

CHATHAM COUNTY EMERGENCY RESPONSE PLAN
THE UNANSWERED QUESTIONS

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INTRODUCTION

Chatham County residents have valid concerns regarding the Shearon Harris Nuclear Power Plant. Carolina Power and Light has stated that we need not worry about a major accident at Shearon Harris Plant. The Nuclear Regulatory Commission (NRC) in its role as the Federal organization that oversees nuclear plant safety only plans for the "design basis accident" (a low level accident by definition), which is only one scenario of many that might occur at a nuclear power plant. Many residents in Chatham County believe that we have a responsibility to protect our own lives, our families, our friends and neighbors, and our land from all possible disasters. Therefore, we believe that it is imperative to prepare as much as possible for a variety of accident scenarios, not just a low level accident. Having this belief we have begun to research the Chatham County Evacuation Plan. Following are comments on some of the deficiencies that exist in the plan. There are serious concerns which remain unanswered.

The document that follows has focused on six specific topic areas included in the evacuation plan. They are the ten mile radius, sheltering, notification and response, emergency service personnel and drill report, agriculture, and evacuation centers. The sections are followed by some concluding comments which provide additional information concerning the need for an in depth review of the Chatham County Emergency Response Plan.

1) TEN MILE RADIUS

There is now new information that points out inadequacies in the NRC's and CP&L's ten mile maximum Emergency Planning Zone. Although the recent nuclear accident at Chernobyl supports this information, this research is totally independent of that event.

"Those responsible for assuring the health and safety of the public should be aware that current techniques have not been used in establishing the EPZ and that there are serious questions in regard to some of the assumptions under which it was established. The obvious implication is that these calculations and the resulting 10-mile recommendation are therefore suspect and uncertain for purposes of protecting public health." (Appendix A)

These statements are supported by another expert who has worked in the Triangle area for four decades as an expert in air pollution meteorology. Hershel Slater says "Notwithstanding current NRC regulations, CP&L and the State can take the initiative to fine tune the configuration of the SHNPP EPZ. CP&L has the data and the professional competency to do so. In light of the concerns of so many, it is prudent for CP&L so to do" (Appendix B)

Even in its present form the emergency plan suggests the following: "The size of the EPZ and the emergency plan are not restricted to, nor designed specifically for protecting only the people in, the 10-mile EPZ. They are designed for the protection of all areas and all people that could be affected by an accident. The NRC assumes that any emergency plan deemed adequate for a 10-mile radius is sufficiently detailed to be adequate to cover emergency needs in areas beyond the 10-mile EPZ (NUREG - 0396, pp 15-16).... Local officials are responsible for deciding if this type and size of emergency planning is acceptable and adequate. There should be demonstrable assurance of ad hoc capability being adequate." (Appendix A)

Essentially what this means is up to date methodology is required to determine where the radiation plume is once an accident has occurred, but techniques that are as much as 10 years old were the basis of the present 10 mile zone. In the field of meteorology this 10 year difference may be compared to trying to achieve earth orbit with a helium balloon instead of a modern day rocket.

2) SHELTERING

In the event of a nuclear reactor accident those responsible for the health and safety of the public will have to decide how to protect the public. The Emergency Response Plan (ERP) for the Shearon Harris Nuclear Power Plant outlines two basic ways to protect the public: evacuation and sheltering. The term "sheltering" refers to members of the public taking advantage of the inherent radiation shielding available in normally inhabited structures by remaining indoors while the radioactive cloud passes.

The relative merits of evacuation versus sheltering depend upon the specifics of the given accident. Some parameters to be considered include severity of the accident, site location, meteorological conditions, and effectiveness of the sheltering (1). The ERP does not however address the issue of sheltering effectiveness in Chatham County. The amount of effective sheltering will vary depending upon the construction of the dwelling. A wood frame house without a basement provides relatively little shelter (.9 shielding factor) from gamma cloud sources of radionuclides (2). The FEMA/NRC emergency planning and preparedness criteria document (NUREG-0654) requires nuclear facility and state officials to provide the bases for the choice of recommended protective actions for the plume exposure pathway during emergency conditions (3). The bases are to include, for example, expected protection afforded in residential dwellings for direct and inhalation exposure to radionuclides (2). The ERP does not document any established shielding factors (shielding effectiveness) for the dwelling in the 10 mile Emergency Planning Zone (EPZ) in Chatham County. How can an appropriate decision be made whether to evacuate or shelter without such information?

The ERP fails to address any measures regarding public sheltering for the users of the Jordan Lake Recreation Area. Two thirds of the Jordan Lake Recreation Area is within the 10 mile EPZ of the SHNPP. According to the Army Corp of Engineers, approximately 10,000 persons use the Jordan Lake facilities on any given weekend day (Friday, Saturday, or Sunday). This is based on an estimated 200,000 persons that used the lake facilities during May 1986 of which approximately 60% of the use was on a weekend day (4). During a nuclear power plant accident of the "atmospheric" type release, duration of radionuclides release is relatively short and evacuation may not be a feasible means of protection(5). How then can

10,000 people in the Jordan Lake area be sheltered? The ERP fails to provide adequate protection for 10,000 persons from radionuclides in the event of an "atmospheric" type of accident at Shearon Harris.

The use of potassium iodide (KI) to block the thyroid gland from absorbing the hazardous radioiodines that might be released from a nuclear power plant is a recognized protective measure (2). The ERP does not however provide for the distribution of KI to the general public in the 10 mile EPZ in the event of a nuclear accident. Only emergency workers and institutionalized persons will receive the radioprotective drug. This violates NUREG-0654 which requires KI or other radioprotective drugs for those "whose immediate evacuation may be infeasible or very difficult". In a sheltering situation this would include everyone sheltering.*

3) NOTIFICATION AND RESPONSE

In NUREG-0654 upon which the emergency plan is based it states "The range of times between the onset of accident conditions and the start of a major release is of the order of one half hour to several hours." The plan in certain instances is primarily of a precautionary nature and does not take into account an accident that might occur in a short period of time. This is particularly true for the Jordan Lake area. A Dept. of Parks and Recreation official who was interviewed stated he believed the plan might work if a precautionary evacuation was to occur, but felt there was no way that his employees would perform their function satisfactorily if an accident occurred quickly. In discussion with other staff they expressed these same sentiments. In fact two employees when questioned said that they would leave the area as soon as they could if there was ever a problem at SHNPP. Additional discussion brought out the fact that last years evacuation drill (1985) took half a day just to notify all the boaters on the Lake. This statement is in direct conflict with the evacuation plans stated longest time frame to complete evacuation in "3 hrs 56 min."-especially since the Jordan Lake exercise did not include having the boaters leave the Lake nor proceed to the evacuation centers. An additional employee who was hired for the summer was not even aware of his role in the Chatham County plan for notification and evacuation.

*compiled by John Rosencrance

There are more than 20,000 acres of gameland in the Jordan Lake Recreation Area. The notification procedures in the plan focus primarily on the lake itself. Hunters and hikers will only be notified if rescue workers remember to fly their aircraft with bullhorns over the land because the plan does not take these individuals into account. Even if these people are thought of, if the weather is inclement and aircraft can not be used, there is no back-up plan.

Fire departments and sheriffs departments are responsible for public warning. It is also their responsibility to identify hearing impaired households, so that in an emergency they can provide "knock on the door type notification". No provisions are made in the ERP to make sure the individuals who knock on the door can communicate effectively with a hearing impaired person. Identification of these people will be through a "special needs response card" recieved from an annual mailing of safety information to all 10 mile EPZ residents. No provision is made for those who might move to the area or lose their hearing between mailings. (Part 2, p 25 ERP).

Night notification has not yet been checked out, but the plan calls for at least one annual exercise between 6pm and midnight and one between midnight and 6am in the next six years. The plan does not say what we will do if an accident occurs during those times before the test exercise.

There is no provision for those who are temporarily without transportation or temporarily handicapped or "shut-in". Annual mailings will make a list of those who send in their cards, but there is no one "assigned" the responsibility for the list's accuracy. There is also no way to know if an individual becomes handicapped or if their condition worsens between mailings.*

There is another aspect of notifying the public that should also be considered by emergency planning personnel. Again, this is a factor that is not required by the NRC, the State, CP&L, or any other organization but research has shown that there is a tendency in a nuclear accident for a larger area to evacuate and for people to leave, hence making the responsibilities of local officials even greater. The ERP does not take this effect into account. (Appendix C)

* preceding 3 paragraphs compiled by Kayren McKnight

4) EMERGENCY SERVICE PERSONNEL

During an interview, a landfill employee stated that he was aware that he was written into the plan. His role is to assist with washing vehicles with water in order to decontaminate them. He stated that he was not trained to do this and that he would not participate. This response was common to others who normally do not participate in emergency response but who are included in the ERP. Their basic concern in our opinion relates to the difference between a nuclear accident and a more common accident (i.e. chemicals/hazardous waste). In many normally encountered emergencies, people have been extensively trained prior to the situation and they are nearly always supplied with state of the art safety equipment. This as far as we can tell by investigating the plan is not the case with many of the rescue/emergency workers who are designated to work during an emergency evacuation resulting from a nuclear release from Shearon Harris Plant. In Appendix D there is a copy of a letter presented to the Chatham County Board of Commissioners from three Chatham County health workers. They attest to requiring more training. These same volunteers did not believe the evacuation drill completed last year (1985) was adequate. Jo Anne Caye Social Work Supervisor D.S.S. and Shelter Manager for Northwood High shelter, felt a need for more on the job training with more public participation than during the last drill in order to better simulate a realistic accident. She mentioned that although she and her staff had learned to read dosimeters and had done a walk-through, they had not received much training in decontamination. The logistics of separating contaminated and uncontaminated people in the shelter needed to be worked out as did the specific tasks of staff members at the shelter and communication between them. *

The Report of the Drill states that the Chatham County "equipment and facilities are marginal". Webster's dictionary defines marginal as "close to the lower limit of acceptability". This directly conflicts with statements by CP&L, the State, and FEMA which highly praise the success of the drill. Do we in Chatham County want a plan that our very lives depend upon to be "marginal"? Part of the problem with the facilities is that they can not possibly contain all the people that might in fact need them. Federal Government projections of the number of people that will utilize the Jordan Lake area are 27,000 people per day. Even if only 15,000 people at the Lake required evacuation, and they were divided between the three schools (our evacuation centers), they would clearly be over the "assumed capacity of 2028" evacuees that the drill report says these facilities can hold. These figures of Lake evacuees do not

* Assistance in this section from Cosi Long and Helen Wolfson

include other Chatham County residents living in the evacuation zone.

Given the new information we have available to us today as a result of new meteorological techniques and the Chernobyl accident radiation may spread much further than the assumed 10 mile radius. With that in mind there remain some unanswered questions. The plan states that Chatham County will receive support from the N.C. State Government and Dept. of Corrections in Raleigh. If those areas need also to be sheltered on whom will Chatham County rely for needed assistance? Is there a contingency plan for this scenario? Similarly if Northwood High School, because of weather conditions, was to be included in the radiation plume area, there is no contingency plan to move people to another shelter.

5) AGRICULTURE

The ERP makes no plans for the protection of livestock during a nuclear accident. And yet, farming is integral to the livelihood of Chatham County. CP&L is presently obtaining baseline radiation level information in the ingestion pathway, which is a 50 mile radius around SHNPP. They are concerned about radiation levels in dairy milk, water sediment, broad leaf crops, as well as air. This is being done to determine potential food chain implication. Numerous unanswered questions exist. How will farmers be notified quickly and what are their available responses to take to protect their livestock? There may be farmers who live outside the ingestion pathway zone who have animals inside the zone. These farmers under the present plan will not be notified to take protective measures for their livestock and the financial well being of their businesses.

The local Extension Service is not directly involved in any evacuation work although extension lists would be (are not presently) made available for such purposes as identifying types of farms within any quarantined areas. Farmers have not been systematically identified and notified of instructions in case of an evacuation as a separate group with special needs. There are no feed reserves as of this writing and there are no water alternatives planned for animals at this time. Additionally there is no special state or federal agricultural team or individual ready to monitor farm products. Presumably, experts would be called in to accomplish this work, but the question remains

how long this process will take to get underway.*

Other questions are:

Who is a farmer? Do state officials know all growers regardless of size? What about the few pigs or chickens in someone's backyard? What about small plantings of commercial produce sold at farmers markets?*

How will farmers be protected from exposure if they reenter contaminated areas as the plan says, following an accident to provide feed and water to their animals?

6)EVACUATION CENTERS

In the present ERP the three evacuation centers are Northwood, Jordan Mathews, and Central Senior High Schools. According to the drill report Northwood would hold 2028 evacuees. This figure does not take into account the situation of school children being at Northwood at the time of an evacuation. Would not the numbers of children present displace a portion of the space designated for evacuees? Additionally, mentioned earlier in this document, the number of potential evacuees just from the Jordan Lake area is far larger than the estimated capacity of 2028. There have also been public comments made concerning the temporariness of the shelters. If evacuees are arriving primarily through the use of their own vehicles from contaminated areas then it is likely that many will not be able to use their vehicles to continue onward after they personally are decontaminated. Therefore it seems likely that many people will in fact utilize the evacuation centers for an extended period of time. The ERP does not specifically mention communication plans to and from the center relating to capacity. How will emergency workers in the field directing traffic be made aware that a center is overcrowded and another center is needed? The plan also does not detail how communication will occur between children at the school and parents in another location. Unless this is cleared up there potentially could be extensive traffic problems which could hinder the arrival of needed emergency supplies.

*Assistance in this section from Charlie Thompson

7) CONCLUSION

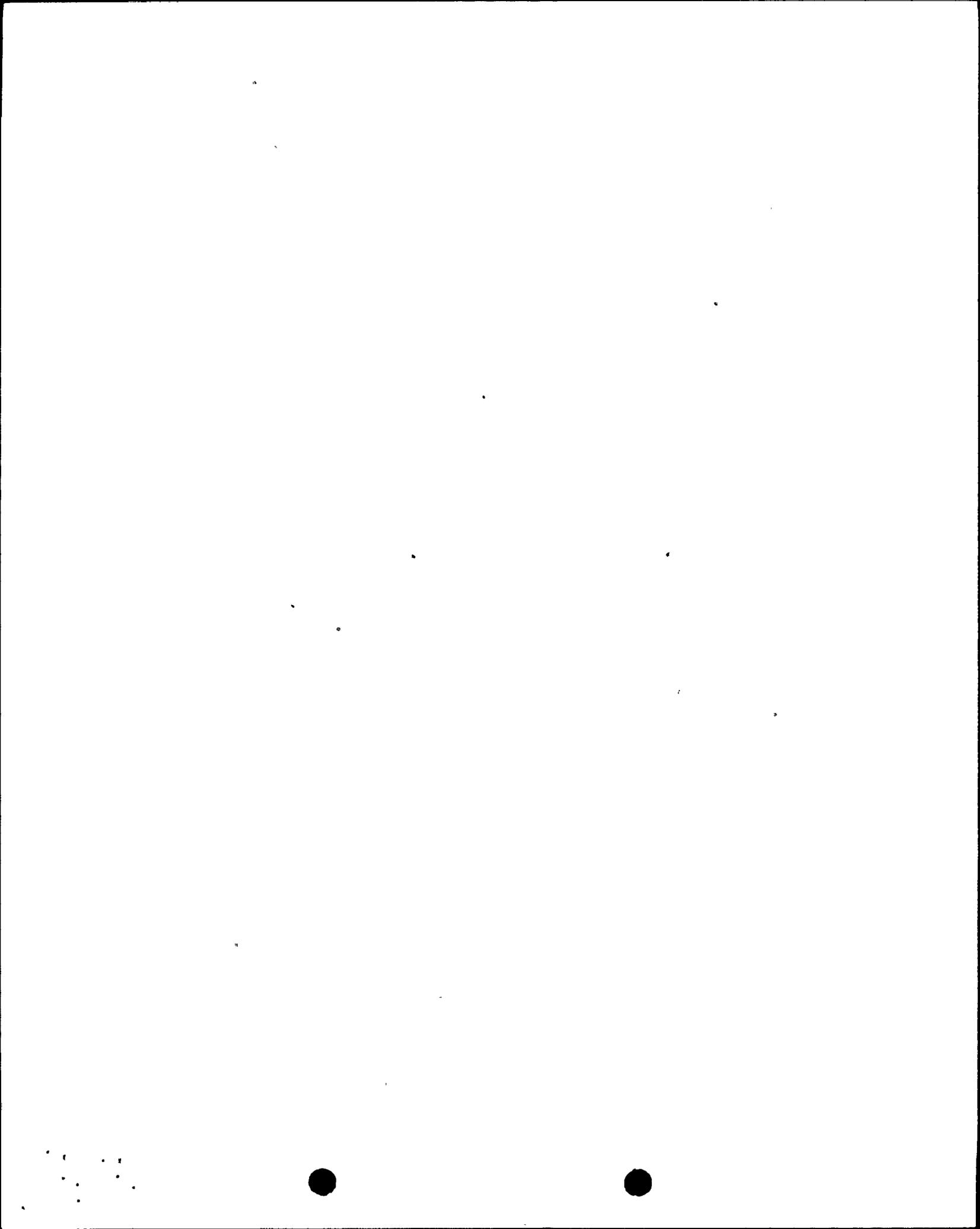
In the event of a nuclear accident at Shearon Harris Nuclear Power Plant any one of the deficiencies mentioned here could cause untold damage, collectively they depict a disaster of a type we have never experienced in North Carolina.

A Nuclear Regulatory Commission report release the summer of 1982 evaluated almost 20,000 "mishaps" at nuclear power plants from 1969 to 1979 and concluded that accidents as serious as that of Three Mile Island were likely to occur once every three to eight years somewhere in the country.⁶ Given the NRC's recent refusal to enforce emergency planning regulation under similar conditions at Indian Point reactors in New York,⁷ though, it will no doubt fall to "local officials" to protect the citizens"⁸

It is the belief of many that if there is a serious accident at Shearon Harris that many people will be killed and injured with any evacuation plan that is developed. While this is true, the result of an improved plan could save thousands of people from injury, disease, and death. There are presently many serious and valid concerns regarding Chatham County's present emergency response plan. It is imperative therefore, to have the best plan we can in place and workable before there is ever the chance of an accident occurring.

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- 3) U.S. Nuclear Regulatory Commission and Federal Emergency Management Agency. "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, for Interim Use and Comment" (NUREG-0654/FEMA-REP-1) (Jan. 1980)
- 4) Army Corp of Engineers Personal Communication with John Young. June 1980
- 5) U.S. Department of Health and Human Services. "Preparedness and Response in Radiation Accidents" (FDA 83-8211) , AUG. 1983)
- 6) "Precursors to Potential Sever Core Damage Accidents" ("Precursors"), NUREG/CR-2497, Oak Ridge National Laboratories, 1982
- 7) "In the Matter of Consolidated Edison Company of New York and Power Authority of the State of New York (Indian Point 2&3)," CLI-83-16, June 10, 1983
- 8) Blueprint For Chaos II: Pilgrim Disaster Plans - Still A Disaster MASSPIRG 1983



APPENDIX A

Comment on
Outdated Federal Guidance for
Size of the Emergency Planning Zone

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June 30, 1986

Q. "IS A 10-MILE EVACUATION AREA ADEQUATE?"

A. NO ONE REALLY KNOWS.

Why not? There are many uncertainties in predictions of nuclear-power-plant-accident consequences. These result from uncertainties in the prediction techniques and in input data. The NRC is currently attempting to resolve major uncertainties for risk assessment. Generic rather than site-specific calculations were performed (using some outdated techniques and over-simplifying assumptions) to help determine the distance. The 10-mile evacuation plan is supposedly adequate to use as a base for evacuating additional areas outside the 10 miles as needed on a "ad hoc" basis when an accident does occur. No one knows if it will work until an accident happens because there are no required formal, predetermined, evacuation plans in place outside the 10-mile area to evaluate. No one claims that deaths and injuries will not occur outside the 10-mile EPZ in the case of a more severe accident.

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There are several important points that should be made very clear to all officials concerned about protecting the safety and health of the people in the counties surrounding any nuclear power plant. These facts come from reports and regulations from the Nuclear Regulatory Commission and the North Carolina Emergency Response Plan (NCERP). The immediate concern is with the Shearon Harris Nuclear Power Plant (SHNPP). However, the following discussion applies to any nuclear power plant of comparable size because the 10-mile EPZ is a generic distance which applies to all U.S. nuclear plants of comparable size.

The 10-mile emergency planning zone (or EPZ) is based on findings of a joint NRC-Environmental Protection Agency (EPA) Task Force which were published in 1978 (NUREG-0396). They concluded that the 10-mile EPZ was more than adequate to protect the public. However, it is also made clear that:

- 1) Although most early fatalities and injuries will occur inside the 10-mile EPZ, the NRC (NUREG-0396, pg 17; NUREG/CR-2239, pp 1-3 to 1-6) and the NC Emergency Response Plan (NCERP, Part 1, pg 1) acknowledge that some of the early severe health effects (injuries or deaths) which would result from the more severe accidents will occur beyond the 10-mile EPZ.

"In addition, the EPZ is of sufficient size to provide for substantial reduction in early severe health effects (injuries or deaths) in the event of the more severe Class 9 accidents."
(NUREG-0396, p 17)

- 2) The size of the EPZ and the emergency plan are not restricted to, nor designed specifically for protecting only the people in, the 10-mile EPZ. They are designed for the protection of all areas and all people that could be affected by an accident. The NRC assumes that any emergency plan deemed adequate for a 10-mile radius is sufficiently detailed to be adequate to cover emergency needs in areas beyond the 10-mile EPZ (NUREG-0396, pp 15-16). The NRC, CP&L, and NCERP acknowledge that emergency response outside the 10-mile EPZ may be needed. "The size of the EPZ represents a judgment on the extent of detailed planning needed to assure an adequate response base" (NCERP, Part 1, pg 1). The concept in the NCERP and NRC guidance is to use the EPZ planning as a "base for expansion of response efforts if necessary" (NCERP, Part 1, pg 1) and to respond on an "ad hoc" basis (NRC, NUREG-0396, pg 16).
- 3) The size of the 10-mile EPZ is "tempered" by probability (NUREG-0396, pg 15). Some amount of risk was determined by the NRC to be acceptable. Their decision was affected by low-probability estimates of the occurrence and nature of severe accidents (NUREG-75/014). More recent NRC reports indicate that many of these earlier accident estimates may be too low (NUREG/CR-0400 cited in NUREG/CR-4199, pp 1; and NUREG/CR-4199, pp 8-9). There is much uncertainty in risk and probability estimates, as well as disagreement among experts on this matter (as indicated in different

NRC reports). The inclusion of a greater accident probability could result in the establishment of a larger EPZ upon reevaluation. Also, it should not be implied that the term "low-probability accident" indicates that a long time will pass before such an event occurs. It is therefore reasonable to expect that consideration of emergency plans be "tempered" by these uncertainties. Local officials should plan accordingly, especially when highly-populated areas are very near but beyond the presently-accepted 10-mile EPZ.

- 4) The latest NRC regulations published January 1, 1986 cite only this 1978 Task Force report as a basis for determining the EPZ (10 CFR 50.47 and its Appendix E). No report is cited which discusses or suggests a smaller EPZ for nuclear plants the size of the SHNPP. Simple techniques and information now known to be inappropriate, or at least not the best, were used for generic calculations used in determining the 10-mile EPZ. Furthermore, seemingly inconsistent NRC regulations do require "state-of-the-art" (current) computations be performed after an accident using site-specific information (eg. information specific to SHNPP) (NUREG-0654, Appendix 2, pp 2-2 and 2-3). "State-of-the-art" models (NRC-sponsored) have been used in recent years to estimate radiation doses to the public under a variety of accident and normal operation conditions, but evidently have not been used for reevaluation of the EPZ (NUREG/CR-2239, NUREG/CR-4199, NUREG/CR-3344, NUREG/CR-4000). Uncertainty is a major problem in accident predictions (NUREG/CR-2239, pp 2-7 to 2-10). There is, in fact, an on-going program for reevaluation of nuclear accident risk at the NRC, but work to date has been "greeted with skepticism... There is a disagreement over the credibility of some computer modeling codes that are the basis for all the predictions that will come out of NUREG-0956" (Science, April 1986, pp 153-154, attached). Therefore, there is justification in requesting the NRC to review and update the 1978 Task Force Report, and consequently the justification for the size of the EPZ. Current thinking would suggest that the NRC should require the SHNPP and all other plants to reevaluate the 10-mile EPZ using on-site and national weather service weather data specific to the area.

Local officials are responsible for deciding if this type and size of emergency planning is acceptable and adequate. There should be demonstrable assurance of ad hoc capability being adequate. For example and specifically related to the SHNPP, consideration should be given to the effect on local emergency response efforts if it were determined that Raleigh (and the state government) needed to be evacuated. Local officials must decide if they accept the very low NRC accident-risk and probability estimates which were determined before the Three Mile Island accident -- a serious accident which occurred despite its "low probability" of occurrence.

Those responsible for assuring the health and safety of the public should be aware that current techniques have not been used in establishing the EPZ and that there are serious questions in regard to some of the assumptions under which it was established. The obvious implication is that these calculations and the resulting 10-mile recommendation are therefore suspect and uncertain for purposes of protecting public health.

ADDITIONAL DISCUSSION

The 10-mile Emergency Planning Zone (EPZ) is recommended by the Nuclear Regulatory Commission (NRC) as follows:

"Generally, the plume exposure pathway EPZ for nuclear power plants shall consist of an area about 10 miles (16 km) in radius, and the ingestion pathway EPZ shall consist of an area about 50 miles (80km) in radius. The exact size and configuration of the EPZs surrounding a particular nuclear power reactor shall be determined in relation to local emergency response needs and capabilities as they are affected by such conditions as demography, topography, land characteristics, access routes, and jurisdictional boundaries." (10 CFR Part 50.47 "Emergency Plans")

This regulation recognizes that approximately a 10-mile radius is appropriate, but also implies that alternate sizes and configurations may be very significantly more appropriate. Although the regulation requires consideration be given to several area-specific factors, no mention is made of local meteorology. This is in contradiction to regulations for siting and post-accident calculations (10 CFR 100.10 and 10 CFR 50.47, respectively), and the findings of more recent accident-consequence estimates (NUREG/CR-2239, p 1-3), all of which consider local meteorology. Local officials must carefully determine local emergency response needs and the adequacy of emergency capabilities in approving a plan specific to a given nuclear power plant.

The 10-mile EPZ is based on the report of a joint NRC-Environmental Protection Agency (EPA) Task Force which was published in 1978. The report's principal meteorological references are dated 1968 and 1970 (USAEC, 1968; Turner, 1970). The report concluded that the 10-mile EPZ was more than adequate to protect the public. However, they used 1) meteorological techniques that are now outdated, and 2) nuclear-reactor-accident estimates developed before the Three Mile Island accident experience and before subsequent additional experiences with nuclear reactor problems. These early calculations and EPZ estimates depend on the estimates of the amount of radioactivity that would be released during accidents and the probabilities of different types of accidents occurring. Assumptions were made which now may be incorrect or inappropriate. Very simple assumptions were made concerning the behavior of the radiation plume that might be released in an accident. The atmosphere and its weather systems are very complex, and a wide range of plume behavior is possible. "The weather conditions at the time of a large release will have a substantial impact on the health effects caused by that release" (NUREG/CR-2239, pg 1-3). Given a plume released during an accident that would result in injury within the 10-mile EPZ, there are meteorological conditions which could result in significant exposure at distances beyond the 10-mile EPZ and even hundreds of miles "downwind". The plume can meander rather than travel in a straight line, making predictions of exposure difficult and allowing for multiple exposures to the population. Also, important considerations such as the effect of rain were mentioned but not included in calculations used in the final distance determination in the 1978 report (NUREG-0396, pp I-25 and I-26). The importance of the effects of rain on downwind radiation doses to the public are now documented by the NRC (NUREG/CR-2239; NUREG/CR-1244). Significantly-larger doses to the public can occur further downwind if the radiation release is "washed-out" of the air by rain (rain can clean the air of radioactive particulate as it falls, creating "hot spots" on the ground). On the official average, North Carolina receives rain on one of every three days. As another example, it was assumed in the report that the major dose exposure would occur within 2 hours after the accident. This assumption is debatable and has several implications. The evacuation time estimate for the NC Emergency Management Plan for the SHNPP is almost 4 hours. Sheltering in place until the released radiation passes may be the best strategy under some adverse conditions, but some meteorological conditions could result in long and uncertain sheltering times (waiting) while some lower-level exposure continues. Therefore, careful dose estimates and monitoring, accurate evacuation-time estimates, and good management by emergency personnel are needed to minimize personal injury not only within the

10-mile EPZ but also at distances beyond the 10-mile EPZ. Unfortunately, beyond 10 miles these types of decisions and management will be performed ad hoc after an accident occurs. With a mean wind speed of approximately 7.5 mph in this area, there will not be much time (1-2 hours) before there could be a problem beyond 10 miles. It is prudent to be able to respond to problems beyond this distance for this reason, if for no other.

All nuclear units operating in this country are subject to the same type of plan. The calculations used for determining the 10-mile EPZ were performed for hypothetical accidents and meteorological systems. The generic 10-mile-distance calculations obviously do not use meteorological parameters or other factors specific for the Shearon Harris site and power plant. There are now better methods for modeling a specific site which result in more appropriate calculations. The NRC now uses more up-to-date (more correct) techniques and computer models to estimate site-specific radiation releases and doses to the public. Several of these models were developed by the NRC itself but evidently have not been used for reevaluation of the 10-mile EPZ. Even with these improved techniques, it is recognized and documented by the NRC that the reliability of the risk and dose estimates is still limited by the uncertainty of the amounts of radiation that will be released during accidents (NUREG/CR-4199, p 8). These uncertainties are further increased by the uncertainties of the meteorological estimates (NUREG/CR-4199, p 9; NUREG/CR-2239, p 1-3).

The obvious implication is that these calculations and the resulting 10-mile recommendation are therefore suspect and uncertain for purposes of protecting public health. Reevaluation with more current methodologies and recent experience could result in a larger EPZ distance which would require modification of the emergency plan and required participation outside a 10-mile radius before licensing of a plant. Part of demonstrating that an emergency plan is adequate is to show that the size of the area affected by the plan is appropriate. The problems and limitations of the older methodologies are now well documented. Those responsible for assuring the health and safety of the public should be aware that current techniques have not been used in establishing the EPZ and that there are serious questions in regard to some of the assumptions under which it was established. Consequently, the emergency plan may not be adequate to protect the health of the public in general. This is especially serious in the case of the SHNPP because heavily-populated areas including the state government systems exist so close to the presently-accepted 10-mile EPZ.

An appendix is being prepared which further documents these statements, includes additional findings and comments, and contains references which document the widely accepted criticisms of the older and simpler assumptions, dispersion parameters, and methodologies. These criticisms are found in 1) reports from the NRC, EPA, AMS (American Meteorology Society), a joint AMS-EPA workshop, and a Department of Energy (DOE) -sponsored DOE-AMS workshop; and 2) a statement from Herschel Slater, formerly of the Monitoring and Data Analysis Division, Office of Air Quality Planning and Standards, EPA, a meteorologist who co-authored the guidance document for EPA Air Quality Models in 1978 (This statement is attached).

Statement by the author:

I am a research associate in the Department of Environmental Sciences and Engineering at the School of Public Health, University of North Carolina, Chapel Hill, where I received my Ph.D. My research field is atmospheric chemistry and computer modeling of photochemical smog. This report represents an independent study not done in connection with my work at UNC.

My personal interest in the emergency plan for the Shearon Harris Nuclear Power Plant (SHNPP) is in regard to the techniques used to establish the size of the emergency planning zone. My reason for preparing this report is a sincere concern that the present plan and zone may be less than adequate to protect the general public in the event of an accident at the SHNPP. I am neither an anti-nuclear activist nor a member of the Coalition for Alternatives to Shearon Harris Steering Committee.

Kenneth G. Sexton

Kenneth G. Sexton, Ph.D

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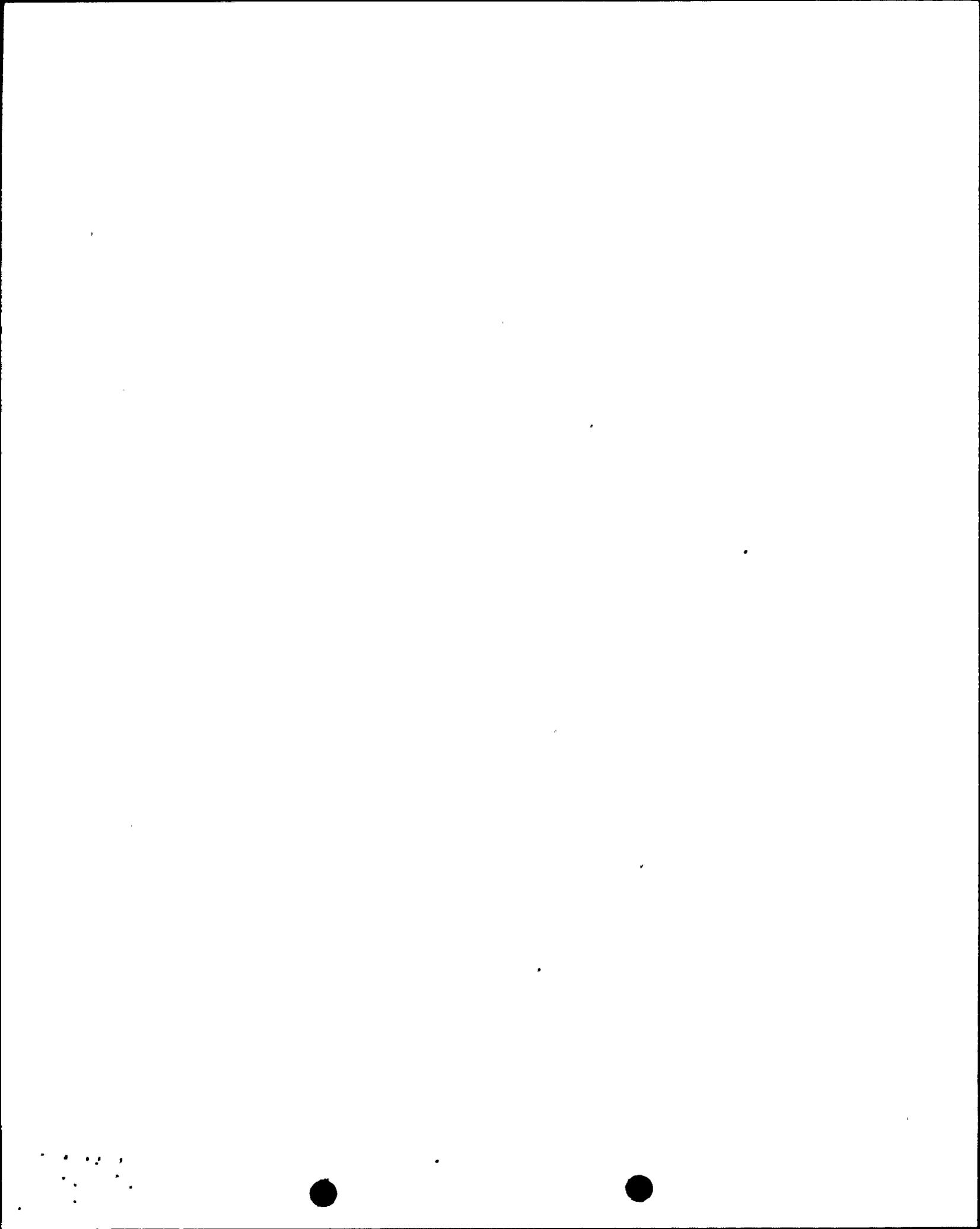
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APPENDIX B



Statement Concerning
the Procedures for Selecting the
Size and Configuration of an
Emergency Planning Zone (EPZ)

Herschel H. Slater, Consultant
Air Pollution and Meteorology
Chapel Hill, NC 27514
June 28, 1986

(I am a meteorologist, specializing in air pollution matters with experience and training that spans four decades. My experience includes service with the US Weather Bureau; US Air Force, as a career officer; Environmental Protection Agency; Adjunct Associate Professor, School of Public Health, UNC-CH; and Logistics Manager for Project GALE for NCSU and the National Center for Atmospheric Sciences.)

Abstract

I am concerned about the size and configuration of the emergency planning zone (EPZ) as it applies to the Shearon Harris Nuclear Power Plant. CPL and the State of North Carolina apparently have accepted the Nuclear Regulatory Commission's suggested plume exposure pathway EPZ. NRC suggests an essentially circular area having a radius of about 10 miles.

Fortunately, meteorological data and analytical techniques have been developed over the past decade that enable more definitive configurations of EPZ's. CPL has the data and the competence to apply more sophisticated methodologies to this problem than the generic approaches suggested in NRC-promulgated regulations. CPL should be required to re-evaluate the proposed boundaries of the EPZ. I expect the result would be a more realistic and effective emergency response plan.

Discussion

Since the NRC regulations that pertain to the size of an EPZ were issued, most nuclear power facilities collect meteorological data on site. Not only are the data site-specific, but they are designed to be applied directly to the problem of estimating the transport and dispersion of a cloud or plume of radioactive material.

Until such weather data began to be collected by commercial nuclear facilities, the weather data used to assist in choosing the boundaries of an EPZ usually came from the nearest official National Weather Service station. In the case of SHNPP, this is the station at the Raleigh-Durham Airport.

Data collected at RDU is of highest quality. The equipment is well-designed, excellently maintained and the observers are well-trained and dedicated civil servants. The problem is two-fold: 1) The data are not observed where, in the event

of an accident, the radioactive plume will generate and 2) The equipment is not designed to sense the meteorological phenomena that determine the rate that a plume of nuclear material will disperse. The equipment and observation procedures used at RDU are designed to meet the needs of aircraft operations and safety and to meet the needs of forecasters in preparing forecasts for the general public. The scales (or size) of atmospheric motion sensed for these purposes are much larger than those which control the dispersion of a plume.

The wind equipment at the airport is designed to be insensitive to the small gusts that are significant in determining the dispersion process. Observations are generally made at hourly intervals. This is much less frequent than needed to characterize the power of the atmosphere to disperse pollutants and to sense the rapid changes of gustiness during periods of the day when this phenomena changes rapidly. Also, the wind observations are made at 10 meters, about 32 feet, above the ground, far below the height that a plume likely may travel.

CPL has a body of meteorological data gathered by sensing equipment specifically designed to study and estimate the dispersion and transport of clouds or plumes of pollutants. Unlike the equipment at RDU it is sensitive to the important small-scale motions of the atmosphere. Also, some data are sensed at heights where a plume is most likely to occur.

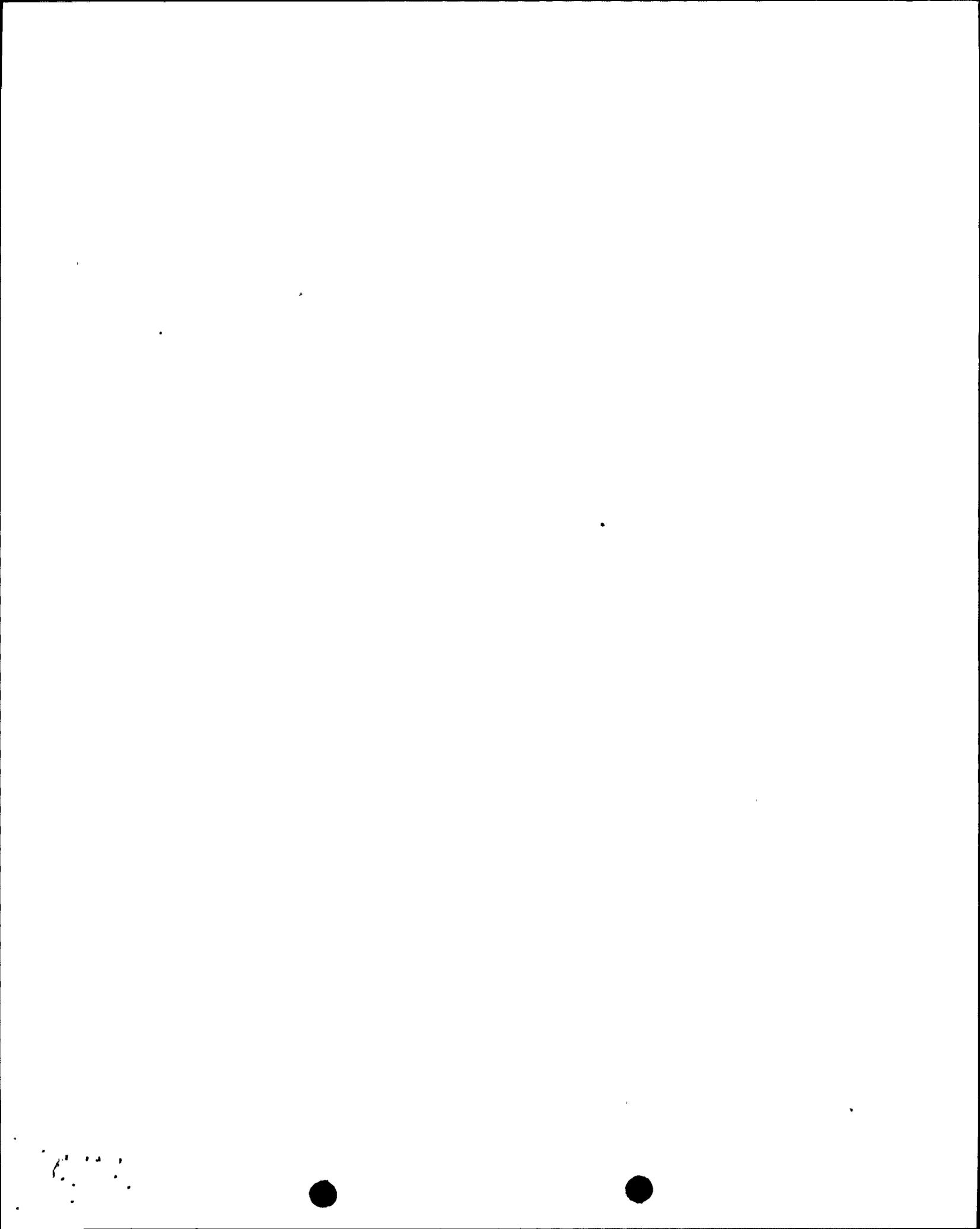
The rate a cloud disperses is often determined by the character of the surrounding topography. The character of the gustiness is influenced markedly by the roughness and the thermal response of the surrounding surface. Is it farmed or forested? Plowed or covered with vegetation? Is a body of water nearby? The nearby SHNPP lake must have a significant affect on the way the atmosphere would disperse pollutants in the event of an accident. The lake's effect varies with season, time of day and cloud cover. With these considerations, good judgment dictates the use of available on-site data rather than data from a distant point when developing the optimum EPZ.

NRC documents stress the importance of rainfall on peak concentrations. A shower may immediately create a surface "hot spot". If a plume is emitted into a rain situation, little of the radioactive material may leave the site itself. With rain occurring on the average of about one day in three in central North Carolina (except in 1986!), careful analysis of rainfall statistics may dictate EPZ boundaries different than a circle.

Notwithstanding current NRC regulations, CPL and the State can take the initiative to fine tune the configuration of the SHNPP EPZ. CPL has the data and the professional competency to do so. In light of the concerns of so many, it is prudent for CPL so to do.



APPENDIX C



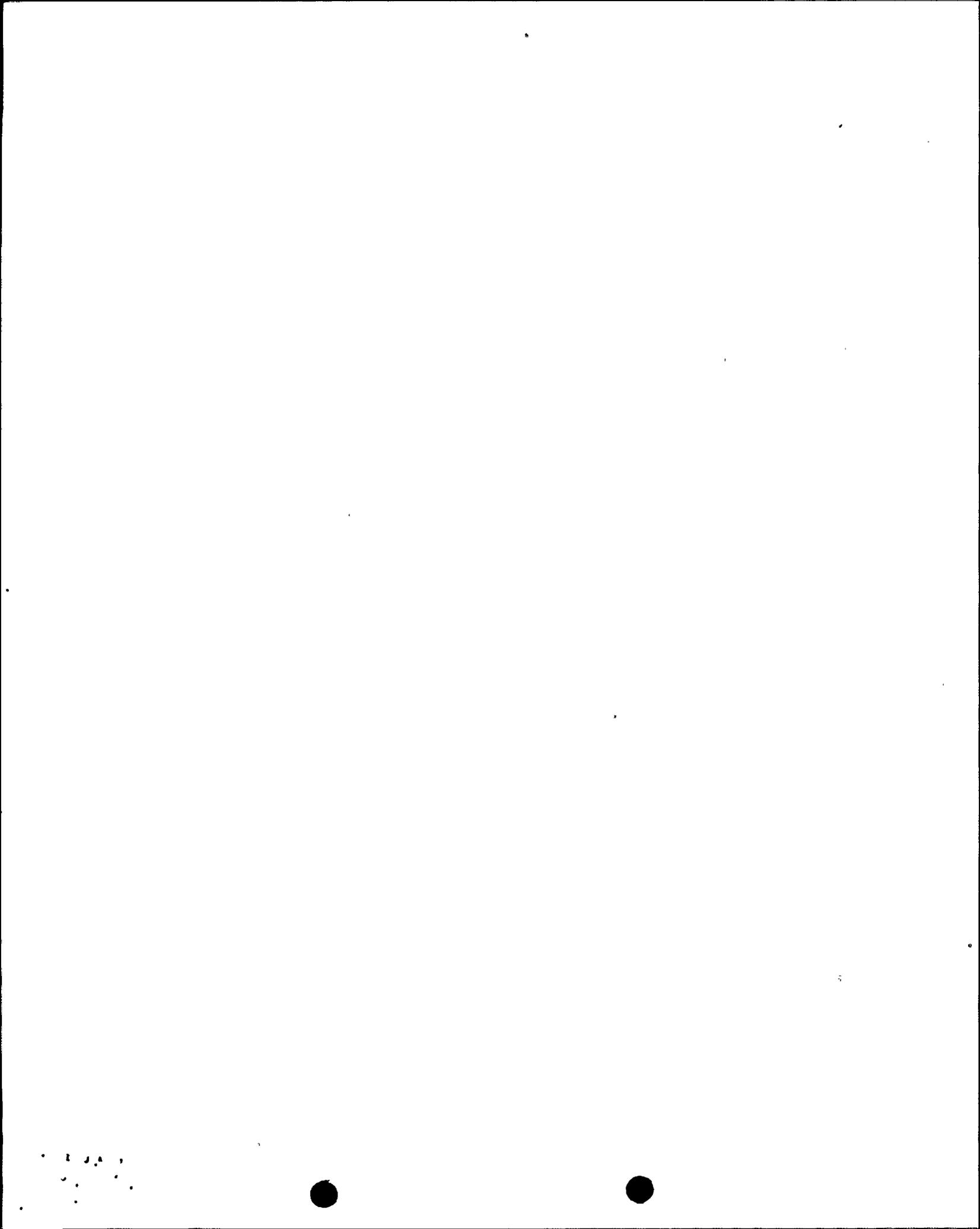
Human Reaction to Radiological Accidents:
A Review of the Research

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At the time of the Three Mile Island nuclear accident in Pennsylvania, no community within five miles of the plant had an emergency response plan approved by the Nuclear Regulatory Commission (Cutter and Barnes, 1982). This raised serious concerns with the Presidential Commission on the Accident at Three Mile Island. The Commission delegated the study of such concerns to a special task force on Emergency Preparedness and Response. The Task Force recommended that before an operating license be granted to a nuclear facility, an evacuation plan must be reviewed and approved. This recommendation has been instituted (see Sills et al, 1982 for details of other recommendations). The Task Force on Emergency Preparedness and Response also noted that the assumptions upon which emergency plans were based were not well documented (Dynes, 1982). As of 1982, emergency plans for nuclear accidents were based on data from research on "natural" and non-nuclear technological disasters. The Task Force recommended that research be undertaken to study actual human responses to evacuation specifically during radiological accidents at nuclear power plants.

Such research has now been completed (Cutter and Barnes, 1982; Johnson and Ziegler, 1983; Ziegler and Johnson, 1984; and Ziegler, Brunn and Johnson, 1981) and the results are clear and consistent: any evacuation related to a nuclear accident will include an EVACUATION SHADOW. An evacuation shadow is "the tendency of an official evacuation advisory to cause departure from a much larger area than was originally intended. (Ziegler, Brunn and Johnson, 1981, p.7)." That is, many more people will evacuate than officially advised to do so. Voluntary evacuation will occur at least as far as twenty-five miles from the accident. And most evacuees will travel over fifty miles from their homes.

There are two sets of research upon which the above conclusions are based. First, there have been at least three studies of the advisory evacuation at Three Miles Island (Cutter and Barnes, 1982; Ziegler, Brunn and Johnson, 1981; and Flynn, 1979). These studies are mutually supportive, despite having been conducted independently at Rutgers University, Michigan State University, and for the Nuclear Regulatory Commission. Four components of the EVACUATION SHADOW were first identified in research on the Three Mile Island evacuation.



- 1)The number of actual evacuees far outnumbered those advised to do so:
 - 3,000 preschool children and 444 pregnant women were advised to evacuate.
 - 144,000 people actually evacuated.
- 2)The geographic area from which people evacuated was 5 times as large as the advisory area.
 - Pregnant women and children within 5 miles were advised to evacuate.
 - 39% of those within 15 miles actually evacuated
 - 9% of those between 15 and 25 miles away evacuated
- 3)The distances travelled by evacuees far exceed the distance advised.
 - Evacuees fled a median distance of between 85 and 100 miles.
- 4)Evacuees do not flee to shelters, whatever the official advice.
 - 74- 81% of evacuees fled to homes of friends and relatives.
 - The maximum number of persons in any shelter at one time was 185.

A second set of studies (Ziegler and Johnson, 1984; Johnson and Ziegler, 1983) also support the existence of an EVACUATION SHADOW during potential nuclear accidents. A survey of 2,595 households on Long Island, NY provides a data base for analyzing potential behavior in response to a nuclear accident. In this research, respondents were asked how they intended to behave given three different scenarios of possible problems at the Shoreham Nuclear Power Plant. Three components of a potential EVACUATION SHADOW were identified.

- 1)The actual number of evacuees will far outnumber those advised to do so. And the geographic areas from which people will evacuate will be much larger than the advisory zone.
 - If anyone within five miles of the plant is advised to shelter-in-place (e.g. stay inside with closed windows), 18-34% of the population between 10 and 25 miles plan to evacuate.
 - If those within 5 miles are advised to evacuate, 25 -44% of those within 10 to 25 miles intend to evacuate.
 - If those within 10 miles are asked to evacuate, 39 to 63% of those within 10 to 25 miles intend to evacuate also.
- 2)The distances travelled by evacuees will far exceed the distances recommended.
 - Over two-thirds of those who intend to evacuate under any circumstances, plan to travel over fifty miles.
- 3)Evacuees do not plan to flee to shelters, regardless of

- official advice.
- 60% of potential evacuees plan to flee toward the homes of friends and relatives
 - 18% of potential evacuees plan to flee to commercial establishments
 - Only 6% to 8% of potential evacuees plan to go to shelters. (Some undecided)

Overall, this research suggests that the public fully intends to IGNORE official advice in the event of a radiological disaster. The public will respond with dramatic behavior in the event of a nuclear disaster, evacuating sooner than suggested, more people will evacuate than required or recommended, and those evacuees will travel farther than suggested.

These results are striking because they contradict what is known about evacuation behavior from studies of natural disasters. Research on natural and non-nuclear disasters has shown that individuals and families will only evacuate when confronted with direct sensory evidence or explicit and convincing warning messages. (Drabek, 1969; Perry, 1979). Indeed, during non-nuclear accidents, emergency evacuation workers often have to persuade the public to evacuate their homes and land.

Therefore, any evacuation plan for a nuclear accident modelled after plans for non-nuclear accidents are destined to fail. The data does exist to correctly specify emergency evacuation plans for nuclear accidents. But emergency planners must accept the reality that public behavior cannot be controlled and capitalize on predicted behaviors by incorporating such action into emergency response plans.

The research first suggested by the President's Commission on the Accident at Three Mile Island is now complete and the conclusions are important: emergency evacuation plans for nuclear accidents need to be based on different assumptions about human nature than any other evacuation plan. Emergency plans for possible nuclear accidents must include at least 25 miles because roads will be clogged by persons who reside outside the ten mile zone whether or not they are advised to evacuate. Voluntary evacuation beyond 25 miles will occur. It may even be that with the increased fear of radioactivity accompanying the Chernobyl accident more people will evacuate from an even greater distance than the pre-Chernobyl research indicates.

Any evacuation plan for the event of a radiological accident at a nuclear power plant which does not include at least 25 miles is simply inadequate based on the most recent research by social scientists. The most excellent technical plan cannot work if it ignores the reality of human behavior.

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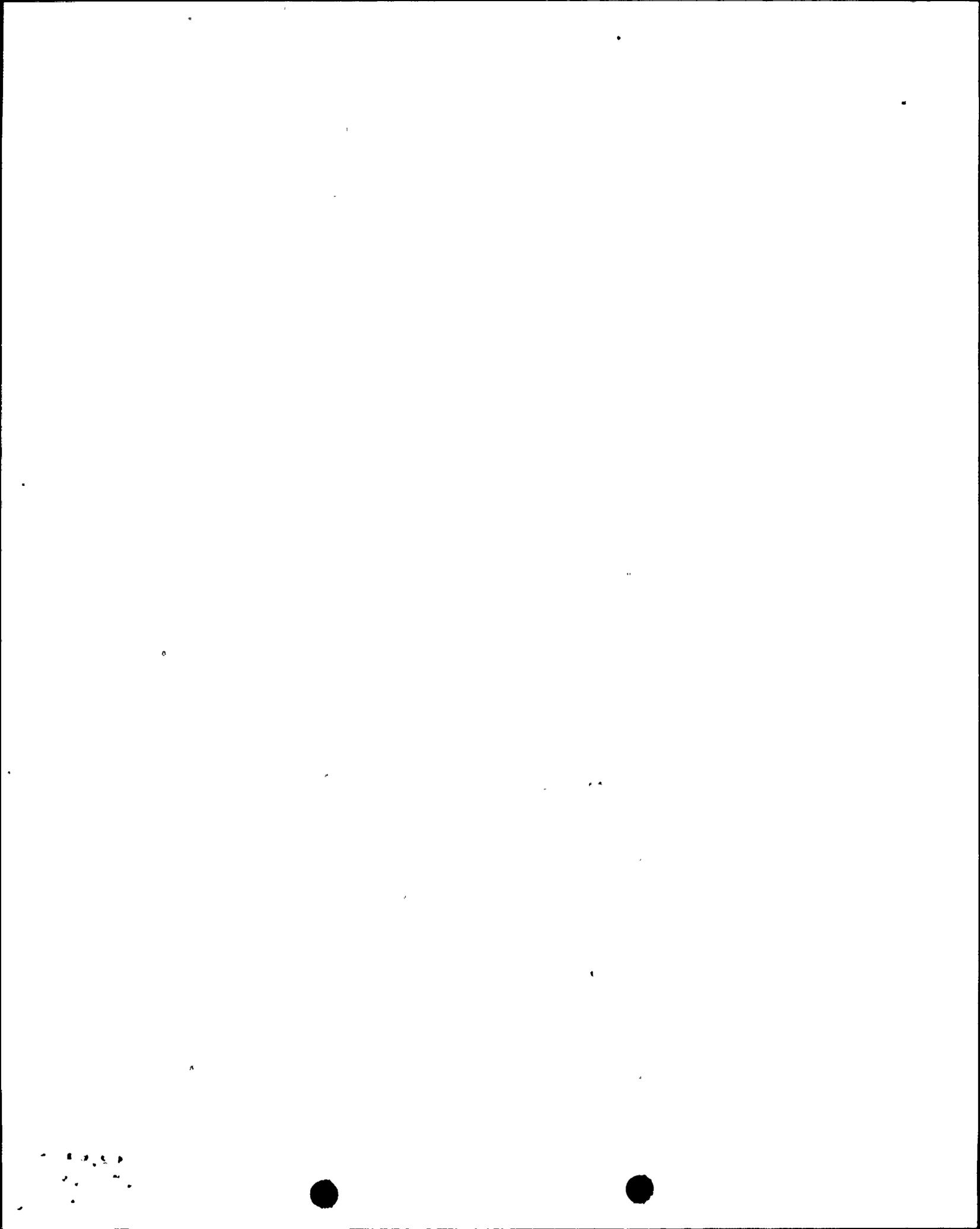
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APPENDIX D



To: Chatham County Board of County Commissioners
From: Employees of the District Health Dept.- Chatham County

Dear Sirs:

We the undersigned are of the personal and professional opinion as workers in the field of Public Health and participants in the mock evacuation drill for the Shearon Harris Nuclear Power facility that the drill conducted in May of 1985 was inadequate.

At the two shelters in which we were assigned, at Jordan Mathews and Chatham Central High Schools, objectives for the participants were unclear, briefing was inadequate, communication with the control center was confusing and plans were poorly executed.

We respectively urge you to rescind the Chatham County approval of the evacuation plan pending further community and participant input.

Sincerely,

Virginia Ryan
Sanitarian, Chatham County

Betty Philips, RN
Nursing Supervisor, Chatham County

Patty Poole, RN
Home Health Nurse, Chatham County

