

> Indoor SEL, 1st Activation = Outdoor peak dBA + 14 dB -House Attenuation
>
> Cumulative Indoor SEL, 1st & 2nd Activation = Outdoor peak dBA + 17 dB - House Attenuation
>
> Cumulative Indoor SEL, all 3 Activations = Outdoor peak dBA + 19 dB - House Attenuation

(Kryter, at 28.)

73. Dr. Kryter stated his conclusion regarding the probabilities of arousal from sleep. Figure 7A of his testimony indicates the probability of arousal for an individual in the age groups 18 - 34 (indicated as 25), 35 - 54 (indicated as 45), and 55 years and older (indicated as 65) as a function of the SEL of the siren signal level inside the bedroom. The curve for the average 45 year-old group is based upon data from Horonjeff, et al., for their test transmission line corona discharge noise; the age factor adjustment is derived from the analysis of Griefahn and Jansen (Figure 6A). The threshold of hearing of the 65 year-old group becomes a factor in reducing the arousability of that group at lower levels of sound. Percent arousal probability for other age groups can be derived using the relationships presented in Figure 6A. In combination with demographic data and the method for estimating the effects of social networking, presented in Dr. Nehnevajsa's testimony, these probabilities provide a basis for estimating the percentage of the households in the Shearon Harris EPZ that would be aroused from sleep

during the hours of 1 am. to 6 am. by the sounding of the alerting sirens in the EPZ. (Kryter, at 28-29.)

74. Dr. Kryter testified on cross-examination that even if the siren to ambient background was plus 2 decibles there is a 20% plus probability of arousal (Tr. 9706). In addition, Dr. Kryter also testified under cross-examination that window air conditioners with the compressor working would not be a significant factor in masking sirens, even in the 60 dB contour (Tr. 9753). Dr. Kryter elaborated that window air conditioners have a 45 to 50 dBA with the compressor working and 40 dBA with the compressor off with the fan working, 30-31 decibels at 500 hertz for the air conditioner in the bedroom. If there is a 60 dB outdoor siren level at 500 hertz subtracting 25 dB for house attenuation, there is a 35 dB level of the siren in the house with windows closed. The usual dB level of the air conditioner at this time of the morning is 30-31 dB due to most compressors not being on during the 1 am - 6 am time frame. Because of the different temporal character of the siren versus the air conditioner, the siren would be detectable by 90 percent of the people (Tr. 9782-9783).

75. While Dr. Bassouni challenged Dr. Kryter's reliance on the Horonjeff data, and stated that the 1962 German study of the effectiveness of air raid sirens is more applicable to the question of nighttime siren alerting (Tr. 9877), the main focus of the German study was during the period of the subjects' deep sleep. For this period of least sensitivity to stimulus, the German study concluded that with house walls muffling an average of 10-15 dB of sound waking signal of 45 seconds duration with a loudness of at least 70-75 dB outside the

building would achieve a waking quota of 60%. At 40 dB inside (55 dB outside) the figure is approximately 35%. (German Study, p. 18.) Using the Applicants' example comparing the German study to Dr. Kryter's analysis, 60 dbc inside the house is converted to an SEL of 73.5. Figure 7a of Dr. Kryter's Testimony (Tr. 9690, Kryter, at 25) indicates that an SEL of 73.5 can be expected to awaken 37% of the populace between the ages of 18 and 34, approximately 41% of the populace between the ages of 35 and 54, and approximately 50% of those 55 years and up.

76. Dr. Nehnevajsa then analyzed the implications of the process referred to as informal notification. Dr. Jiri Nehnevajsa is a Professor of Sociology at the University of Pittsburgh. He has a PhD degree in Sociology, with minors in mathematical logic and journalism, from the University of Zurich, Switzerland (1953). (Testimony of Jiri Nehnevajsa Regarding Eddleman Contention 57-C-3" at 1-3.) [hereinafter "Nehnevajsa"].

77. For approximately the past twenty-five years, Dr. Nehnevajsa has conducted research on emergency preparedness problems. For a significant portion of this period, his research dealt with the possible threat of nuclear war and its implications for people. For a number of years, this work has been expanded to the consideration of attitudes and behavior related to any mass emergency, be it a natural disaster or a particular technological hazard. In the past few years, Dr. Nehnevajsa has served as principal investigator in a program to develop a major data resource concerning existing findings as they are expressed in the disaster research literature. He is also involved in generating a data base of original surveys and other studies that have been undertaken over the

years by various researchers on attitudes and behavior in anticipation of, preparedness for, and response to emergencies. (Nehnevajsa, at 2-3.)

78. Dr. Nehnevajsa was asked by International Energy Associates Limited to address some of the key issues which arise in the context of the behavioral implications of possible nighttime emergencies at the Shearon Harris Nuclear Power Plant. (Nehnevajsa, at 3-4.)

79. Dr. Nehnevajsa incorporated the results of Dr. Kryter's analysis into his analysis in order to reach the conclusions expressed in his testimony. (Nehnevajsa at 4.)

80. Dr. Nehnevajsa used socio-demographic statistics concerning the approximate area of the Shearon Harris EPZ provided by Donnelley Marketing Information Services in 1985. This data, as supplied by Donnelley, covered an 11 mile radius around Shearon Harris. The data was adjusted to conform to the 10 mile EPZ. (Carter, Tr. 9847)

81. These data are based on Bureau of the Census materials, the best estimates possible. Only dramatic changes in the data, none of which appear to have occurred around Shearon Harris, would render Dr. Nehnevajsa's conclusions sensitive to differences. He is entirely confident that such differences as might exist between the current situation in the area and that to which the Donnelley materials refer, or the changes which may have taken place, in no way affect the major findings of his analysis. (Nehnevajsa, at 5.)

82. Dr. Nehnevajsa concluded first that between 1 AM and 6 AM, not all people are asleep. He next concludes that upon arousal of one member of a household by an alerting signal, an immediate cascading, or intra-family "networking" process begins. This intra-family cascading

effect occurs immediately once a threat is perceived. "Immediately" means with a time delay of perhaps not more than a minute or two. (Nehnevajsa, at 7.)

83. Dr. Nehnevajsa concluded that he is entirely certain that the intra-family networking process must be fully recognized as part of direct warning, even though it must of necessity rely on interpersonal communication within the household itself. (Nehnevajsa, at 8.)

84. This is so simply because no one can assume that a 2-year-old or a 6-year-old or even maybe a 10-year-old, if awakened from sleep by the alerting signal, could properly interpret the meaning of the signal and thus recognize that a threatening situation/an emergency is in the making. Thus any concept of "direct" warning message delivery simply cannot be grounded in the premise that every single human being, or almost all of them, can or must be warned by the signal system. Children up to a certain age cannot be alerted in any other manner than by some adult who will have been aroused and alerted. (Nehnevajsa, at 8.)

85. Finally Dr. Nehnevajsa concluded that many people would contact, or attempt to contact, officials, relatives, neighbors and friends, and in some instances such contacts would arouse and alert some persons, through them households, previously not aroused. (Nehnevajsa at 5-6)

86. Dr. Nehnevajsa testified that people who are not asleep do not need to be aroused so they present no special or additional nighttime alerting problem. People who would already be awake and become alerted, as well as people who would be aroused by the siren system would alert all other members of the household. (Nehnevajsa, at 6.)

87. Those who are awake and not at home, whether at work or for whatever other reason would seek to contact their household/family members by trying to get home as fast as possible and/or phoning. Such actions would alert those household members who are at home asleep. (Nehnevajsa, at 6.)

88. Once aroused, Dr. Nehnevajsa testified the desire to confirm the warning along with the desire to be sure that relatives, friends and neighbors know that something serious may be "amiss", would cause people to attempt to reach others. Even where they are only seeking confirmation of the warning message, if they contact someone previously not aroused, the interaction would have the effect of arousing and alerting such others. This is the broader, and so well documented, cascading or networking process which is triggered by any initial warning that is interpreted, in fact, as a warning. (Nehnevajsa, at 7.)

89. Dr. Nehnevajsa testified that some people, will attempt more than one such contact, whether in person or by phone. (Nehnevajsa, at 7.) Social cascading or networking, will also occur very rapidly, most generally right after the other household members have been aroused and alerted. (Nehnevajsa, at 7.) If intra-family cascading is, as Dr. Nehnevajsa thinks it must be, an integral aspect of an alerting system, then it is not unreasonable to suggest that the social networking and cascading system, too, should be viewed as the equivalent of "direct" warning message delivery. (Nehnevajsa, at 8.)

90. Dr. Nehnevajsa described the assumptions he made in conducting his study of the implications of the three processes described above. (Nehnevajsa, at 8-9.)

91. First, Dr. Nehnevajsa assumed that the Donnelley Census-based data provide a good approximation of the distribution of households by size, in the Shearon Harris EPZ. This distribution is shown in Table 1 of the Appendix to his testimony. (Nehnevajsa, at 9.)

92. He next assumed that the distribution of households by peak dBC signal delivery throughout the EPZ is that which is indicated in Table 2 of the Appendix to his testimony. This distribution is one which was developed by I.E.A.L. (Nehnevajsa, at 9.)

93. Dr. Nehnevajsa assumed, implicitly, Dr. Kryter's specifications regarding the "behavior" of sirens over a fifteen-minute interval, and his specifications regarding the kinds of sirens that are in place. (Nehnevajsa, at 9.)

94. Dr. Nehnevajsa took, as initial parametric values, Dr. Kryter's estimates of arousal probabilities for different sound levels and for different magnitudes of attenuation. Dr. Nehnevajsa's Table 4, which shows this distribution, was derived from Figure 7A of Dr. Kryter's testimony. (Nehnevajsa, at 9.)

95. Dr. Nehnevajsa assumed that only those who are eighteen years of age and older serve as "message recipients" or "message targets" - in that they are individuals who can not only "hear" an alerting signal if aroused but also interpret its meaning and thus trigger the intra-family arousal-alerting cascade. Dr. Nehnevajsa testified that this is a very conservative assumption, since it would be reasonable to set the age of such primary message recipients at 16 or even 13+. However, since Dr. Kryter's probability estimates deal only with those who are eighteen years of age and older, and since he also asserts from his expert

knowledge that younger people are harder to arouse than are others, Dr. Nehnevajsa used this 18 years or older benchmark. Dr. Nehnevajsa went on to assert that if one were to agree that 16 year olds are old enough to recognize a warning and even if fewer of them than in other age brackets might be initially aroused it follows that all results he presented here are slanted toward the minimum estimates of what would actually happen rather than in some more optimistic direction. (Nehnevajsa, at 10.)

96. Dr. Nehnevajsa further assumed that the Shearon Harris area people are not very different from other American households and families. He thus used national data from his own research to estimate the composition of the EPZ households with respect to age. Thus, he used national data to give a good approximation of households of a given size in which there are 0, 1, 2, 3, or more "adults" (those who are eighteen years of age and older.) This distribution is shown as Table 5 in the Appendix to Dr. Kryter's testimony.

97. Dr. Nehnevajsa also assumed, that the households by size-and-composition are proportionately distributed in the various "zones" defined by the peak dBC's. Dr. Nehnevajsa testified that more detailed information on this matter would not significantly alter his findings. Table 6 in the Appendix to Dr. Nehnevajsa's testimony shows this distribution. (Nehnevajsa, at 11.)

98. In his analysis Dr. Nehnevajsa first estimated the probability of people being awake at night. Dr. Nehnevajsa employed the data from a University of Michigan study to provide such estimates for the Shearon Harris area. Dr. Nehnevajsa concluded that the use of this study was

appropriate in that the residents of the Harris EPZ are not dramatically different from other Americans. (Nehnevajsa, at 11.)

99. Dr. Nehnevajsa testified that it is reasonable to postulate that these basic patterns of behavior would be descriptive of the behavior of individuals in households regardless of size or composition. (Nehnevajsa, at 12.)

100. Therefore, only households where everyone is asleep require special attention as far as nighttime alerting is concerned. (Nehnevajsa, at 12.)

101. Dr. Nehnevajsa also estimated the percentage of households with at least one adult awake during various nighttime hours. He concluded that from midnight to 2AM 17.0% of the households and 18.7% of the people would fit into this category; between the hours of 2AM to 4AM 11.0% of households and 12.2% of the people would fall into this category. The hours from 4AM to 6AM result in the same estimates as the hours from 2AM to 4AM. (Nehnevaisa, at 12.)

102. Dr. Nehnevajsa testified that in terms of the issue under consideration by the Board, this result is of the utmost importance. It means that to achieve alert notification for essentially all households in the area, the problem of sleep arousal is salient for about ninety percent of households during the "worst" hours of the night, after 2AM, and such a notification, by sirens or whatever means, is a problem with regard to some 88 percent of the total population. (Nehnevajsa, at 12-13.)

103. Only very few people are "in transit" during the particular periods considered: the probability is only .066 between midnight and 2 AM,

it drops to .002 between 2 AM and 4 AM, to increase again to .004 between 4 and 6 AM. This small fuzziness in the interpretation of the data can be ignored for any and all practical purposes. (Nehnevajsa, at 13.)

104. Dr. Nehnevasja next calculated the percentage of households and people aroused or awake for three different categories of houses: all with windows open, all with windows closed, and one half with windows open. He provided such estimates for three siren activations. He assumed that the sirens would be sounded for three minute intervals with a 3 minute respite between soundings. He assumed the attenuation values provided by Dr. Kryter. (Nehnevajsa at 14-15.)

105. Dr. Nehnevajsa then described the effect social networking would have on the number of people alerted. The literature abounds with data pertaining to the fact that many people, if alerted to a danger, will seek to contact others either in person or by phone, with the latter being the most common form of reaction. (Nehnevajsa, at 16.)

106. In a study conducted in the Pittsburgh area in 1985, for instance, 87.5% of the respondents expected that people in their area would be contacting others to make them aware of an impending danger. In addition, just as many respondents claimed that they would expect that someone would try to contact them under such circumstances. (Nehnevajsa, at 16-17.)

107. Therefore, Dr. Nehnevajsa concluded that he had erred on the conservative side by assuming that only half of the alerted households would contact others, whether to confirm that an emergency is evolving or to warn them. In effect then, any contact with households not aroused by the alerting signal itself would amount to alert notification, whatever

the reason may have been for initiating the contact on the part of the contact initiator. (Nehnevajsa, at 17.)

108. To assess the implications for the process of inter-family networking, Dr. Nehnevajsa focused on a realistic though conservative situation. He assumed that half of the people sleep with all windows closed, and half with at least one window in at least one bedroom open, so that the attenuation was 15 dB for half of the residents and 27.5 dB for the remaining half. (Nehnevajsa, at 17.)

109. The sounding of an alerting signal between 2 AM and 6 AM, is the "worst case" with respect to the proportions of people being asleep. (Nehnevajsa, at 17.)

110. Since the non-arousal proportion is .355 for this situation once the initial warning has sounded, the probability is .232 that a household making a contact with some other household would "reach" some family not yet aroused if all awake and aroused households made an effort at one such contact. As he has stated, Dr. Nehnevasja assumed that only one half of such households might do so, a conservative premise in the light of such data as those from the most recent Pittsburgh area survey. This then implies that the probability of an alerted household actually making contact with an unalerted household is about .116. (Nehnevajsa, at 18.)

111. It is important to note, that with respect to the effects of inter-family networking, it does not matter in which subarea of the EPZ people live with respect to peak signal strength or whether or not windows are open or closed. It only matters that one member of the household, eighteen years of age and older, is awakened by the ringing of the telephone or, by neighbors ringing the doorbell or knocking on the

door. (Nehnevajsa, at 18.) The 1985 Pittsburgh area study shows that 93.0% of the respondents asserted that they, or at least someone in the household, would be awakened by the telephone were it to ring during nighttime hours. (Nehnevajsa, at 19.)

112. Using this probability of .93 of being aroused by the phone as an additional conservative factor to degrade the .116 probability of an unaroused household being aroused due t the inter-family networking pattern Dr. Nehnevajsa calculated that the likelihood of a household making contact with an unalerted household would be .108 instaead of .116. (Nehnevajsa, at 19.) Under these simple premises 75.3 % of the households would end up being aroused before the second sounding of the sirens rather than 64.5%, and 79.8% of the people, rather than 69.0% of them, would be aroused and alerted. (Nehnevajsa, at 19.)

113. This change, of course, has immediate and direct implications for the arousal outcome as a corsequence of the second, or subsequent, sounding of the sirens. There are, to be sure, fewer people in need of arousal given interfamily networking than there would be were it not for this empirically well established pattern of behavior. Nehnevajsa, at 19.

114. Given the arousal probabilities upon the second sounding of the sirens, the results now show that 77.8% of households would be aroused, and 82.2% of residents will have become alerted. (Nehnevajsa, at 20.) This, of course, compares favorably with the 68.3 percent of households and 72.8 percent of residents who would be alerted by the end of the second 3-minute warning signal if there were no interfamily cascading of the alerting message. Nehnevajsa, at 20.

115. It is reasonable to assume that some people may make more than one phone call or otherwise seek to contact other residents of the area. (Nehnevajsa, at 20.)

116. Based on his analysis Dr. Nehnevasja concluded that 83.6% of households will have been aroused and alerted, and 87.8% of the individuals in the EPZ will have become aware of the impending emergency. (Nehnevajsa, at 21.)

117. Dr. Nehnevajsa explained the findings, in a cumulative manner, incorporated the effect of nighttime activities. The effect of intra-family networking given household size and composition, household distribution by peak dBC estimates, and arousal probabilities for attenuations of 15 dB, an average of 21.25 dB, and 27.5 dB the effect of of social, inter-family networking. Dr. Nehnevajsa concludes that due to the assumptions he has used his analysis is a conservative one. The Board agrees.

118. In the statement made by Dr. Bassiouni during the conference call held on November 5, 1985, Dr. Bassiouni stated that informal notification should not be heavily relied upon. (Tr. 9878). This statement is inconsistent with Dr. Bassiouni's previous position as expressed in his 1983 article entitled "Prompt Notification of 100% of People in the EPZ". In light of this inconsistency, and in light of the fact that Dr. Bassiouni's statement does not demonstrate any expertise in the field of sociology, his conclusion concerning the amount of reliance which should be placed on informal notification should be given no weight by the Board.

119. Mr. Carter described the conclusions the panel of experts reached regarding Eddleman Contention 57-C-3. The conclusions incorporated the following major considerations:

120. The effect of nighttime activities, so that some percentage of people are awake:

Between midnight and 2 AM;

Between 2 AM and 4 AM; and

Between 4 AM and 6 AM.

(Carter, at 15.)

121. The effect of intrafamily networking, given household size and composition, household distribution by peak dBC estimates, and individual arousal probabilities. (Carter, at 15.)

122. The effect of social, interfamily networking, assuming that about half of those awake or aroused by the initial siren alerting signal will make one single contact with some other household so that some of these contacts arouse and alert households that may not have been alerted by the sirens and in which no member is awake during the period in which the sirens are sounded. (Carter, at 15-16.)

123. And, furthermore, that one third of the people who will have been aroused by the end of the second siren signal will attempt to contact others. (Carter, at 16.)

124. The interfamily ripple effect was applied only to a situation in which half of the residents sleep with all bedroom windows closed because of the use of air conditioning, and half keep at least one window (in at least one bedroom) open. (Carter, at 16.)

125. The "worst" night hours were assumed, that is between 2 AM and 6 AM, hours when the potential alerting "payoff" due to people who are awake anyway is at a minimum. (Carter, at 16.)

126. Some 87.8% of the people in the EPZ can then be expected to be aroused and alerted as a result of activating the Shearon Harris siren system for fifteen minutes with a pattern of three minutes on and three minutes off. (Carter, at 16.)

127. In responding to the question whether the Shearon Harris siren system can be improved, Mr. Carter stated that any public siren system can be improved. In considering adequacy, and further system improvement, what is prudent and reasonable must be addressed. NUREG-0654/FEMA-REP-1 states on page 3-1 that the design objective does not constitute a guarantee that early notification can be provided for everyone with 100% assurance. The NRC elaborated on this aspect in its statements of consideration for the Final Rule, 10 CFR Parts 50 and 70, Emergency Planning (45 Fed. Reg. 50705), regarding public notification systems:

> "The commission recognizes that not every individual would necessarily be reached by the actual operation of such a system under all conditions of system use."

The Shearon Harris siren system, as currently being augmented, is capable of providing, under average conditions, a sound coverage of greater than 80 dBC to almost sixty percent of the residences in the EPZ. This coverage is 20 dBC greater than that required by FEMA and NRC guidance. This 80 dBC represents ten times the sound pressure of 60 dBC. Therefore, in the Shearon Harris EPZ almost sixty percent of the

residences are exposed to ten times the sound pressure level considered by FEMA and NRC to be adequate. (Carter, at 16-17.)

CONCLUSIONS

128. The Shearon Harris offsite plans for notification of the public provide reasonable assurance that essentially complete and timely notification of the public can be achieved in accordance with 10 CFR § 50.47(b)(5).

129. The Shearon Harris offsite plans for notification of the public demonstrate compliance with the standards described in 10 CFR § 50.47(b)(5) in that the design objective of the siren system has the capability to essentially complete the initial notification of the public within the plume exposure pathway EPZ within about 15 minutes.

130. Compliance with the guidance set forth in NUREG-0654/FEMA-REP-1 (formally approved by the Commission) has been litigated a number of times and in those cases where the notification system has complied with that guidance, systems have been found acceptable. The Shearon Harris alert and notification system complies with NUREG-0654 guidance in that it provides a minimum of 60 dBC coverage to 100% of the EPZ.

131. Even if the 60 dBC standard is not taken into account, the alert and notification system meets the 10 CFR Part 50, App. E IVD.3. criteria because the system operating under the contention scenario will notify no less than 87.8% of the population of the EPZ within 15 minutes. This figure takes into account, informal notification or social networking, an integral part of an alert and notification system which has been previously recognized by other Licensing Boards. Further gains in the number of people notified will be accomplished through mobile alerting,

social networking, and by continued activation of the sirens beyond the initial 15-minute period.

Reply to Attorney General's Proposed Findings of Fact and Conclusions of Law on Eddleman Contention 57-C-3 (Nighttime Notification)

132. The Attorney General's proposed finding number 6 makes mention of Dr. Bassiouni's challenge of the awakening curves on which the FEMA analysis relies. Dr. Bassiouni's criticism was primarily based on an untranslated 1962 study (German Study) discussed supra, that examined the arousal of test subjects who were subjected to an air raid siren signal for 45 seconds (three repetitions) during the period of deepest sleep. The study's conditions did not approximate the normal patterns of sleep but assumed a worst case of deep sleep. Nor does the 1962 study approximate the duration of the siren signal if activated in the event of an emergency at Shearon Harris. Applicants demonstrated that the conclusions of the German study are actually less conservative than the expected percentage of people aroused based upon either Dr. Kryter's or the Applicants' data (Applicants Proposed Findings of Fact and Conclusions of Law on Eddleman 57-C-3, paras. 33-35).

133. In proposed finding 8a the Attorney General states that the nighttime notification issue of Contention 57-C-3 is not addressed in federal guidelines. Federal regulations provide that design objective of the alert notification system shall be to have the capability to essentially complete initial notification of the public with the plume exposure pathway, EPZ within about 15 minutes. The Applicants and FEMA have demonstrated that the Shearon Harris alert notification system

meets the federal regulations in that the system has such a capability under the nighttime conditions postulated by Eddleman Contention 57-C-3. (Lee, at 26.)

134. In proposed finding 8b, the Attorney General asserts that reliance or informal alerting is an inferior safety standard. Informal alerting is a well documented and accepted means of alerting the populace (Nehnevasja, 16) Duke Power Company et al. (Catawba Nuclear Station, Units 1 and 2), supra. In response to proposed finding 8c, the issue is not whether a better alternative is available; there are a number of alternatives systems and approaches to alert the public, the issue is whether the alert and notification system is in compliance with the Commission's regulations and guidance documents that have been recognized by the Commission. FEMA has determined that the Shearon Harris Alert and Notification System meets NUREG-0654 and the 10 C.F.R. Part 50 requirements. (Lee, at 26.)

135. The Attorney General's proposed finding number 9 asserts that the probability of arousal from sleep with a siren sound level of 60 db in an air-conditioned house is essentially zero. Dr. Kryter testified that a 60 db outdoor siren level is detectable by 90 percent of the people inside the house assuming the condenser is off and the fan is running (Tr. 9783-9784) and that the masking of the siren was not significant. In addition, Dr. Kryter indicated that the fact that only 30 percent of the houses have window air-conditioners assuming that everyone that had a window air conditioner did not hear the siren, the impact upon the total percentages would be less than one percent (this is not a proper assumption according to Dr. Kryter's calculations) (Tr. 9784). Further,

Dr. Kryter indicates that approximately 20 percent of the population would be aroused from sleep with an outdoor siren signal of 60 dbc with the air conditioner running but the condenser not in use. (Tr. 9706, 9753, 9783-9784). Considering the small percentage of households in the 60 db contour area, the percentage of households with window air conditioner units, the small percentage of households with the condenser running at night, the fact that the air conditioner was on or off has no effect on the arousability. (Tr. 9785).

136. In response to the Attorney General's proposed finding number 9, FEMA expert testimony indicates the probability of arousing an individual from sleep with windows closed (Central air-conditioning) and an outdoor siren sound level of 60db is approximately 20%; with windows open approximately 30%. (Kryter, at 25-26, 28.) Using a mix of one and two resident households, this corresponds to an average household probability of direct (siren) arousal of 33% for houses with windows closed and 47% for houses with windows open. These arousal probabilities are at the minimum acceptable sound levels (less than 4% of the EPZ is covered by the minimum acceptable db level, greater than 96% of the EPZ is covered by an excess of 60db (Lee, at 23).

137. In response to Attorney General's proposed finding number 10, FEMA expert witness testimony indicated that approximately 85db would provide a 50% probability of direct arousal of a sleeping person. (Kryter, at Figure 7a.) Using a mix of one and two resident households an 85db level would be expected to arouse 70% of all households. The Shearon Harris Siren System as currently augmented is capable of providing, under

average conditions, a sound coverage of greater than 80dbc to almost 60% of the EPZ. (Carter, at 17.)

138. In response to the Attorney Generals proposed finding number 12, mobile alerting and indirect notification were recognized and accepted by the Licensing Board in Duke Power Company, et al., supra as a means of supplemental notification that give reasonable assurance that the EPZ population will be promptly notified. In Duke Power Company et al. (Catawba Nuclear Station, Units 1 and 2) ALAB-813, 22 NRC 59 (1985), the Appeal Board rejected, as without merit the Intervenors claim that the Licensing Board was required as a matter of law to await the final FEMA findings on sirens.

139. In response to the Attorney General's Proposed Finding 14, FEMA has found that the alert notification system satisfies the NUREG-0654 criteria in that it provides 60dbc coverage to 100% of the EPZ and that 10 C.F.R. Part 50 Appendix E.IV.3 criteria are met in that the system has the capability to essentially complete the initial notification of the public within the plume exposure pathway EPZ within about 15 minutes under the nighttime conditions postulated in Eddleman 57-C-3. (Lee at 26.)

140. As stated by the Licensing Board in Catawba, the function of the Licensing Board:

> "...is not to require that measures be taken which exceed the Commissions requirements."

Duke Power Company et al., supra at 940.

141. In response to the Attorney General's proposed finding number 15, FEMA has never received OMB approval to conduct a telephone survey at

night. OMB has instructed FEMA not to inconvenience the public any further than absolutely necessary. (Tr. 9444).

142. In response to the Attorney General's Proposed Finding Number 16, the proposed finding lacks specificity. If the Attorney General's Proposed Finding is meant to require that the operating license be withheld until a field test of the alert notification system is conducted, this finding is contrary to the decision of the Appeal Board in Catawba. Duke Power Company, et al. (Catawba Nuclear Station, Units 1 and 2), ALAB-813, 22 NRC 59 (1985). It is FEMA's position that if a nighttime survey were conducted, substantial prenotification must occur to preclude alarming the public. This would affect the ultimate results of the test (Tr. 9933). As indicated previously, FEMA's authority to conduct a telephone survey requires OMB approval, and that approval has been given under the condition that FEMA was not to inconvenience the public any further than absolutely necessary (Tr. 9944). If the Attorney General's office in conjunction with the Department of Emergency Management, State of North Carolina, were able to sponsor such a test, the Federal Emergency Management Agency would be able to review the results of such a field survey and assess its validity. NRC Staff/FEMA emphasizes, however, that a field survey of the alert and notification system is not a prerequisite to the issuance of an operating license.

V. CONCLUSIONS OF LAW

1. The Board has considered the entire record in this portion of the proceeding relating to offsite emergency planning except for matters pertaining to Eddleman Contentions EPX-2 and EPX-8, the subject of ongoing discovery. Except for issues raised by Contentions EPX-2 and EPX-8, the Board concludes, in accordance with 10 C.F.R. § 2.760a and Section VIII of Appendix A to Part 2, that the offsite emergency response plan for the Shearon Harris Nuclear Power Plant, with respect to all matters placed in controversy and considered in this partial initial decision complies with the applicable provisions of 10 C.F.R. § 50.47 and 10 C.F.R. Part 50, Appendix E, and provides reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency.

This Partial Initial Decision is effective immediately and will constitute the final decision of the Commission 45 days after the date hereof, unless a party appeals or seeks a stay. Pursuant to 10 C.F.R. § 2.762, an appeal from this Partial Initial Decision may be taken by filing a notice of appeal with the Atomic Safety and Licensing Appeal Board within 10 days after service of this decision. A brief in support of an appeal must be filed within 30 days after the filing of the notice of appeal (40 days if the appellant is the NRC Staff). Within 30 days after the period for filing and service of the briefs of all appellants has expired, any party not an appellant may file a brief in support of or

in opposition to the appeal. The NRC Staff may file a responsive brief within 40 days after the period for filing and service of the briefs of all appellants has expired.

Respectfully submitted,

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Dated at Bethesda, Maryland
this 20th day of December, 1985

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
CAROLINA POWER AND LIGHT COMPANY AND	)	
NORTH CAROLINA EASTERN MUNICIPAL	)	Docket Nos. 50-400 OL
POWER AGENCY	)	50-401 OL
	)	
(Shearon Harris Nuclear Power Plant,	)	
Units 1 and 2)	)	

I hereby certify that copies of "NRC STAFF/FEMA PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW ON EDDLEMAN CONTENTION 57-C-3 (NIGHTTIME NOTIFICATION" in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class, or deposit in the Nuclear Regulatory Commission's internal mail system (*), this 23rd day of December, 1985:

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