50-413/4140L

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

5/24/84

In the Matter of)	
)	
DUKE POWER COMPANY, et al.)	Dockets Nos. 50-413
)	50-414
(Catawba Nuclear Station)	
Units 1 and 2))	April 16, 1984

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

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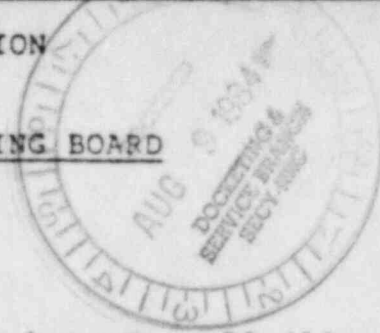Charlotte, NC
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Carolina Environmental
Study Group

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 fatatlities
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.

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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 occurence 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?

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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 occurence 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.

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Similarly, t e 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 acccident 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.

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C-C-73-139, March 31, 19;/. Judge McMillan noted

that parties to the case, the Atomic Energy

Commission, Duke Power Company, and CESG 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.

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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
17 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 woula choose N.C.
27 in lieu of U.S. 74.   A 17 mile radius would
also be acceptable and incidentally ... 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 1862 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.

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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?

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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.

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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 notifica'ion 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.

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It is obvious that weather conditions, howling winds, heavy rain, dense snow layers, well sealed and insulated structures do not condu'e to a siren being heard. Deep sleep and impaire 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.

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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.
           Preferrred departure routes would be specified.

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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 i.. 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 form 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 $22\frac{1}{2}°$ 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

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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 co vert 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 th Rasmussen Report been quantitatively (rather than subjectively) used to obtain these estimates?

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