

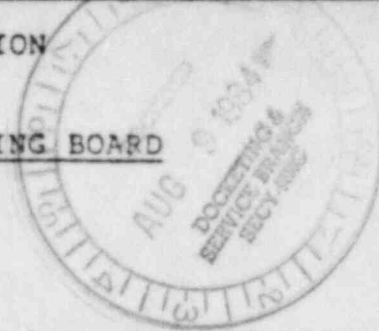
50-413/41402

NUCLEAR REGULATORY COMMISSION

I. J-49

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

5/24/84



In the Matter of)

DUKE POWER COMPANY, et al.)

(Catawba Nuclear Station)
Units 1 and 2))

Dockets Nos. 50-413
50-414

April 16, 1984

PRE-FILED TESTIMONY OF PALMETTO ALLIANCE
AND
CAROLINA ENVIRONMENTAL STUDY GROUP
ON
EMERGENCY PLANNING CONTENTIONS

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U. S. NUCLEAR REGULATORY COMMISSION

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Applicant Staff Intervenor X
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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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TESTIMONY OF JESSE L. RILEY

1. Q: WHAT IS YOUR NAME?
A: My name is Jesse L. Riley.
2. Q: WHERE DO YOU LIVE?
A: In Charlotte at 854 Henley Place.
3. Q: WHOM DO YOU REPRESENT?
A: I am the spokesperson for the Carolina Environmental Study Group, a party in this proceeding.
4. Q: WITH WHAT WILL YOUR TESTIMONY DEAL?
A: With the need for emergency planning, for at the least, southwest Charlotte.
5. Q: WHY?
A: Information provided by the NRC, or by contractors for the NRC, indicates that as the result of a serious accident people of Charlotte, people not in the present Emergency Planning Zone, would be subject to a great number of early fatalities, early injuries, and latent cancer cases. The planning

basis document, NUREG-0396, Figure 1-17, indicates that lacking immediate protective action, a one-day exposure in the radial interval of 10 to 25 miles from the Catawba Plant would, for the mean population density of Charlotte of 2500 persons per square mile, be expected to result in 5 to 40 early fatalities, 350 early injuries. The Siting guidance study, NUREG/CR-2239, specifically projects for the Catawba Plant 100 mean early fatalities for an SST-1 accident and release and 710 mean early injuries. The NRC staff, in the Final Environmental Statement, does a worst case analysis sampling weather sequences actually observed at the Catawba Plant. They find, the possibility of exposing 44,000 persons to over 200 REM, 270,000 persons to over 25 REM, Table 5.11. Under these conditions I anticipate 19,000 fatalities if only the present EPZ is evacuated. However, if there is relocation from 10 to 25 miles from the plant, early fatalities would be reduced to 470, a savings of 18,530. The 19,000 fatalities are conditioned on availability of moderate medical treatment. As there are only 10 radiation beds in Charlotte, it seems that medical treatment would be minimum and 24,000 fatalities projected for minimal medical treatment are a more realistic indication of what would happen in the event of such a release.

Because of the demographics and prevailing wind direction, by far the largest part of these 24,000 fatalities would occur in Charlotte. Another confirmation of high level consequences of an SST-1 accident is given by studies made at Sandia. The worst case SST-1 accident is estimated to result in 42,000 early fatalities, 88,000 early injuries, again presumably the largest part in Charlotte. (Letter report of Committee on Interior and Insular Affairs, Sub-committee on Oversight and Investigations, November 1, 1982.)

6. Q: DOES THE FES ASSERT THAT PEAK CONSEQUENCES OF SUCH MAGNITUDE ARE ACCEPTABLE IN A COST BENEFIT WAY?
- A: Yes. A variety of accident scenarios and weather situations are averaged, after being converted to "risks". In this context risk is the probability of the calculated consequences by an assumed probability of occurrence of the event. The "risk" of the most serious consequence is put as 1 in 100 million reactor operating years.
- Summation of this very small product with other small products leads to the conclusion that there would be about .1 of an early fatality in the full anticipated 80 reactor year operation of the plant.
7. Q: DO WE FIND REASONABLE AND ACCEPTABLE THIS FINDING BY THE STAFF?

A: No. While I believe that the consequence estimates are reasonable and based on actual experience such as the inventories of reactor cores, measurements of half-lives, and radiation intensities for different isotopes and the dosage consequences at Hiroshima and Nagasaki, the same is not true for the probabilities.

I believe that it is generally recognized there are three types of "probabilities". One type is postulational, chances are one in two with a flipped coin will be a head or a tail. Similarly the mathematics of the chance occurrence in a given combination of cards in a deck may be expressed as a probability. Another type of probability is actuarial, based on experience. One's chances of death by automobile accident or injury are well established by many years of actuarial data. The "probability" in the present context differs from these. It reflects on analysis and an estimate. Probabilities of the reactor safety study are based on fault-tree analyses. The accident at TMI-2 invalidates the RSS assumption of no multiple failures including operator error. The fallacy of this approach to "probability" has been shown by actual experience. Before it happened the probability of the TMI-2 accident was zero--it had not been envisaged.

Similarly, the probabilities of Brown's Ferry fire and the FERMI-1 partial meltdown were unenvisaged and hence, had a probability of zero. We simply have no knowledge of all possible scenarios which may lead to a serious release though it must be said that since the occurrence of the aforesaid events the staff has greatly enlarged its contemplation of severe accident sequences. Given only 800 years or so reactor operated experience it is very non-conservative to project 100,000,000 year spans. An additional point ignored by the FES is that even where valid probabilities relating events to time spans are available, indication has been given as to when in the time span the event will occur. Although death by vehicular accident has a probability of about one in 2,000, none of us knows beforehand whether he is going to be one of the victims nor at what moment this will occur.

8. Q: ARE THERE OTHERS WHO SHARE YOUR CONCERNS?

A: Members of the Carolina Environmental Study Group and numerous others who have spoken to me who are not members share this view. I think that it is particularly significant that this concern was expressed by Judge James McMillan of the United States District Court for the Western District of North Carolina in declaring the Price-Anderson Act unconstitutional, CESG v. AEC, Case No.

C-C-73-139, March 31, 1977. Judge McMillan noted that parties to the case, the Atomic Energy Commission, Duke Power Company, and C2SG all agreed that severe accidents were possible. The remaining question was one of probability. In regard to probability the Judge concluded "the court is not a bookie:"

The significant conclusion is that under the odds quoted by either side a nuclear catastrophe is a real, not fanciful possibility.

The Court finds without being as rosily optimistic as the Reactor Safety Study, nor as pessimistic as Dr. Kendall, that a core melt at McGuire or Catawba can reasonably be expected to produce hundreds or thousands of fatalities, numerous illnesses, genetic effects of unpredictable degree in nature for succeeding generations, thyroid ailments, and cancers in numerous people, damage to other life and widespread damage to property. Areas as large as several thousand square miles might be contaminated and require evacuation. Since life of individual human beings, as shown in a number of publicized cases involving death or disability, is now being valued in some cases at sums greatly exceeding a million dollars, it would not require death of or serious injury to many people to exceed the \$560,000,000 Price-Anderson Act limitation now in effect, in a day when failure of an earthen dam in sparsely populated Idaho can produce property damage reported by the press at about a billion dollars, is it unreasonable to conclude, as I do, that radioactive pollution of a few hundred square miles of heavily populated Piedmont North Carolina or South Carolina could well produce property damage vastly exceeding the Price-Anderson ceiling.

9. Q: CONSIDERING THESE VIEWS, DO YOU EXPECT THE CATAWBA PLANT TO BE LICENSED TO OPERATE?
- A: Yes.
10. Q: WHAT REMEDY DO YOU SEEK?
- A: An effective emergency plan for Charlotte. The initial Atomic Safety and Licensing Board admitted CESG/Palmetto Contention 11. This contention permits us to consider an emergency plan which would reach approximately 17 miles from the Catawba Plant but not to 25 miles, the farthest city limit. This 1 1/2 mile radius may well be within the purview of the "about ten miles" radius referred to in NUREG 0396. This matter is given consideration by the initial Catawba ASLB's Memorandum and Order of September 29, 1983, pp. 1-5, and in a Memorandum and Order dated December 30, 1983, pp. 1 through 5. It should be noted in this connection that the present EPZ reaches to about 13.8 miles south of the Catawba Plant including all of the City of Rock Hill and some of the environs. To the northeast of the Catawba Plant, the EPZ stops at the Charlotte city limit, 9.7 miles from the plant. The prevailing wind direction from the Catawba Plant toward Charlotte is approximately twice the random frequency, which, together with the demography argue for such protection.

CESG would like to see the Planning Zone extend to the 17 mile radius from the plant through Charlotte. This would delineate almost the same area used in the Board's example, an EPZ reaching U.S. 74 and N.C. 16. In the alternative, CESG would choose N.C. 27 in lieu of U.S. 74. A 17 mile radius would also be acceptable and incidentally ~~also~~ reach as far as the Board's example did at its farthest point. At the 17 mile radius, an area of 73 square miles would be added to the present EPZ area of 332 square miles. The present EPZ has a population of 95,000 people. The area proposed for addition has a population of 136,000. The population density in the initial EPZ is 286 people per square mile, that in the southwest Charlotte area under consideration is 1863 people per square mile, or 6.5 times as high a population density. An increase of 22% in area covered results in an increase of 143% in persons covered by the emergency plan. It is clearly the people in the area of southwest Charlotte who contribute most heavily to the estimated early deaths in FES Table 5.1.2. In order to accomplish the relocation which would save the largest proportion of these lives, effective planning will be required.

11. Q: ARE THERE OBSTACLES TO EFFECTIVE PLANNING IN THIS REGION?
- A: There is a prospect of high traffic density and possible panic. It is generally recognized that radiation hazard is not identifiable by visual or olfactory indications. At a hint of radioactive disaster, people will tend to flee. There will be confusion and if their panic is a serious one, it will be paid for with a loss of lives.
12. Q: WHAT EMERGENCY PLAN IS USED AT THE PRESENT EMERGENCY PLANNING ZONE?
- A: It is defined and described in the brochure sent to EPZ residents. A siren system has been installed. Instructions have been given that on hearing a steady three-minute siren signal, an individual is to turn on an emergency broadcast and follow the instructions that they are given. Evacuation routes are shown and shelter procedures are described.
13. Q: WOULD YOU LIKE TO SEE THIS SYSTEM EXTENDED IN CHARLOTTE TO A SEVENTEEN MILE DISTANCE FROM CATAWBA?
- A: This would be an improvement over present plans for an emergency response.
14. Q: WHAT IS THE PRESENT PLAN?

A: The "All Hazards Plan for Charlotte" has deficiencies. Foremost is probably the lack of information and instructions for the public. An accident would be dealt with on an ad hoc basis. I cannot visualize providing the necessary instructions to hundreds of thousands of people in a timely way during the course of the accident. It is even less likely for appropriate, individualized instructions, which would relate to location, the time of the release, the magnitude of the release, wind speed and direction indicated.

In a recent successful evacuation for a chemical fire generating toxic fumes and complicated by wind shifts, door-to-door warnings and instructions were given. This is not feasible for up to 136,000 people. It did work for the several thousand people involved. An all-hazards plan is described in seven pages. This contrasts with the hundreds of pages in the North Carolina and South Carolina Emergency Plans for Catawba. A Mecklenburg County Plan alone takes up 50 pages and deals with a much smaller area and a very much smaller number of people than we have under consideration.

15. Q: THEN YOU ADVOCATE THE EXTENSION OF THE PRESENT SYSTEM TO SOUTHWEST CHARLOTTE?
- A: No, not if a better system can be devised.
16. Q: WHAT DO YOU SEE AS FAULTS IN THE PRESENT SYSTEM IF IT WERE APPLIED TO SOUTHWEST CHARLOTTE?
- A: There are deficiencies in the siren system of notification. The primary deficiency is that it will only operate when there is AC power. Several sequences of serious plant accidents result in the absence of off-site and on-site power. Under such conditions there would be no notification and the majority of radio and television sets would not play. There would be neither alerting nor adequate emergency broadcast system instruction.
- When sirens do sound, they cannot be depended upon always to reach targets in their normal operating area. In a FEMA sponsored study, Bolt, Beranek, and Neuman point to lens and sound refraction effects which depend on the temperature gradient in the atmosphere and which will determine whether the siren sound propagates in a plane or bends upward, out of hearing. It points out that persons in an automobile are not likely to hear a siren.

It is obvious that weather conditions, howling winds, heavy rain, dense snow layers, well sealed and insulated structures do not conduce to a siren being heard. Deep sleep and impaired hearing reduce a likeliness of effective siren notification. Playing radio, stereo or television, or normal family activities may result in a siren signal being ignored. The CESG survey shows that 20% of the residents of the McGuire EPZ have not heard the siren sound during tests. Other answers show that 60% of a sample of McGuire residents do not know the significance of the siren sound; namely, to seek shelter and tune to the EBS broadcast. Fairly general information which would be required in an EBS message will not make clear to a person near the plume pathway whether it is better to evacuate to, say, the northwest, or the southeast where both options are possible. In a narrow plume, which will develop under conditions of relatively stable air, the plume pathway may be less than two miles wide in Charlotte. The direction of the evacuation could be critical for persons near the pathway. The general EBS message will not make clear which people would be better off sheltering or, being prospectively exposed to no hazard, staying where they are.

17. Q: CAN YOU PROPOSE A MORE SATISFACTORY ALTERNATIVE?

A: Yes. It involves a system of telephonic alerting and notification in which messages would be individually tailored to suit the needs of respondents. It would be supplemented by the EBS system for those away from the phone or unable to reach a phone.

In order to make possible instructions of individual utility, I propose dividing the plan area into quarter sectors, 5.63° of arc at one-mile intervals. Between 10 and 11 miles from the plant the area of such a subdivision would be 1.03 square miles; between 16 and 17 miles from the plant, it would be 1.62 square miles. Superimposing this grid on a map of Charlotte shows that at least one major road, or feeder, runs through each of these approximate square mile areas.

Southern Bell Telephone Company is able to access the phones in each such small area with a specific recorded message. There are four or five central stations in southwest Charlotte, each having the potential for automatically dialing as many as 1700 calls per minute. There are 247,000 telephone subscribers in Mecklenburg County. It is reasonable to estimate 50,000 to 60,000 phones in the proposed planning area. The time to ring these phones will be less than 10 minutes.

Facilities include a special ring as an alert signal. It is possible to preempt all normal calls for an emergency message. The two systems under consideration would be computer actuated. Up to a 17 mile radius, there would be 56 subdivisions as described in the foregoing. Each of these subdivisions could receive an individual message. These messages could be taped or the specific instructions would be pre-taped. In the first system the computer would dial. It would play, as appropriate, either an alerting message, or an instructional message. In the second system the computer would send a non-voice signal to actuate a multi-functional "black box" installed at the subscriber's phone. The actuating signal would be effective whether or not the phone were in use.

18. Q: WOULD PHONE NOTIFICATION BE MORE EFFICIENT THAN SIREN ALERTING AND NOTIFICATION?

A: I think so. As long as a person is near the phone, whether waking or sleeping, listening to radio, stereo or TV, it would be heard and, most probably, answered.

19. Q: WOULD PHONE NOTIFICATION BE MORE EFFECTIVE?

A: Yes. It would make clear which subsections should evacuate and at what time, and in which direction, and which subsections should shelter and for how long and when to leave shelter and relocate. Preferred departure routes would be specified.

20. Q: WOULD WEATHER BE ELIMINATED AS AN ALERTING AND NOTIFICATION FACTOR?
- A: Yes.
21. Q: WHAT ABOUT THE HARD OF HEARING?
- A: Hardness of hearing is already compensated for by amplifier setups or light setups.
22. Q: WOULD PHONE NOTIFICATION BE MORE RELIABLE THAN A SYSTEM DEPENDENT ON AC POWER?
- A: Yes. As said previously, both sirens and most radios and TVs depend on AC power. The phone system is independent of AC power. It operates on a battery supply at 48 volts. These storage batteries can be kept charged by the phone company's generators.
23. Q: WHAT WOULD SUCH A SYSTEM COST?
- A: A computer-dialed, real time system has not been priced by Southern Bell. My impression is that it may cost between 5 and 10 million dollars. The second system would be adapted for multiple uses which would contribute to paying for it. Uses include fire-alarm, burglar alarm, utility meter reading, electrical demand reading, load shedding, and cable TV use monitoring. Southern Bell's part of the system, I am told, would cost about 5.5 million dollars. To use this system,

a subscriber would need the black box which, installed, it is estimated it would cost between \$100 and \$150.

24. Q: HOW SOON COULD SUCH A SYSTEM BE PLACED IN OPERATION?

A: I have been told by the third quarter of 1985.

25. Q: ARE THERE OTHER ADVANTAGES FOR A PHONE NOTIFICATION?

A: Alerting and notification would compensate for the fact that a substantial fraction of the public would not have read instructional material or not remembered the instructions at the time of the event. The messages would be repeated at least once to improve retention. As the accident progressed, and the wind changed, the instructions would be updated. Between updating messages, the phone could receive normal use. During messages, such use would be preempted. The specificity of the messages would also be of reassuring value. A clearly specific message would reduce the likelihood of panic responses, irresponsible rush to cars by people who did not need to evacuate.

26. Q: WOULD THIS BE THE SOLE MEANS OF ALERTING AND INSTRUCTION?

A: No. As said previously, the Emergency Broadcasting System would alert many of those in cars. Other means considered in the Emergency Plan, helicopters with loud speakers, patrol cars with bull horns, etc. could notify those away from phone and radio.

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TESTIMONY OF RAY TWERRY

1. Q: WHAT IS YOUR NAME AND ADDRESS?
A: My name is Ray Twerry. I live at 3335 Sunnybrook Ave.
2. Q: WHAT ARE YOUR PROFESSIONAL QUALIFICATIONS?
A: I hold a Master of Science Degree in Mathematical Statistics from the University of Illinois and have completed the coursework for a Doctor of Philosophy in that field at the same school. I have worked as Senior Statistician at the Stanford Research Institute, and have worked extensively as a consultant in mathematics, planning and statistics. I am presently a lecturer in statistics at the Department of Mathematics and Computer Science at the University of North Carolina at Charlotte.
3. Q: WHAT IS THE PURPOSE OF YOUR TESTIMONY?
A: As a resident of east southeast Charlotte, about a dozen miles from the Catawba reactors, I was

interested in assaying the need for emergency plans including notification, evacuation and treatment for my neighborhood. As a professional statistician whose 20 years of industrial experience has included use of computer simulation, I sought pertinent information in the Catawba Final Environmental Statement, NUREG-0921, and in the Sandia Siting Study, NUREG/CR-2339.

NUREG-0921 quotes an expected value of .0022 for early fatalities per reactor year. This becomes .176 for the expected 80 years of reactor life at Catawba. Since I am in a $22\frac{1}{2}^\circ$ sector which would receive a plume from Catawba units about 5% of the time, the .176 becomes .035 for the sector that I reside in. The density of population in this sector is at least 10 times greater than the average density for the entire 50 mile radius that the NUREG-0921 study apparently assumed was uniform throughout. Accordingly, the .035 becomes .350 for my sector. The NUREG study estimates that their probabilities used to obtain the initial figure of .0022/reactor year are uncertain by a factor between 10 and 100, so the .35 may be 3.5 to 35 for my sector. The Sandia Study, NUREG/CR-2239, Fig. 2.7.1-3, estimated that for a reactor of the size of Catawba, the lack of "perfect" preparation would increase early fatalities by a factor of over 10 for

a major accident (apparently the main contribution to the expected value .0022), so 3.5 to 35 becomes 35 to 350 early fatalities expected (for just my sector through southeast Charlotte) during the life of the Catawba reactors using the NUREG figures and assuming an imperfect preparation plan.

If one were to convert these early fatality statistics to a dollar equivalent, then at \$1 million per life, we are talking about an expected economic cost of \$35 million to \$350 million just from early fatalities and just in my sector that could be reduced by a factor of about 10 by a realistic preparation for an accident.

Consideration for Charlotte's expected economic costs related to resulting illness would make the economic case even stronger.

Some statistical comments:

(a) The NUREG's estimate that probabilities are low by a factor of 10 to 100 may itself be low. Has the full experience since the Rasmussen Report been quantitatively (rather than subjectively) used to obtain these estimates?

(b) The re-settlement costs of \$125 per person seems low by a factor of 10^3 to 10^5 .