April 13, 1988

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of LONG ISLAND LIGHTING COMPANY (Shoreham Nuclear Power Station, Unit 1)	Docket No. 50-322-OL-3 (Emergency Planning)

TESTIMONY OF STEPHEN COLE, RALPH H. TURNER, AND ALLEN H. BARTON ON THE REMAND OF CONTENTION 25.C. -- ROLE CONFLICT OF SCHOOL BUS DRIVERS

Introduction

Q. Please state your names and summarize your professional backgrounds.

A. (Cole) My name is Stephen Cole. I am a professor of sociology at the State University of New York at Stony Brook. I am also President of Social Data Analysts, Inc., a consulting firm engaged in conducting applied sociological studies, including surveys.

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TESTIMONY OF STEPHEN COLE, RALPH H. TURNER, AND ALLEN H. BARTON ON BEHALF OF SUFFOLK COUNTY ON THE REMAND OF CONTENTION 25.C. -- ROLE CONFLICT OF SCHOOL BUS DRIVERS

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I graduated from Columbia College with majors in both sociology and history in 1962 and received a Ph.D. in sociology from Columbia University in 1967. Since 1962 I have been professionally involved in conducting social surveys. For the last 15 years, first under the name of Opinion Research Associates and starting in 1977 as Social Data Analysts, Inc., I have conducted more than 150 social surveys for various clients, including Newsday, The Boston Globe, The Baltimore Sun, Columbia University, the University of California at Irvine, the National Bureau of Economic Research, Brookhaven National Laboratories, the State of California, the Commonwealth of Massachusetts, Suffolk County, and the Long Island Lighting Company, among others. Since 1979 I have conducted more than 10 surveys on public attitudes toward nuclear power. I have also conducted three surveys on the anticipated response of potential emergency workers to a radiological emergency at the Shoreham Nuclear Power Station.

I am the author of more than 30 articles appearing in such journals as Scientific American, Science, Public Opinion Quarterly, American Sociological Review, and the American Journal of Sociology. In addition, I am the author of seven books, including a textbook on research methods, The Sociological Method, third edition (New York: Harper and Row, 1980). My work in sociology has been recognized by the receipt of a Guggenheim Foundation Fellowship, appointment as Fellow to the Center for Advanced Studies in Behavioral Science, and receipt of a Ford

Foundation Faculty Research Fellowship. For a more complete description of qualifications and publications, see my Vita, which is Attachment 1 to this testimony.

A. (Turner) My name is Ralph H. Turner. I am a professor of sociology and former chairman of the department of sociology at the University of California, Los Angeles.

After receiving a B.A. and M.A. in sociology from the University of Southern California, I received a Ph. D. in sociology, with a speciality in social psychology, from the University of Chicago in 1948. I joined the faculty of UCLA that same fall and have been there since. Visiting appointments at other institutions have included the University of Washington, University of Hawaii, University of Georgia, University of London and Oxford University in England, Australian National University, Hebrew University and Ben Gurion University in Israel, American University of Cairo in Egypt, and the China Academy of Social Sciences in China. I have served as President of the American Sociological Association, Chairman of the American Sociological Association Theory Section, Social Psychology Section, and Collective Behavior Section, and as Vice president of the International Sociological Association.

For seven years, I was Editor of the Annual Review of Sociology, which is sponsored by the American Sociological Association, and for three years I was Editor of Sociometry (now Social Psychology Quarterly) which is the official social psychology journal of the American Sociological Association. I am the author or coauthor of four books and the editor or coeditor of two others, the author of over 100 articles in scholarly journals and books, and the author of approximately the same number of book reviews in scholarly journals.

My areas of professional expertise that are most relevant to the topic of this hearing are (1) the theory of social roles, (2) collective behavior, and (3) human behavior in response to disasters and warnings of disasters. With respect to the theory of social roles, I have authored 15 scholarly articles on the subject, including a definitive essay on role theory in the International Encyclopedia of the Social Sciences. I have also taught the graduate course on "role theory" in the UCLA Department of Sociology for approximately 25 years.

I am coauthor (with Lewis Killian) of a textbook on collective behavior, first published in 1957, revised in 1972, and published in a third edition in 1987 by Prentice-Hall, Inc. In addition, I have published numerous scholarly articles on col-

lective behavior, including in the Encyclopedia Britanica, and have taught an undergraduate course on the subject for 39 years and a graduate seminar on the subject for over 30 years.

In connection with disaster research, I chaired the National Research Council Panel on Public Policy Implications of Earthquake Prediction (1975), was a member of a National Academy of Sciences delegation to China to study the Chinese earthquake prediction effort (1976), served as one of two American representatives on the planning committee for a UNESCO International Conference on Earthquake Prediction (1979), served on the Advisory Committee on Earthquake Research for the U.S. Geological Survey, and am currently on the National Research Council Advisory Committee on the International Decade of Natural Hazard Reduction and the Advisory Committee for the Southern California Earthquake Preparedness Program. I am senior author of the book, Waiting for Disaster: Earthquake Watch in California, and author of numerous scholarly articles on response to disaster warnings.

A copy of my resume is attached hereto as Attachment 2.

A. (Barton) My name is Allen H. Barton. I am a professor of sociology at Columbia University.

I graduated from Harvard College in 1947, majoring in social relations, and received a Ph.D. in sociology from Columbia University in 1957. I have directed several large-scale survey research studies, including studies of populations such as school teachers, educational researchers, students and faculty in a university crisis, community leaders and local residents in New York City community planning districts, and samples of national leaders in Yugoslavia and the United States. My publications include approximately 40 papers, chapters, and monographs, and several books, individually or jointly with research colleagues.

As Director of Columbia's Bureau of Applied Social Research from 1962 to 1976, I have been involved with a large number of research proposals and projects by staff members, faculty members, and students. I have taught graduate courses on survey methods and the logic of social research at Columbia since 1957, as well as substantive courses on formal organizations, social problems, political behavior, and the attitudes and behavior of national elites.

In 1959, I was requested by the Disaster Research Group of the National Academy of Sciences' National Research Council to conduct a sociological review of the available social research on community response to disasters. I analyzed the then-existing studies by social scientists covering well over 100 disaster situations, as well as dozens of historical accounts of disasters

and other incidences of collective stress such as wars, depressions, concentration camps, and racial persecution. I also reviewed the summary monographs on particular aspects of disaster behavior (e.g., panic, convergence, response to warnings) produced by the Disaster Research Group, and other efforts to summarize and theorize about behavior in collective stress situations by sociologists and psychologists. My report, Social Organization Under Stress, with an introduction by Prof. Robert K. Merton, was published by the National Academy of Sciences in 1963. I subsequently amplified and updated the review of the research in a book, Communities in Disaster, published by Doubleday in 1969, and republished in both Britain in 1970 and Japan in 1974. I have since kept up with the disaster literature, reviewing the specialized journals in the field, attending various government-supported conferences on disaster research and appearing on panels at professional associations on disaster research.

For a more complete description of qualifications and publications, see my Vita, which is Attachment 3 to the testimony.

Q. What is the purpose of this testimony?

A. (Cole, Turner, Barton)[1/] The purpose of this testimony is to address Emergency Planning Contention 25, subpart C, as re-

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1/ Unless otherwise indicated, the answers are sponsored by all three witnesses.

manded by the Appeal Board in its March 26, 1986, decision (ALAB-832). The Contention states as follows:

> Intervenors contend that the LILCO Plan fails to comply with 10 CFR Sections 50.47(a)(1), 50.47(b)(1) and 50.47(b)(3) because the Plan fails to address the problem of emergency worker role conflict. Intervenors contend that a substantial number of the emergency workers relied upon under the LILCO Plan will resolve such conflicts by attending to their other obligations prior to, or in lieu of, performing the emergency functions assigned to them by LILCO. In the absence of such workers, the LILCO Plan cannot and will not be implemented, and there can be no finding of compliance with 10 CFR Sections 50.47(a)(1), 50.47(b), and NUREG 0654 Section II. The emergency workers likely to experience role conflict, the type of conflict, and the effect of such conflict upon the implementability of the LILCO Plan are set forth in paragraphs A-F below.
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> . . .
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> C. The LILCO Plan fails to take into account the role conflict that will be experienced by school bus drivers. In fact, a substantial number of school bus drivers are likely to attend to the safety of their own families before they report (if they report at all) to perform the bus driving duties which LILCO assumes will be performed. Role conflict of school bus drivers will mean that neither school buses nor school bus drivers will be available to implement the LILCO Plan. Without an adequate number of buses or bus drivers, LILCO will be incapable of implementing the following protective actions:
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> 1. early dismissal of schools (necessary under the LILCO Plan to permit school children to be sheltered or to evacuate with their parents);
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> 2. evacuation of schools;
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> 3. evacuation of persons without access to cars; and

4. evacuation of persons in special facilities.

Q. Please summarize the matters you will discuss in this testimony.

A. Under the LILCO Plan, the school bus drivers who regularly take children to and from schools in the school districts within the EPZ are expected to do one of two things in a Shoreham accident: either take the children home for unification with their families or evacuate the children to reception centers outside the EPZ, depending on the severity and timing of the accident. See OPIP 3.6.5. This testimony will discuss the potential for role conflict among those school bus drivers and whether, in light of that potential, a sufficient number of school bus drivers can be relied upon to perform emergency duties in driving school children home or to relocation centers during a Shoreham accident.

Specifically, we will discuss: (1) why the school bus drivers would experience severe role conflict in the event of a Shoreham accident; (2) why large numbers of them would be likely to resolve that conflict by attending to the needs of their families, or assuring themselves that those needs had been attended to, prior to or in lieu of performing early dismissal or evacuation bus driving functions; and (3) why LILCO's arguments

that role conflict would not result in large numbers of school bus drivers failing to perform the driving duties assigned by the LILCO Plan, are without merit.

The Bases for Role Conflict and How It Is Resolved

Q. For background purposes, please explain what is meant by the term "role conflict."

A. In all complex societies, individuals simultaneously occupy many social positions (usually called "statuses" in sociology). As a result of occupying these multiple positions, individuals have role relationships with many other people. Thus, most people have work roles, family roles, and other roles (for instance, roles in religious or other voluntary organizations).

Society has certain expectations of how an individual is supposed to perform each of these roles. The people with whom we interact also have expectations for how we should behave in our roles. Since we often simultaneously must fulfill many roles, it is not unusual for the obligations or expectations connected with one role to come into conflict with the obligations or expectations connected with another role. Sociologists have used many different terms, including "role conflict," "status conflict," "role-set conflict," and "role strain," to describe variations of

this familiar situation. It is not necessary, for our purposes, to review or analyze all of the different versions of this concept. Here we shall simply define role conflict as the experience of incompatible obligations from two or more of a person's societal roles.2/

Role conflict can be a moderate or intense experience, depending upon how deeply committed the individual is to the roles involved and what the consequences of a particular role decision may be. For instance, conflict between a business trip and a meeting of one's monthly bridge group is usually resolved with a minimum of stress by opting for the business trip because the commitment to the occupational role is much stronger than commitment to the bridge group, and because consequences of missing the bridge group occasionally are not serious or irrevocable. By contrast, commitment to family roles such as parent, husband or wife, son or daughter, and brother or sister, is usually high. In daily life, role conflicts are often resolved

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2/ Consider the following examples: a minister of a church who in his role as minister accepts it as his religious responsibility to accept gratefully a modest salary, but who in his role as a father feels obligated to secure the best education that money can buy for his children; a labor union official who in his role as union official is expected to support the union's endorsed candidate for public office, but in his role as brother feels obligated to support his brother's candidacy for the same position; the businessman who in his work role feels obligated to bring work home and in his family role obligated to spend time with his wife and children; or the man who in his role as employee perceives a responsibility to perform emergency responsibilities, but in his role as husband or father feels obligated to help ensure the safety and well-being of family members and other dependents.

without great stress by temporarily setting aside family commitments because the consequences are minor and temporary. But when the life, safety, or health of a family member is at stake, and the consequences of failing to carry out one's responsibilities are therefore perceived to be severe and irrevocable, the experience of role conflict will be intense unless the conflicting role is easily set aside.

The potential role conflict that concerns us here is between the school bus drivers' responsibilities toward family or other dependents, and the perceived job responsibilities of such drivers during a radiological emergency. In our opinion, those school bus drivers with responsibilities to spouses, children or other dependents will experience role conflict -- i.e., their roles as family protectors will be perceived to conflict with their roles as school bus drivers. For the reasons discussed below, large numbers will resolve such conflicts in favor of their family responsibilities.

Q. In general, how do people resolve role conflict?

A. One way to deal with role conflict is to carry out the responsibilities of one role and to neglect the responsibilities of the other. This solution is sometimes called "role abandonment." The abandonment can be permanent or temporary.

When commitment to both roles is high, people may also try to resolve role conflict either by attempting to perform both roles in some way, or by performing only part of their responsibilities to each role. This approach is often counter-productive, with the result that both roles are performed poorly, if at all.

It is also important to note that the stress of severe role conflict affects concentration, motivation, and attitude on the job. A lessened ability to concentrate, resentment over the choice that had to be made, and continuing worry about the safety of loved ones all increase the likelihood of mistakes in performance. Thus, regardless of the ultimate resolution of the role conflict dilemma, the quality of role performance is likely to be damaged by strong role conflict.3/

Q. What factors affect how people resolve role conflict?

A. There are many factors affecting the resolution of role conflict.4/ The two most important factors, however, are the

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3/ For a more general introduction to the theory of social roles, see J. Heiss, "Social Roles," Social Psychology: Sociological Perspective, M. Rosenberg and R. H. Turner, eds. (1981); R. H. Turner, "Role: Sociological Aspects," 13 International Encyclopedia of the Social Sciences, (1968) at 552-57.

4/ For a general discussion of mechanisms utilized to cope with role conflict see Stephen Cole, The Sociological Orientation, 2nd Edition (1979), pp. 61-65. Robert K. Merton discusses similar mechanisms in an article on "role-set" conflict. Merton, "The (footnote continued)

relative importance, or "dominance," of the roles at issue and the consequences of the role choice.

With respect to the relative dominance of the roles at issue, it must be recognized that not all roles that individuals occupy are equally important to them. When an individual faces a role conflict situation in which it is necessary to make a choice as to which role will take priority, the individual will be heavily influenced by the expectations and demands of the dominant role. Which roles are dominant are not always readily apparent, but the sociological literature demonstrates that in our society, family roles tend to be the most important. People are taught from childhood that their roles as parents, and other family roles, are the most important. Thus, family roles are likely to be dominant over virtually all others. This does not mean, however, that in all situations the individual will always opt to fulfill family obligations rather than obligations of another role. Other factors will apply as well.

This brings us to the second important factor determining how individuals will resolve role conflicts -- that is, the consequences of the role decision. When an individual is in a situation in which failing to meet the obligations of a dominant role, such as a family role, will result in potentially irrevoc-

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Role-Set: Problem in Sociological Theory," 8 British Journal of Sociology, (1957) at 108-20.

able and serious consequences, they will generally choose to meet the obligations of the dominant role. There are strong social norms or expectations which define it as essential for family members to give precedence to their family roles when other members of the family are in a situation where their health, safety, or lives are threatened. For instance, parents who fail to perform family obligations in such a situation are generally looked upon with great disapproval. Thus, in a situation where the individual is faced with either performing an obligation connected with work or acting to protect the life of a family member, almost all will chose the latter alternative.

Another related factor pertinent to the resolution of role conflict is "degree of involvement." The people with whom we interact in our various roles place different degrees of importance on their relationships with us. The bus driver with children is likely to have an intense personal involvement with them and a less intense personal involvement with those with whom they interact in their role as bus driver. The fact that different people will react differently to our failure to live up to their expectations helps us establish priorities in cases of conflict.5/

5/ This mechanism is really the inverse of the dominant role. When we consider which role is dominant, we consider which one has the most importance to us. When we consider the degree of involvement with others with whom we interact in our roles, we consider the importance of our behavior to others. Ultimately, in deciding what to do in socially induced conflict situations, we consider both our own feelings and the reactions of others. (footnote continued)

Role conflict may also be affected by concerns with the differing degrees of power of those with whom we interact in our roles. The employer of the bus driver would have the power to dismiss the bus driver if he or she did not report to drive the bus in an emergency. The bus driver's family members would not have any direct coercive power to force the bus driver to meet their needs. The consequences, however, of violating family expectations could and probably would be permanent damage to the family relationship. In some situations, an employer with the ability to fire an employee might coerce the employee to give priority to the demands of job over demands of family. For reasons discussed further below, in the event of a nuclear accident at Shoreham, this is highly improbable.

Another factor relevant to role conflict is <u>societal expectations</u>, which may be manifested as either positive social approval or negative social sanctions. Because role conflict is generated by location in society, it is usually the case that individuals do not face or experience role conflict in isolation; rather, they face it along with other people in similar social situations. Family members expect each other to rally in solidarity in an emergency. Society expects such behavior as well. The pointedness of the disapproval from dependent family members for failing to carry out a family role would be much

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And both of these sets of feelings are socially conditioned by societal values.

greater and more inescapable than disapproval from the community for failing to attend to an emergency role. There is no more poignant criticism than the question, "Where were you when I needed you most?" from a child, a spouse, or a dependent parent.

With respect to emergency-specific factors, role conflict is also influenced by the extent to which the emergency worker normally performs emergency work as part of their regular job, the amount of training and experience he or she has had in performing such tasks. Workers with no clear commitment to, or expectation of performing emergency work, who do not do so regularly in their jobs, and who have not been trained to do so, are less likely to perform emergency roles.

Q. In a Shoreham emergency, would the school bus drivers LILCO relies upon under its Plan experience role conflict and, if so, how would they resolve it?

A. It is our opinion that in a radiological emergency at Shoreham, almost all emergency workers with families or other dependents will experience role conflict to some degree, including the school bus drivers LILCO intends to rely upon to evacuate the schools. It is also our opinion that a very large number of them would choose to attend first to the safety and needs of their families. Only after they had fully satisfied themselves that their families were safe -- which in this case

[illegible] out of the area at risk -- would they be willing to perform their bus driving functions, if they ever [illegible] t all. This will have negative consequences for the rapid evacuation or early dismissal of school children from the schools.

Our opinion is based on the factors which we have described above, which are well-documented in sociological literature, as applied to the school bus drivers. As noted above, family obligations are dominant to virtually all other roles in our society. It is our understanding that a large majority of the school bus drivers LILCO intends to rely upon reside in or near the EPZ.6/ Thus, in a radiological emergency at Shoreham, these school bus drivers are likely to believe that their families are at risk and will seek to take steps to fulfill their obligations to their families.

This is particularly so given the likely perceived consequences of not performing that role. Because of the high level of fear that Long Islanders (consistent with people in the rest of the country) have of radiation,7/ the potential danger which the school bus drivers will perceive their families to be exposed

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6/ See Direct Testimony of Bruce G. Brodsky, Edward J. Doherty, Howard M. Koenig, Nick F. Muto, Robert W. Petrilak, Anthony R. Rossi, J. Thomas Smith, and Richard N. Suprina on Behalf of Suffolk County on Contention 25. C (the "School Administrators' Testimony").

7/ The high degree of concern about radiation has been documented by Professor Cole in previous testimony. See, e.g., Cole et al., SC Ex. 13 to the Reception Center hearing, at 26-47.

to, and the negative consequences of not taking effective action to mitigate that danger, most school bus drivers will choose to abandon, or at least to delay, the fulfillment of their bus driving duties. Thus, the two most important factors affecting how people deal with role conflict weigh heavily against fulfillment of the role LILCO expects them to play in an evacuation.

The other factors noted above also support the likelihood that school bus drivers will resolve their role conflict in favor of their families. Societal expectations, at least on Long Island, are that the primacy of the school bus drivers' family obligations are understandable and acceptable. School officials, government officials, and other bus drivers have all acknowledged that school bus drivers would attend first and foremost to the needs of their own families rather than perform school evacuations. See School Administrators' Testimony. Indeed, 255 school bus drivers have already publicly stated their intention not to report to their jobs in an evacuation in a radiological emergency. A sample of the signed statements is attached to the School Administrators' Testimony.

In light of these facts, and because this issue has already been a subject of discussion among bus drivers, the school authorities, and the community in general, it is evident that there is not a clear societal consensus that bus driving duties

must be performed to the detriment of family obligations.8/ Nor does it appear that bus drivers would have much to fear from their employers if they attended first to the safety of their families instead of driving school buses. This removes a potentially potent source of social pressure on the school bus drivers not to abandon their emergency roles.9/

School bus drivers are also more likely to resolve their role conflict in favor of their family obligations because they are not trained emergency workers and do not, in the normal course of their duties, perform emergency functions. Policemen, firemen, ambulance drivers, emergency medical technicians, etc. cope with emergencies frequently as part of their normal jobs and most have had significant experience and training in handling emergencies. These types of emergency workers would also experience role conflict in case of an accident at Shoreham, as

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8/ Even though one could postulate the possibility of some community criticism of a bus driver who did not show up to participate in school evacuation, the driver's justified concern and decisive action to protect his or her own family members would mitigate much of that criticism.

9/ Furthermore, even if we assume that the bus drivers thought that they would be fired if they did not drive a bus at Shoreham, the great majority would attend to the needs of their family anyway. This is because in a Shoreham radiological emergency, the bus drivers would perceive that the very health and lives of their family members were threatened and would not be willing to risk jeopardizing their family members lives in order to retain their jobs as bus drivers. There are very few people in our society who would leave their family members to fend for themselves if they perceived that their family members' lives were in danger.

revealed by the volunteer firemen surveys we discuss below; but, they would probably be less likely to abandon their emergency roles than would school bus drivers.

School bus drivers, on the other hand, very infrequently deal with serious community-wide emergencies as part of their normal jobs. The most serious type of "emergency" that most school bus drivers have encountered would be driving a school bus for an early dismissal during a snow storm. Since snow frequently falls on Long Island during the winter, and since most people have often driven during snow storms, this is not likely to be perceived as a major "emergency" by most school bus drivers. Furthermore, most people do not perceive a snow storm as placing their families at serious risk; most people would perceive a radiological emergency as placing their families at risk. We can safely assume that most school bus drivers have never performed their duties in a situation similar to that which would exist if a radiological accident occurred at the Shoreham plant.10/

10/ Indeed, LILCO witness Dennis Mileti, has testified in the past that it is important to distinguish between regular emergency workers and people who might be expected to play some supportive role in an emergency without having, prior to the emergency, accepted the emergency role. Thus, policemen and full time firemen know that they have emergency roles and know that they are expected by their employers and the community to serve in these emergency roles in case of an emergency. School bus drivers, however, are not in the same category. LILCO might argue, however, that even though the bus drivers have said that they will not drive the buses in a Shoreham emergency and school officials have expressed their views that they do not expect nor want bus drivers to drive school buses during a Shoreham
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Nor have the school bus drivers made a commitment to fulfill the emergency role LILCO has assigned to them. The policeman and other trained full-time emergency workers have made a special commitment to emergency work, and their families have had to work out their own patterns for adapting to this role. Unless these emergency workers have learned to give top priority to the emergency role, however, and unless they have worked out a satisfactory modus vivendi with their family members, they do not remain in these occupations. School bus driving, on the other hand, is not an emergency role; the drivers have not volunteered for emergency service, or for the potentially dangerous activity involved in driving through a potentially contaminated area. They also have not agreed to leave their families to fend for themselves in the event of a radiological emergency. Indeed, many have said publicly that they would not do so. Thus, their level of commitment to driving a bus during an emergency is low compared to their commitments to protect their families.

There is at least one other very important point which weighs against school bus drivers performing their LILCO-assigned emergency roles. In natural disasters, there is no "enemy." The disasters are acts of God or nature, and institutions or organizations cannot be blamed for their occurrence. In such cases, communities have been observed to band together for the common

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emergency, that they will do so anyway. This is simply wishful thinking and not based on data or valid sociological theory.

good (the so-called "therapeutic community"). This would not be the case in the Shoreham emergency. Such an emergency would not be an act of God or nature; it would be perceived by the public as a result of incompetence on the part of Shoreham's operator, LILCO. As has been demonstrated to this Board previously, LILCO has a low degree of credibility on Long Island and the people feel a great deal of anger toward LILCO.11/ If Shoreham were to be licensed and a serious accident requiring the evacuation of all residents of the EPZ were to occur, not only would LILCO's already low credibility decline, but the residents of Long Island would blame LILCO for the accident.

These facts will also affect what school bus drivers will do in an emergency. Man-made disasters provide the opportunity for placing blame, and placing blame can often serve as a device for shifting responsibility. It is possible that many drivers will feel their own emergency responsibilities lessened because the accident is plainly the fault of the power company that built and runs the nuclear plant. In an emergency, the only organization which would expect school bus drivers to drive the school buses is LILCO. In contrast, their families would expect them to come home and school officials would not expect them to drive the buses. The concept of "therapeutic community" is only relevant when there is a clear community need and a clear course of action for an individual to follow. This would not be the case for

11/ See, e.g., Cole et al., SC Ex. 13 to Reception Center hearing, at 44-47.

school bus drivers responding to a Shoreham emergency. Given the low credibility of LILCO and the anger which would be directed at LILCO if a serious accident was to occur, it is highly unlikely that the bus drivers would accept LILCO's unilateral assignment of bus driving responsibilities.

Q. LILCO has argued that school bus drivers who are worried about their families can deal with that concern by making a phone call that would not substantially interfere with their ability or willingness to perform their school evacuation driving duties. Do you agree?

A. No. Many of the school bus drivers have children who would be in school. It would be virtually impossible for a bus driver to check on the safety of his or her child by telephone. Furthermore, many bus drivers, unless they were at home, would not have easy access to telephones. Also, it might be difficult to use the telephone at all, as the phone system would probably be tied up during the course of a major accident at Shoreham. Even if a dial tone could be obtained it would be difficult to get through to an individual school (which would be likely to have its switch boards flooded) and even harder to be able to find out about an individual child.

In addition, even if a school bus driver could get through to a child, it is unlikely that this would be enough to ensure him or her that the family members were safe. There is overwhelming evidence that under conditions which would trigger an early dismissal or evacuation of the schools because of a Shoreham accident, most Long Island residents would not consider themselves or their families to be safe until they had left the EPZ and travelled a significant distance from Shoreham.12/ Most school bus drivers, like most other citizens who live in and around the EPZ, will gather up their family members and leave the area by car.

Q. LILCO has also stated that it has offered to provide "training" to the school bus drivers and that such training would reduce role conflict or would reduce the likelihood of role abandonment by school bus drivers. Do you agree?

A. No. In this case we think that any training LILCO might provide would be of little value.

First, we understand that the Exercise (OL-5) Board, which reviewed LILCO's February 13, 1986 exercise performance, has found that LILCO's training program is "fundamentally flawed" and

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12/ Cole, ff. Tr. 2792, at 3, 12-14; Zeigler and Johnson, ff. Tr. 2789, at 17-18 and Figs. 3, 4; Evans et al, ff. OL-5 Tr. 3786, at 159-65.

is, in essence, inadequate.[13] In light of this finding, LILCO is hard pressed to say it will be able to resolve role conflict through training.

Second, we understand that the school bus drivers in question have not received any LILCO training and that none of the bus drivers have agreed to participate in a training program preparing them to drive during a radiological emergency.[14] An offer to provide training is not the same thing as effective training.

Third, we believe that the kind of training envisioned by LILCO, which we understand would consist of a few hours of general information about radiation and the LILCO Plan, would have no influence on the bus drivers. LILCO has very low credibility among the general public and apparently among bus drivers. It is unlikely that bus drivers would believe anything that LILCO said about the dangers of radiation released during a radiological emergency at Shoreham. Training can only be effective when the trainees want to be trained, the trainees accept it as their responsibility to learn, and the trainer has high credibility. None of these conditions exist in this case.

13/ LBP-88-2, 27 NRC ____, slip op. at 172-252 (February 1, 1988).

14/ See Deposition of Douglas M. Crocker, February 2, 1988, at 60-62.

Finally, even in the unlikely event that the bus drivers were to participate in a training session, the training proposed by LILCO would be ineffective in dealing with the most serious problem faced by the bus drivers: role conflict. To our knowledge, the proposed training does nothing to protect the dependent family members, who would be in just as much danger whether the bus drivers are trained or not.

The Sociological Literature And An Assessment Of LILCO's Misinterpretation of It

Q. Has there been any analysis in the sociological literature of role conflict experienced by emergency workers during disasters?

Killian and Subsequent Studies on Role Conflict

A. Yes. As in many other areas of science, there are some conflicting views of the significance of role conflict experienced by emergency workers during disasters. Virtually all researchers agree that emergency workers will experience varying degrees of role conflict. They disagree about the likelihood of this conflict resulting in the abandoning of the emergency role. We will briefly review this literature and discuss why we believe that this literature supports our conclusion that a large number of bus drivers are likely not to drive school buses during a Shoreham radiological emergency.

In 1952, Lewis Killian introduced the concept of role conflict and utilized evidence from studies of disasters to illustrate the concept.15/ In his article, Killian presented evidence from a study of the reactions of people in four Southwestern communities to physical disasters. The study, which was carried out by the Disaster Studies Project at the University of Oklahoma, of which Killian was then the chief analyst, covered three tornado-struck communities and the Texas City ship explosion disaster. Killian quoted the report of a volunteer fireman who "fought the fire by myself until the army got there to help me," and that "all the rest of the firemen had relatives that were hurt, and they stayed with them. Naturally, they looked after them. If it hadn't been that my wife was all right, this town probably would have burned up." Killian concludes:

> The great majority of persons interviewed who were involved in such dilemmas resolved them in favor of the family, or, in some cases, to friendship groups. Much of the initial confusion, disorder and seemingly complete isorganization reported in disaster communities was the result of the risk of individuals to find and rejoin their families.16/

Besides Killian's classic study, other studies have provided examples of role conflict experienced during emergencies and reached the conclusion that family roles would take priority in

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15/ L. W. Killian, "The Significance of Multiple Group Membership in Disaster," American Journal of Sociology, (January 1952), 309-14.

16/ Killian, at 311.

case of conflict. These include a study of the 1953 Holland flood disaster,17/ a 1958 study by Harry C. Moore of tornadoes in Texas,18/ a 1958 doctoral dissertation by Charles W. Fogelman,19/ and a 1958 study by William H. Form and Sigmund Nosow.20/

Most of these studies were summarized in a text on disasters by Professor Barton, Communities in Conflict (1969). Typical of the findings summarized by Professor Barton is the report by Form and Nosow of the reactions of volunteer firemen:

> Interviews indicated that in only one case was there immediate attendance to duty. The chief, who was not in the area at the time, went directly to the firehouse. For all others, two paths of action were followed: if their families were in danger, they saw to them first; or if their families were free of danger, they then proceeded to take some sort of action that they defined as appropriate.

Form and Nosow at 152. They conclude, "Help for family members, close friends, and neighbors comes first; then, but apparently only then, other victims can be looked after." Id. at 66. The other studies provide similar evidence.

17/ Instituut voor Sociaal Orderzoek van het Nederlandse Volk, Studies in Holland Flood Disaster, Vol. III at 103-108, Vol. IV at 22 (1955).

18/ H. Moore, Tornadoes over Texas (1958).

19/ Fogelman, Family and Community in Disaster (unpublished doctoral dissertation) Louisiana State University (1958).

20/ W. H. Form and S. Nosow, Community in Disaster (1958).

LILCO's Arguments and Selective Use of Data

Q. In light of all of this evidence, that role conflict can create a problem for emergency workers during a disaster, why do you say that there is no consensus on this question?

A. There are other researchers on disasters, including LILCO's witnesses, who have argued that it is unusual for emergency workers to abandon their roles during disasters. We will briefly summarize their position, explain why we believe them to be in error, and, more importantly, explain why we do not believe that their conclusions are applicable to the issue presented here.

In order to bolster their argument that the conflict will be unlikely to result in the abandonment of emergency roles by emergency workers -- including school bus drivers -- it has been necessary for LILCO's witnesses to dismiss the work and conclusions of Killian and the other sociologists cited above who found evidence of role conflict and role abandonment among emergency workers during disasters. Thus, they have inaccurately described Killian's article as "theoretical." The bulk of Killian's article, however, was devoted to reporting the results of a study of four disasters. Thus, it is simply wrong to characterize his work as mere theory. Furthermore, they have argued that those who abandoned roles "had no definite responsibilities in the

emergency social system." It is difficult to understand how such an argument would apply to the volunteer fireman quoted by Killian, or the firemen referenced above by Form and Nosow. Certainly, volunteer firemen are regular emergency workers who are aware that they have a responsibility to put out fires and even to help in other types of emergencies.

LILCO's witnesses have also attempted to dismiss all of the above-referenced studies which give examples of people who were reported to have abandoned an emergency role by suggesting that the subjects of the studies were either people who did not "know" that they were supposed to play some emergency role, or that they had evidence that the emergency role could be performed adequately without them. LILCO's witnesses, however, provide no evidence that is true. Again, it is also unlikely that emergency workers like the firemen referenced above did not "know" about their emergency duties. In any event, this factor is unlikely to be applicable in these circumstances since so many bus drivers have publicly rejected the role which LILCO has unilaterally assigned to them.

In general, LILCO's witnesses have been highly selective in their discussion of the research on disasters and have failed to adequately consider how differences in the type of disaster could affect the way emergency workers respond to the conflict. There are two basic studies which these researchers generally used to

bolster this position. The first is an unpublished 1962 masters thesis by Meda White. White interviewed various emergency workers about what they had done during and after tornadoes. Of the 117 people she interviewed, 82 percent contributed to disaster activity first, before attending to their families. LI'CO's witnesses have attributed the difference between the earlier reports of role abandonment and the results of White's study to the "fact" that White was supposed to have studied workers who were "certain" of their emergency roles whereas the others (e.g., Form and Nosow) studied people who were not certain of their emergency roles. This conclusion is insupportable and distorts White's work. First, we have already pointed out that many of the emergency workers previously reported to have abandoned their roles were in fact experienced emergency workers, such as volunteer firemen who were aware of their emergency roles.

Second, the basic problem in applying the results of White's study to bus drivers facing a Shoreham emergency concerns the nature of the disaster agent. Disasters vary in the duration of the threat or impact, from brief in the case of tornadoes and earthquakes to prolonged in the case of floods and radiation emergencies. The duration of threat from a hurricane will generally be longer than a tornado, but substantially shorter than a serious radiological accident at a nuclear power plant. Disasters also vary in their impact area, from very narrow in the

case of tornadoes to very broad in hurricanes, floods, earthquakes, and radiation emergencies. They also vary in the extent to which the threat is visible. Most natural disasters present visible threats while radiation danger is invisible without the aid of special equipment. All of these attributes of the disaster agent contribute to how emergency workers might react to potential role conflict. Because tornadoes, the disaster which White studied, pass quickly and then are gone, by the time an emergency worker had to perform his or her emergency role the threat would have passed. Thus, it would be possible for emergency workers to find out quickly if their family members had been affected by the tornado. If not, then their family members would not be in danger and they would not experience role conflict.21/

White concluded that people usually opt for the role where the need is more certain and that "the family did win the majority of role conflicts, when the two needs were equally

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21/ Thus, it is not surprising that few of the 117 respondents in White's study were in a situation of "certainty" of need in both family and emergency job role. Only four felt equally needed in both the family and emergency roles. Of these few, half chose family role and half chose the job role. Another four people were "undecided" about both roles and, of these, only one carried out his job. Thus, most emergency workers were in situations where the organization's need was more certain than the family's. However, "[w]henever the family need was more certain, 0% put the organization first. There were only seven such cases, remarkably few." White, at 27. This distribution of situational perception on the part of the emergency workers was clearly a function of the nature of the disaster agent -- namely, a tornado -- which strikes a narrow swath across a community and is over within minutes.

certain." White, herself, was concerned with why her study seemed to yield results differing from those reported by Killian and stated:

> Why, then, did Killian get the findings that he did? A look at the map of the Texas City disaster [one of the disasters studied by Killian] area revealed what was so unusual about Texas City and so important in causing job-defection: the workmen's homes lay next to the dock area. When the first ship exploded, these little homes caught fire. Workmen were in the awful position of seeing that both the place they worked and their homes were going up in flames. This is the intense Family 1-Organization 1 conflict that is completely missing from our sample.22/

Thus, the circumstances studied by Killian presented a role conflict situation which resulted in the family role taking precedence, while the White study simply did not present that situation. LILCO's witnesses have completely ignored this distinction between the two studies.

Professor Barton's 1969 book, Communities in Disaster, devoted seven pages to a discussion of the White study. He concluded:

> It must be emphasized that the finding of White's study is not that 'the great majority of people choose their organizational role over their family role' but that they will do so under certain conditions, which prevailed in the three tornado disasters she studied. In other types of disasters -- exemplified by the Texas City

22/ Id. at 31.

> explosion -- the distribution of knowledge about the needs of the family may be quite different. In the case of an atomic attack, the visible extent of fires or the undetectable extent of radiation might create a certainty of family danger over a wide area, similar to the Texas City situation.[23]

If we compare a potential Shoreham radiological emergency with the tornadoes studied by White and the Texas City ship disaster which was discussed by Killian, we believe the situation at Shoreham would be much closer to the latter. To understand this conclusion, it is important to understand the situation to be faced by the school bus drivers. According to LILCO, they would be expected to serve as evacuation drivers while the radiological threat is imminent or actually present in the EPZ where the schools in question are located. They would not just be called upon to perform rescue or other community activities after the danger has passed. Thus, the drivers (most of whom, live in the school districts in or near the EPZ) would have reason to be concerned that their families would be in danger. LILCO would be advising some or all EPZ residents to evacuate as soon as possible. LILCO would also be requesting that the bus drivers drive school children in the EPZ to safety. In an ongoing radiological emergency requiring evacuation, the danger would be perceived as persisting, unlike in White's tornado studies. It is therefore highly likely that those bus drivers with families would feel certain that their family members needed

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23/ Barton, at 120.

their help, experience intense role conflict, and resolve that conflict in the socially expected way of giving priority to the family role in a situation in which the consequences of not doing so might be severe and irrevocable.

LILCO's witnesses, however, have completely misinterpreted the conclusion of the White study. They have argued that White's study shows that where emergency roles are clear and certain, people will do their emergency jobs, and that good training establishes "role certainty." This distorts White's findings for three reasons. First, White's concept of "certainty" had nothing to do with training or past experience, but with the emergency worker's knowledge of whether he or she was needed in the family role and in the emergency role. See White, at 26. Second, White studied emergency workers whom she described either as professionals (full-time firemen, policemen, city officials, etc.) who work with emergency situations regularly as part of their normal jobs, or trained volunteers who frequently perform emergency functions (such as volunteer firemen or Red Cross workers). The Shoreham school bus drivers fit into neither of these categories.

Third, and perhaps most importantly, as we have already pointed out, the disaster agent in White's study was a tornado. White herself (as demonstrated in the quote above) was very aware that it would be wrong to generalize from the behavior of emer-

gency workers in one type of disaster to disasters which would pose substantially different circumstances. Whereas the emergency workers which White studied were able to ascertain that the tornado, which had passed and left, had not harmed their family members, this would be difficult for school bus drivers to do during an ongoing radiological emergency at Shoreham.

Finally, there is one other piece of research which is referred to by those, such as LILCO's witnesses, who argue that the role abandonment by emergency workers in disasters is not a serious problem. This is the research carried out by Quarantelli and Dynes at the Disaster Research Center in Ohio and recently published by Dynes.[24/] Dynes draws the following conclusions from the re-analysis of the Disaster Research Center data:

> However, in examining over 150 different disaster events and in the course of interviewing over 7000 different organizational officials, role conflict did not emerge as a problem.

Dynes at 81. He then concludes:

> In sum, in examining a sample of 443 persons who held positions in emergency-relevant organizations, not one abandoned his/her emergency role obligations to opt for familiar-role obligations.

Dynes at 84.

24/ R.R. Dynes, "The Concept of Role in Disaster Research," in R.R. Dynes, B. deMarchi and C. Pelanda, Sociology of Disasters (1987) at 71-102 ("Dynes").

The Disaster Research Center data are not reliable and are not relevant to the issue before this Board for the following reasons. First, the Quarantelli and Dynes study is based upon a re-analysis of data which were originally collected for other reasons. In the original interviews, no questions were asked about role conflict. The respondents were asked where they were at the time of the disaster and to describe their actions in chronological sequence, without any specific questions about role conflict or their family's situation. Since the interviews were clearly about disasters and the performance of the respondent's role during a disaster, there may have been little reason for the respondent to talk about role conflict.

Second, it is also possible that the responses could have been influenced by normative responding. Emergency workers and officials were being interviewed by a government-funded research organization which was examining their performance during an emergency. There probably was incentive for the respondents to paint their own performance as emergency workers in as favorable a light as possible.

Third, most of the people interviewed were highly professional disaster workers. To our knowledge, none was a school bus driver.

Fourth, although many emergency workers were interviewed, this was not a systematic quantitative study. No information is presented about questions asked, the order in which they were asked, or about who did the interviewing. In short, it is impossible to draw any definite causal conclusions from the type of analysis done by Quarantelli and Dynes. Qualitative research can be used to gain a greater understanding into a social situation, but not to test hypotheses. And given the fact that the research was not aimed at finding out anything about role conflict, it is of dubious value for gaining any insight into this problem.

Fifth, the disasters studied by Quarantelli and Dynes did not include any radiological emergencies. We have already pointed out why it is dangerous to generalize from the behavior of people in one type of disaster to their probable behavior in a radiological emergency.

Sixth, even the data presented by the Disaster Research Center suggest that the role conflict can be a serious problem in some types of disaster. For instance, for emergency workers called from their homes in floods or hurricanes, only 33 percent reported responding immediately to emergency jobs.

In short, it is evident from reviewing the sociological literature that role conflict has been found to occur and that it would occur more often under the circumstances that would prevail in a radiological emergency for Shoreham -- particularly for non-emergency workers like school bus drivers. In attempting to rebut this evidence, LILCO has distorted or ignored the applicable studies and data.

Survey Data Supporting the Existence of Role Conflict

Q. Have you conducted any research on Long Island to support your position that many bus drivers will not perform the emergency roles that LILCO expects under its Plan?

A. (Cole) Yes. I have conducted three surveys that are directly relevant to the issue of how school bus drivers would resolve role conflict: (1) a 1982 survey of school bus drivers; (2) a 1982 survey of volunteer firemen; and (3) a 1988 survey of volunteer firemen. The results of all three surveys suggest that large numbers of school bus drivers would resolve their role conflict by not performing school bus driving roles, and instead by attending to the safety of themselves and their families.

Q. For background purposes briefly summarize the results of your 1982 survey of school bus drivers.

A. (Cole) The results of that survey are described in detail in my testimony which was submitted on the role conflict issue in 1984.25/ Briefly, that survey was conducted of virtually all (246) of the school bus drivers who at the time (September 1982) drove for the Riverhead Central School District, the Eastport Union Free School District, the Middle Island Central School District (now Longwood), the Shoreham-Wading River School District, and the South Manor Union Free School District.

The results of the survey indicated that in the event of a radiological emergency at the Shoreham plant, a substantial majority of school bus drivers would first look after the health and safety of their families rather than report to drive a school bus. Specifically, 69 percent of those interviewed said that if there were an accident requiring the evacuation of people within a ten mile zone of the plant, they would first make sure that their families were safely out of the evacuation zone; an additional four percent stated that they would first check on their families and then go to drive the school bus; 24 percent said that they would report to work so that they could pick up school children in the evacuation zone and drive them to a shelter; three percent said that they would immediately leave the evacuation zone.

25/ See Cole et al., ff. Tr. 2792 (January 20, 1984).

Q. Do you believe that the 1982 survey of school bus drivers is still valid?

A. (Cole) Yes. If there have been any significant changes in conditions since the time of the 1982 survey they have been such as to increase the level of role conflict school bus drivers would experience and to increase the probability that they would abandon their roles as emergency workers during a Shoreham radiological emergency.

Q. Please explain.

A. (Cole) Since the first survey was done in 1982 there has been a significant change in the attitudes of Long Island residents towards the Shoreham nuclear plant. Such changes have been documented both in surveys conducted by Newsday and in surveys conducted for Suffolk County. As these surveys demonstrate, there has been a substantial increase in apprehension about the dangers of a potential nuclear accident at the Shoreham plant. This is in part due to the great interest in Shoreham and the widespread discussion of the plant, the political opposition to the plant of the County, State, and other local governments, and the accident at Chernobyl in the Soviet Union.26/ The increase in concern about Shoreham means that in the event of an accident, bus drivers are more likely today than they were in

26/ See, e.g., Cole et al., SC. Ex. 13 to Reception Center hearing at 37-40.

1982 to perceive that their families would be seriously endangered by a Shoreham accident and in need of their assistance to escape or minimize the danger.

With respect to the school bus drivers, the statements signed in 1986 by 255 drivers from several school districts in or near the EPZ, including some of those surveyed in 1982, demonstrates this increased concern.

Q. Please describe any other data you have obtained regarding role conflict among emergency workers on Long Island.

A. (Cole) In 1982 I conducted a survey of firemen from the following volunteer fire departments which serve areas within approximately 10 miles of Shoreham: Ridge Volunteer Fire Department, Miller Place Volunteer Fire Department, Sound Beach Volunteer Fire Department, Rocky Point Fire Department and Riverhead Fire Department.

The questionnaire used in the survey was prepared by me in consultation with Drs. Kai Erikson and James Johnson, whom the Board will remember as sociological experts whose testimony on role conflict was admitted by the Board in 1984. A copy of the questionnaire is Attachment 4 hereto.

The interviewing for this survey was conducted on the telephone.27/ It was not possible to reach all of the 467 members of the five fire departments, although an attempt was made. However, we were able to complete interviews with 291 firemen, or 62 percent of all the firemen in the five departments.28/ Since the procedure used in this survey was not based upon sampling, but represented an attempt to interview an entire population, sampling statistics estimating the sampling error would not be appropriate. It is possible, although there is no evident reason why it should be so, that those firemen whom we were not able to contact on the telephone may have somewhat different attitudes than those firemen whom we were able to contact.29/

Q. Please describe the results of the 1982 volunteer firemen survey.

27/ All the interviewing was conducted from a rented telephone facility in Melville, New York. Interviewing was done on the evening of September 28, September 30, and during the day on Saturday, October 2, 1982. Evening calls were made between the hours of 6:00 and 10:00 p.m., and Saturday calls were made between the hours of 10:00 a.m. and 3:00 p.m. All the interviewers were experienced and trained people who had previously performed surveys for Social Data Analysts, Inc.

28/ There were 83 members of the Ridge Department surveyed, 144 members of the Riverhead Department, 60 members of the Sound Beach Department, 110 member of the Rocky Point Department, and 70 members of the Miller Place Department.

29/ Of the 323 firemen we were able to contact on the telephone, 32 or 10 percent, refused to participate in the survey. For the majority of the remaining firemen with whom we did not complete the interviews (i.e., the 144 firemen other than the 323 who were actually contacted), we were unable to reach them, either receiving no answer or busy signals on the four or more attempts we made.

A. (Cole) The questionnaire asked, among other things, the following question:

> Assuming that the Shoreham Nuclear Power Plant is licensed and begins to operate, we are interested in knowing what you think you would do if there was an accident at the plant. Suppose that you were at work on a weekday morning and there was an accident at Shoreham. Everyone living within ten miles of the plant was advised to evacuate. Volunteer firemen were expected to help with the evacuation. What do you think you would do first?
>
> First, you would report to the fire station so that you could help with fire fighting and evacuation in the evacuation zone, or
>
> first, you would make sure that your family was safely out of the evacuation zone, or
>
> first, you would do something else
>
> _____
> (Specify)
>
> Don't know

The survey results indicate that a significant percentage of firemen would first ensure the safety of their families before attempting to report for duty. In response to the above question, 68 percent of the firemen said that they would first make sure that their families were safely out of the evacuation zone, whereas only 21 percent said that they would first report to the fire station to help with evacuation or fire fighting. One percent said that they would leave the evacuation zone, seven

percent said that they would do something else (generally involving an activity which would delay their reporting to duty), and four percent said that they did not know what they would do.

For those firemen who said that they would first make sure that their family was safely out of the evacuation zone (68 percent), we asked the following question:

> How would you make sure that your family was safely out of the evacuation zone?
>
> go home and drive your family to a safe place out of the evacuation zone
>
> call home and tell your family to leave without you
>
> some other way _____ (Specify)
>
> Don't know

Fifty-one percent said that they would call home and tell their family to leave without them; 32 percent said that they would drive their family to a safe place outside the evacuation zone; 12 percent said that they would seek to protect their family some other way (generally involving an activity such as taking a boat to Connecticut which would delay their reporting to work); and five percent said that they did not know what they would do. These results are shown in Attachment 5 hereto.

Combining the answers to these two questions, we constructed an index which suggests that 36 percent would look after the safety of themselves and their family in a way which would prevent them from reporting quickly to duty, 53 percent would attempt to report to work relatively quickly, and eight percent did not know what they would do.30/

This conclusion was supported by answers given to certain "agree/disagree" questions which were included in the survey. For example, 92 percent of the firemen agreed that: "In the event of a nuclear emergency at Shoreham, it would be the obligation of everyone to first look after the health and safety of their family." Only five percent disagreed with this and three percent had no opinion. Or the other hand, only 17 percent agreed with the statement that: "In the event of a nuclear

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30/ In constructing this index, we defined those who would "report to work quickly" as those who said they would first report to the fire station (response 1 to question 18), or those who said they would first make sure that their family was safely out of the evacuation zone by calling home and telling the family to leave without them (response 2 to question 19, following response 2 to question 18). We defined those "who would not report quickly for duty" as those who said they would leave the evacuation zone to make sure they were in a safe place (response 3 to question 18); those who said they would go home and drive their families to a safe place out of the evacuation zone (response 1 to question 19, following response to question 8), those who said they would do something else first (response 4 to question 18), or those who would make sure their families were safe some other way response 3 to question 19, after response 2 to question 18). An examination of the specific responses given by firemen who responded to the "something else" option in questions 18 or 19, indicated that they would deal with the role conflict in some way which would make it difficult for them to report to work quickly. For example, several of them said they would try to evacuate by boat.

emergency at Shoreham, a volunteer fireman must place duty to the fire department over duty to family." Seventy-seven percent disagreed with this and six percent had no opinion.

Q. Please describe how the 1988 survey of volunteer firemen was conducted.

A. (Cole) In March 1988, the following volunteer fire departments, which serve areas of the Shoreham EPZ, provided us with up-to-date lists of their members: Ridge Volunteer Fire Department, Sound Beach Volunteer Fire Department, Rocky Point Fire Department, and Riverhead Fire Department.31/

The interviewing for this survey was conducted on the telephone from my offices at the State University of New York at Stony Brook by trained interviewers who had previously worked for Social Data Analysts, Inc. It was not possible to reach all of the 407 members of the four fire departments, although at least four call back attempts were made to reach each member. We were able, however, to complete interviews with a total of 266 volunteer firemen, or 65 percent of all the firemen in the four departments.32/

31/ An additional attempt was made to obtain a list from the Miller Place Volunteer Fire Department. The commissioners of this fire department decided that they did not want to participate in the survey but did send a letter saying that their fire department had voted not to participate in a Shoreham evacuation.

32/ The survey included 102 members of the Ridge Volunteer Fire Department, 54 members of the Sound Beach Volunteer Fire Depart-
(footnote continued)

The questionnaire utilized in the 1988 survey was prepared by me and was reviewed by Professors Barton and Turner prior to finalization. A copy of the questionnaire is attached hereto as Attachment 6.33/

Q. Please describe the results of the current survey of volunteer firemen.

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ment, 79 members of the Rocky Point Fire Department, and 172 members of the Riverhead Fire Department.

Of the 335 firemen we were able to contact on the telephone, 69, or 17 percent, refused to participate in the survey. We were unable to reach the remaining firemen with whom we did not complete interviews (i.e., the 72 firemen other than the 335 we actually contacted), either because we were unable to get through on the telephone or the fireman was not at home and a convenient time for a call back interview could not be arranged.

Since the procedure used in this survey is not based upon sampling, but represents an attempt to interview an entire population, sampling statistics estimating the sampling error would not be appropriate. It is possible for this survey as in the previous survey of volunteer firemen that those firemen whom we were not able to contact on the telephone may have somewhat different attitudes than those firemen whom we were able to contact.

33/ A telephone pretest was conducted with ten members of the Sound Beach volunteer fire department. The purpose of the pretest was to make sure that the questionnaire was intelligible and that it was possible to administer it easily. Since no significant changes were made on the basis of the pretest it was possible to include the ten pretest interviews with the others. (They have indeed been included with the other interviews with volunteer firemen from Sound Beach.)

A. (Cole) Let me begin by describing the general structure of this survey. After ascertaining whether the individual was indeed a member of the relevant fire department and determining how long he or she had been a member, the following question was read:

> Assuming that the Shoreham nuclear power plant is licensed and begins to operate, we are interested in knowing what you would do if there was an accident at the plant. Suppose that you were at work on a weekday morning and there was an accident at the plant. Everyone living within ten miles of the plant was advised to evacuate as soon as possible. Volunteer firemen were asked to report to the fire house to help with the evacuation. What do you think you would do <u>first</u>?
>
> <u>first</u>, you would report to the fire station so that you could help with fire fighting and evacuation in the evacuation zone, or
>
> <u>first</u>, you would make sure that your family was safe, or
>
> <u>first</u>, you would leave the evacuation zone to make sure that you were in a safe place, or
>
> <u>first</u> you would do something else _____ (specify)
>
> Don't Know or Refuse

When asked this question, 14 percent of the firemen said that they would first report to the fire station, 77 pe cent said that they would first make sure that their families were safe, two percent said that they would first leave the evacuation zone

to assure their own safety, five percent said that they would do something else, and two percent said that they did not know what they would do.

Based upon the answer the respondent gave to this first question, an additional series of questions was asked which were aimed at finding out the order in which the fireman would perform various activities and whether the fireman would report for duty at the fire house in a timely manner. A total of 18 questions were utilized in order to make this determination. These are questions 6 through 23 on the attached questionnaire and are mostly open-ended, which allowed the respondent to tell us most accurately what he intended to do. Given the fact that each fireman respondent could have had a unique set of responses to these open-ended questions, it was decided to develop a code to categorize the questionnaires.34/

34/ The code consisted of the following seven categories:

Category 1: would report promptly for work at the fire house;

Category 2: would check on family and report relatively promptly for work at the fire house;

Category 3: would check on family and then report relatively promptly for work at the fire house unless spouse asked to be taken out of the evacuation zone;

Category 4: would stay at home with family members and be unable to report relatively promptly or at all for duty;

Category 5: would leave the evacuation zone with family members preventing them from reporting promptly or at all for duty. Given what we know of the general attitudes of EPZ residents from prior surveys, it is quite probable that many
(footnote continued)

The coding procedure yielded the following results: 16.5 percent (44 people) said that they would first report to the fire house; 9.4 percent (25 people) said that they would check on their families and report without delay to the fire house; 4.5 percent (12 people) said that they would check on their

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firemen would be in such a situation. However, since we did not want to assume that a spouse would be asked to be taken out of the evacuation zone, we considered that these people would report relatively promptly for work at the fire station as long as they answered question 23 (see attached questionnaire) that after they had checked on the safety of their family they would report, or would try to report, for duty at the fire house;

Category 6: would do something else which would make it difficult or impossible for the fireman to report promptly or at all;

Category 7: does not know what he or she would do in a Shoreham emergency.

The following rules were utilized in coding:

1. Firemen who said that they would report first to the fire house were coded Category 1;

2. Firemen who said that they would leave the area to assure their own safety were coded Category 6;

3. Firemen who said that they would first check on the safety of their family members and then responded on question 8, 9, 11, 12, 15, 16, 19, or 20 that they would take their family members out of the evacuation zone were coded as Category 5. It was assumed that for a fireman to go from work to pick up family members and then drive them out of the evacuation zone in the congested conditions which would exist in a General Emergency, it would take at least several hours; thus making it impossible, even if the fireman was so inclined, to report for duty in a timely fashion. Another assumption used here was that it would probably be difficult or impossible for a fireman to assure the safety of family members by telephone. This is because during an emergency at Shoreham the telephone system will be overloaded making it difficult to get a dial tone and difficult to get through to specific people. It was assumed that an emergency in which all residents of the EPZ were advised to evacuate would last for at least several hours and that as long as LILCO was

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families and unless their spouse asked them to leave the evacuation zone would report relatively promptly to the fire house; nine percent (24 people) said that they would stay at home with their families; 50.8 percent (135 people) said that they would leave the evacuation zone with their families; three percent (8 people) would do something else which would make it difficult or impossible to promptly report to the fire house; and 6.8 percent (30 people) said that they did not know what they would do in a Shoreham emergency. If we combine Categories 4, 5 and 6 we may conclude that 64 percent of the firemen would either leave the evacuation zone or engage in other behavior making it difficult or impossible to report promptly for duty. If we combine the first three categories, we may conclude that 30 percent of the firemen would report relatively quickly for duty. Seven percent of the firemen could not decide what they would do in a Shoreham emergency.

(footnote continued from previous page)
advising all residents of the EPZ to evacuate, firemen and their families would perceive that they were in some danger. Many of the firemen who said that they would go home and stay with their families told the interviewers that they would want to evacuate (as advised by LILCO), but that they thought that it would be impossible due to traffic congestion and that therefore the best course of action would be to remain at home.

4. Firemen who said that they would first check up on their families and then responded to question 8, 9, 11, 12, 15, 16, 19, or 20 that they would stay at home with their families were coded as Category 4;

5. Firemen who said that they would first check on their families and then in response to either question 13 or 17 said that they would leave the evacuation zone, were coded Category 3;

6. Firemen who replied "something else" or "don't know" were coded on a case by case basis.

To understand further how the respondent firemen would resolve role conflict in the event of a Shoreham accident, the survey also contained several questions on how dangerous the respondent believed it would be both for family members and the firemen to be in the EPZ. Seventy-nine percent of the firemen said that if an accident occurred at Shoreham which required the evacuation of everyone in the EPZ, it would be dangerous for a member of their family to remain in the evacuation zone for several hours. Of this group, 64 percent said it would be "very dangerous." Ten percent did not know how dangerous it would be.

These results confirm the large body of existing evidence that Long Island residents have a high level of fear of radiation which could be released during an accident at Shoreham. The fact that the firemen themselves and their family members (we have no direct data on the beliefs of their family members but there is no reason to believe they are dissimilar to other residents of the EPZ) believe that a Shoreham accident poses a high level of danger to them, places the firemen in a position of heavy role conflict.

In short, the survey we have conducted provides evidence that a majority of firemen will resolve their role conflict by giving priority to their roles as family members and by looking first after the needs of their family. Some firemen would try to

do what LILCO hopes all, or most, emergency workers will do -- perform their emergency roles. However, the conditions which are likely to exist in a Shoreham emergency make it extremely difficult, if not impossible to look after the needs of one's family and to report promptly for emergency duty. We concluded that less than one third of volunteer firemen can be counted on to help out during an emergency at the Shoreham plant.35/

35/ Q. Dr. Cole, in the 1982 survey of volunteer firemen you concluded that slightly more than half of the firemen would attempt to report for work relatively promptly. The current survey suggests that only about one third of the firemen can be counted upon to report to the fire house relatively promptly. How can you explain the apparent change in results?

A. (Cole) In my opinion there are two primary reasons for the change. First, the current questionnaire is a better questionnaire for assessing what firemen would do in a Shoreham emergency than the one employed in the 1982 research. In the 1982 survey we asked the firemen what they would do "first." If the respondent said that he or she would first make sure that "your family was safely out of the evacuation zone," we asked them how they would do this. We utilized a closed ended question. This question has two problems: first it assumes that the fireman would be able to get through on the telephone and actually talk with their family members, second it does not allow the fireman a chance to express in their own words what they would do. The current survey asked each fireman who said that he or she would first make sure that their family was safe (note that we did not say here "safely out of the evacuation zone" as we did in the first survey), how they would make sure that various members of their family were safe. We also asked the firemen what they would do if they could not reach their family members on the telephone. Whereas the first survey used two questions to assess what the fireman would do, the current survey used a series of seventeen primarily open ended questions to make the same assessment. It is probable that the first survey underestimated the proportion of firemen who would engage in behaviors making it difficult or impossible to report promptly to the fire station.

The second likely reason for the change is the greater concern over Shoreham in the Long Island community. As we pointed out above, concern with and opposition to Shoreham has significantly increased between 1982 and the time the current

(footnote continued)

Q. Please explain why the results of the firemen surveys are relevant to the issue of how school bus drivers would respond during Shoreham emergency.

A. In ALAB-832, the Appeal Board recognized the relevance of the fireman surveys conducted by Professor Cole, stating:

> Stated in its simplest form, if a trained professional emergency worker such as a fireman would put family obligations ahead of the discharge of any Shoreham emergency duties that might be assigned to him or her, it is a fair inference that an individual not in such a line of endeavor would encounter at least as great role conflict. It is thus unsurprising that, in the consideration of emergency planning in Zimmer, we found that surveys of volunteer life squadsmen and firemen concerning the role conflict they would encounter raised "a serious question as to whether bus drivers could be depended upon to carry out their responsibilities" in the event of an accident at that plant. We further determined there that those surveys precluded, on the evidence of record, a finding that the school bus drivers would respond promptly.

ALAB-832, 23 NRC 135, 153-154 (1986).

(footnote continued from previous page)
survey was conducted in March of 1988. This change has resulted from extended public debates about the Shoreham plant (Shoreham has been a major issue in most Long Island elections over the last several years), the continued opposition to the opening of Shoreham by Suffolk County, New York State, and other local governments, and probably most importantly, the accident at Chernobyl in the Soviet Union. It must be remembered that role conflict is created because emergency workers believe that a serious accident at Shoreham endangers the health and even perhaps the lives of themselves and their family members. The more emergency workers and their families who believe that an accident at Shoreham would expose them to life threatening and health threatening risks, the more the workers will experience role conflict.

Volunteer firemen are trained and experienced emergency workers who have volunteered to deal with life threatening emergencies (fires). They have also received substantial training in how to deal with fires. Nevertheless, 60 percent of the volunteer firemen responding to the most recent survey conducted by Professor Cole have indicated that they would not report for duty in a timely manner.

School bus drivers do not have the experience, training, or commitment of firemen in dealing with life-threatening emergencies. Thus, it is likely that, consistent with the results of the 1982 school bus driver survey, substantially more than 60 percent of the school bus drivers would look first to the needs of their family and that only a small fraction could be counted upon to report on time to drive school buses as contemplated under the LILCO Plan.

Q. Are the survey data obtained by Professor Cole useful in predicting the actual behavior of school bus drivers in an emergency at Shoreham?

A. In general, surveys provide useful information on how people will behave in an emergency. The actual behavior of any particular individual in an actual emergency would, of course, be influenced by the specific conditions existing at the time of the

emergency and his or her perceptions of those conditions. For this reason, we use these surveys not to predict what particular school bus drivers will do or the exact proportion of drivers who will resolve role conflict by looking after the needs of their families, but rather to estimate the approximate extent to which role conflict will present a problem in implementing the LILCO Plan.36/

Q. LILCO has also conducted a survey which purports to investigate how bus drivers have responded in past disasters. Can you comment on the validity of that survey?

36/ (Cole) In addition, in evaluating the extent to which the school bus driver survey we conducted accurately predicts the behavior of school bus drivers in a real emergency, we must consider that, although anonymous, the 1982 school bus driver questionnaires were filled out in a work setting at which the bus drivers' supervisors were present. Interviews with some bus drivers after completion of the questionnaire indicated that they were apprehensive about saying that they would not report to drive the bus. Several expressed fear that if it became known that they would not report to work during an emergency, they would lose their jobs.

(All) Given this setting, which emphasized the importance of work and the fear that some drivers may have felt about saying that they would not report for work during a radiological emergency, it is possible that the results obtained from this survey underestimate the proportion of bus drivers who would look after the needs of their family rather than report to drive a school bus during a radiological emergency. At any rate, we feel confident that the survey did not overestimate the potential for role conflict. Moreover, as noted, we believe these 1982 data are still valid, as evidenced by the more recent surveys and by the bus driver statements mentioned above.

A. (Cole) Yes, although LILCO only provided the final completed questionnaires of its survey to us a few day before this testimony was due. Based on my preliminary review of the completed survey instruments, and a report prepared by LILCO's witness, Mr. Kelly, I believe that this research is completely irrelevant for understanding how Shoreham school bus drivers will behave in a radiological emergency.

This is because in none of the 16 emergencies studied by LILCO did a significant number of bus drivers face any type of role conflict. First, in almost all of the emergencies analyzed by LILCO, the families of the bus drivers utilized were not located within the area of danger.37/ Accordingly, the questionnaires reveal that in most of the cases, the bus drivers did not perceive that their families were in any danger. Likewise, in some of the emergencies the danger had passed prior to the time when the bus drivers were asked to participate and there was no danger at all to their family members.38/

These facts demonstrate a basic misunderstanding of role conflict on the part of LILCO. The question is not simply whether bus drivers will drive buses, but whether they will do so

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37/ Indeed, in some of the questionnaires, the respondents suggested that bus drivers were not called to duty whose families were in the impact zone.

38/ In addition, in many of the emergencies studied, the disaster agent (e.g., flood or hurricane) was familiar to the bus drivers, visible, and unlikely to create the kind of anxiety that would be created by invisible radiation.

when they perceive that their families or other dependents are threatened by the disaster agent. It would not be surprising if LILCO draws the conclusion from its survey that some bus drivers drove buses in past emergencies. It would be very surprising, however, if LILCO's witnesses concluded that the survey sheds any light on the issue at hand -- role conflict in the event of a radiological emergency at Shoreham.39/

39/ It is possible to show for each of the 16 emergencies why the information collected has little or no relevance to determining how Shoreham school bus drivers will behave in a radiological emergency. For the sake of brevity, we will analyze only one.

The questionnaire on the top of the pile sent to us by LILCO concerned the Springfield, Massachusetts gas leak. First, it is important to note that the area that had to be evacuated was identified by the respondent as being "over one-half mile." Presumably, this means less than one square mile. Given the relatively small area of evacuation, it is probable that few, if any, of the 33 bus drivers had family members within the evacuation zone. Indeed, in Question 37, the respondent said that he did not know if any bus drivers had families in the area at risk during the emergency. Thus, there is no evidence that any of the bus drivers experienced role conflict. A question on how many drivers volunteered to drive the buses is also completely irrelevant because it does not tell us if any of these people had family members in the evacuation zone or if they perceived that they, themselves, would be in danger by participating in the evacuation. According to Question 33, the bus drivers did not think that they were in danger during the time when they were driving buses in the evacuation zone. This is totally the opposite of the situation which Shoreham school bus drivers would experience. If the bus drivers did not think that they would be in danger by driving into the evacuation zone, they certainly would not have perceived their family members, who were outside of the evacuation zone, as being in danger.

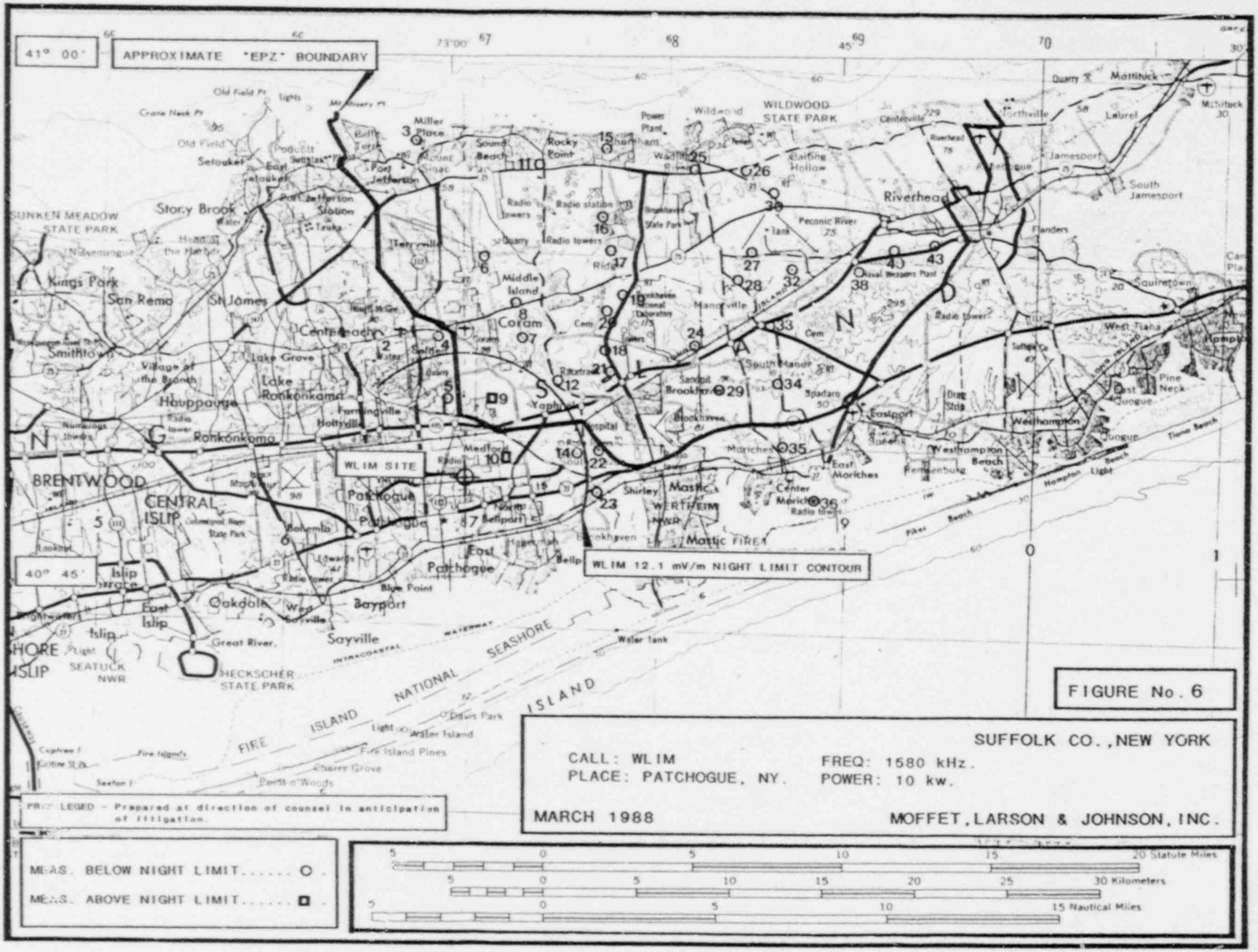
It is particularly interesting to note the response to Question 35 in which we are told that the bus drivers did not go into the "hot spot" which was "cordoned" off. Thus, the drivers themselves were never exposed to any hazard. And we are told that school children who were at risk in the "hot spot" were told to walk about one-quarter of a mile through the hazardous zone to the busses, which were outside of the hazardous zone. This is a situation which is unlike that contemplated by LILCO and which

(footnote continued)

Q. Does this conclude your testimony?

A. Yes.

(footnote continued from previous page)
would be totally intolerable at Shoreham. It raises the question of: Why weren't the bus drivers asked to drive directly to the school to pick up the children, thus substantially shortening their exposure to the hazard?


41° 00'
APPROXIMATE "EPZ" BOUNDARY
40° 45'
WLIM SITE
WLIM 12.1 mV/m NIGHT LIMIT CONTOUR
MEAS. BELOW NIGHT LIMIT..... ○
MEAS. ABOVE NIGHT LIMIT..... □
PRIVILEGED - Prepared at direction of counsel in anticipation of litigation.
FIGURE No. 6
SUFFOLK CO., NEW YORK
CALL: WLIM
PLACE: PATCHOGUE, NY.
FREQ: 1580 kHz.
POWER: 10 kw.
MARCH 1988
MOFFET, LARSON & JOHNSON, INC.
20 Statute Miles
30 Kilometers
15 Nautical Miles

ENGINEERING REPORT

MOFFET, LARSON & JOHNSON, INC.

5203 LEESBURG PIKE CONSULTING TELECOMMUNICATIONS ENGINEERS FALLS CHURCH VA 22041

PRIVILEGED - PREPARED AT THE DIRECTION
OF COUNSEL IN ANTICIPATION OF LITIGATION.

ENGINEERING STATEMENT REGARDING FIELD STRENGTH MEASUREMENTS OF RADIO STATIONS

WICC (AM)	BRIDGEPORT, CONNECTICUT
WELI (AM)	NEW HAVEN, CONNECTICUT
WGLI (AM)	BABYLON, NEW YORK
WLIM (AM)	PATCHOGUE, NEW YORK
WRHD (AM)	RIVERHEAD, NEW YORK
WRIV (AM)	RIVERHEAD, NEW YORK
WLNG (AM)	SAG HARBOR, NEW YORK

April, 1988

MOFFET, LARSON & JOHNSON, INC.

5203 LEESBURG PIKE CONSULTING TELECOMMUNICATIONS ENGINEERS FALLS CHURCH, VA 22041

AFFIDAVIT

COUNTY OF FAIRFAX)
) SS:
COMMONWEALTH OF VIRGINIA)

CHARLES G. PERRY, III, being duly sworn upon oath deposes and says:

That he has Bachelor's degree in Electrical Engineering from the University of Tennessee and that he is a registered professional engineer in the Commonwealth of Virginia;

That he is corporate treasurer of Moffet, Larson & Johnson, Inc., consulting telecommunications engineers;

That this firm has been retained by Suffolk County, New York to prepare this engineering statement;

That he has either prepared or directly supervised the preparation of all technical information contained herein, and that the facts stated in this engineering statement are true to the best of his knowledge, except as to such statements as are herein stated to be on information and belief, and as to such statements he believes them to be true.

Charles G. Perry, III

COMMONWEALTH OF VIRGINIA
CHARLES G. PERRY, III
No. 15347
PROFESSIONAL ENGINEER

Subscribed and sworn to before me this 6th day of April, 1988.

Joan G. Bubniak
Notary Public

JOAN G. BUBNIAK
NOTARY PUBLIC
COMMONWEALTH OF VIRGINIA

My Commission expires June 13, 1989.

MOFFET, LARSON & JOHNSON, INC.

5203 LEESBURG PIKE CONSULTING TELECOMMUNICATIONS ENGINEERS FALLS CHURCH, VA 22041

ENGINEERING STATEMENT REGARDING FIELD STRENGTH MEASUREMENTS OF RADIO STATIONS

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INTRODUCTION

This engineering report has been prepared on behalf of Suffolk County, New York, to provide the results of field tests conducted within the 10-mile Emergency Planning Zone ("EPZ") around the Shoreham Nuclear Power Station on Long Island, New York. The purpose of the field tests was to verify the signal level of the AM radio stations participating in an Emergency Broadcast System ("EBS") network proposed by the Long Island Lighting Company ("LILCO"), as owner of the Shoreham plant, in the event of a radiological emergency at Shoreham. The stations surveyed were the following:

WICC Bridgeport, Connecticut	600 kHz	1.0/0.5 kW	DA-2-U
WELI New Haven, Connecticut	960 kHz	5.0 kW	DA-N-U
WGLI Babylon, New York	1290 kHz	5.0/1.0 kW	DA--U
WLIM Patchogue, New York	1580 kHz	10.0 kW	ND-D
WRHD Riverhead, New York	1570 kHz	1.0 kW	DA-D
WRIV Riverhead, New York	1390 kHz	1.0 kW	ND-D
WLNG Sag Harbor, New York	1600 kHz	0.5 kW	ND-D

The measurements were made by Charles G. Perry, III and Jeffrey M. Bixby of Moffet, Larson & Johnson, Inc. during the week of March 14, 1988. Analysis of all the daytime field strength measurement data indicates that none of the stations surveyed provides any meaningful or reliable nighttime service within the EPZ, even if operated at their licensed daytime power levels. Indeed, in some cases the radio stations relied upon by LILCO fail to provide even meaningful or reliable daytime coverage to the EPZ.[1]

DISCUSSION

This report provides the results of field strength measurement tests conducted on the AM stations participating in LILCO's proposed EBS network for the Shoreham EPZ, and sets forth the conclusions that can be drawn based upon these test results regarding coverage of such stations with respect to the Shoreham EPZ. The points were initially selected by use of a 2 mile x 2 mile grid in the manner provided in

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[1] Due to the limited time made available for Moffet, Larson & Johnson to conduct field strength measurement tests of the radio stations participating in LILCO's proposed EBS, it was decided to focus upon the AM stations relied upon by LILCO; in particular, the extent to which these stations could be said to provide meaningful or reliable service to the Shoreham EPZ, especially at night. Measurements were also taken of WPLR(FM) at selected points. However, the data gathered concerning WPLR(FM) was insufficient to permit any conclusions regarding its coverage of the EPZ.

Section 73.314(c) of the Federal Communications Commission ("FCC") Rules. In addition, radials were established through the EPZ with respect to WICC, WELI and WLIM. All measurements were taken during daytime hours (specifically within the period from two hours after local sunrise to two hours before local sunset). This is in accordance with generally accepted or standard procedures, and serves to minimize the effects of skywave interference on the measurements. The measurements were made with a Potomac Instruments field intensity meter, type FIM-71 designed specifically for the purpose of such measurements. The meter, serial number 189, had a current calibration certificate at the time the data were taken. As a double check, immediately following the measurements, the instrument was returned to the manufacturer for an "incoming" calibration of three frequencies (600, 1290, 1600) over the range of the stations measured. The instrument was found to be well within the manufacturer's specification.

As noted above, the measurements were taken during daytime hours in accordance with FCC accepted practices and with generally accepted procedures. Although some of the measured stations do not operate at night, and others reduce their broadcast signal strength at night, the stations were presumed to be operating with their normal daytime facilities, since it is our understanding that LILCO has indicated that in the event of an emergency at Shoreham, these stations could operate

with their daytime facilities, in order to maximize coverage of the EPZ. Figures 1 through 7 are, for each station, reproductions of a map of the Long Island area showing the approximate boundaries of the EPZ, the theoretical nighttime coverage with respect to the EPZ (assuming the station was operating with daytime facilities), the station location (where possible), and the results of measurements taken in the area. While a complete discussion of the factors which determine the coverage of a radio station is beyond the scope of this report, a brief description of some of these factors follows.

RADIO STATION COVERAGE IN GENERAL

In very general terms, the coverage of any AM station is determined by three major factors: (1) the strength of the signal leaving the transmitter plant; (2) the propagation losses along the paths to prospective listeners; and (3) for each receiving location, the ability to override interference which might be present and the signal level needed to override it.

1. Strength of Signal

The strength of the signal leaving a transmitter is a function of the station's power, the efficiency of its antenna system, and, in the case of "directional" stations, the antenna's radiation pattern. Directional antenna system patterns are designed to comply with FCC rules regarding interference to other stations and coverage of the community of license.

In nearly all cases, a directional station's coverage will be greater in certain directions than in others. Typical of this is radio station WRHD in Riverhead, New York. WRHD is located on the southeast side of Riverhead near the Peconic River and operates with 1000 watts of power. The station's radiation pattern is such that its equivalent power toward the southeast (125°) is 2400 watts, while toward the west (265°)--the direction of the EPZ--it operates with the equivalent of only approximately 80 watts.

2. Propagation Losses

Losses along the path to potential listeners are affected primarily by distance, frequency, and the ability of the earth to "conduct" the signal, a factor called "conductivity." Under conditions of "perfect" conductivity, signal strength varies inversely with distance, that is, each time the distance is doubled, the signal strength (measured in terms of voltage) is reduced by half. However, conditions approaching "perfect" conductivity are generally seen only over sea water paths, and even there only for distances less than about 100 miles. Sea water has an estimated conductivity of 5000 mS/m, while the land areas of Long Island have an FCC estimated conductivity of 0.5 mS/m. The effect of this is to rapidly attenuate the signal over such land areas. If one considers a radio station operating with a power of approximately 250 watts on a frequency of 1000 kHz, a listener located 10 miles away

might receive a signal strength of 10 mV/m if the intervening path were sea water, and only 0.55 mV/m if the path were over a land mass like Long Island, a ratio of 18:1. As a result, while radio stations WICC and WELI (both located in Connecticut) can be heard on the north shore of Long Island, their received signal levels diminish rapidly as one moves away from the north shore.

It should be noted that estimated conductivity is taken from an FCC map called Figure M-3, which shows estimated conductivities for the United States. It is our experience that these values generally overstate the conductivity, that is, the actual value is generally somewhat lower than shown. There are also variations in conductivity which tend to reduce coverage in warmer weather.

Finally, losses along the propagation path are less for the lower AM frequencies than for the higher ones. For this reason, a 250 watt radio station operating on 550 kHz in an area like Long Island (conductivity 0.5 mS/m) might have a signal strength of 1.4 mV/m at a distance of 10 miles, while one operating at 1600 kHz under otherwise similar conditions might only have 0.31 mV/m, a ratio of 4.5:1.

3. Interference

The third factor in the ability of a radio station to serve an area is the interference it must overcome at any prospective listener's location. Sources of such interference include man-made noise (power

lines, electric appliances, automotive ignition systems), atmospheric noise (static), and interfering signals from other radio stations. During the day, man-made noise and, in some cases, signals from nearby radio stations are the primary interference sources. Pursuant to 47 CFR 73.182(e), under daytime conditions, a signal level of 0.5 mV/m is generally sufficient to provide service. However, in more densely populated areas it may require considerably more signal to overcome man-made noise. Again, as a guideline, the FCC assumes that a signal of 2 mV/m or greater is required to serve a community with a population of 2,500 or more.

At night, however, signals from radio stations at great distances often create very high levels of interference. To account for these levels, the term "night interference-free limit" or "night limit" is generally used to refer to the received signal strength required to overcome all the distant interfering signals and provide a "listenable" signal. This night limit is generally much higher than the levels required for daytime service. For example, radio station WRHD in Riverhead has a night limit of 50 mV/m, meaning that its useful coverage is limited to areas which receive 50 mV/m or more from the station. By contrast, during the day, the station provides service consistent with the FCC Rules to those receiving 0.5 mV/m.

RADIO STATIONS WICC AND WELI

WICC is located in Bridgeport, Connecticut. It operates with a daytime power of 1000 watts on 600 kHz and uses a directional antenna both day and night. WICC's night limit, calculated in accordance with FCC procedures, is 4.6 mV/m.

WELI is located in New Haven, Connecticut. It operates with a power of 5000 watts day and night on 960 kHz. WELI uses a non-directional antenna for its daytime operation and a directional antenna at night. WELI's night limit, calculated as above, is 3.7 mV/m.

The results of daytime measurements and projections of the night limit contour of WICC are shown on Figure 1 of this report, and those of WELI on Figure 2. As a result of the sea water path over the Long Island Sound, the stations can be heard on the north shore of the EPZ, but "fade" rapidly going inland. Thus, the signal from WICC's daytime operation exceeded the night limit at three points, all along the north shore of the island. The signal from WELI exceeded its night limit at only two points, also along the north shore.[2]

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[2]Taking into account WELI's increased radiation toward the EPZ from its nighttime operation, however, we would expect that point 11 would also receive service. Thus, of 33 points measured, 3 might exceed the night limit for WELI.

RADIO STATIONS WRHD AND WRIV

These stations are located in Riverhead, New York, at the extreme eastern edge of the EPZ. WRIV operates on 1390 kHz daytime with 1000 watts, and a non-directional antenna. WRHD operates on 1570 kHz, with 1000 watts daytime, and a directional antenna. The WRHD night limit is 50 mV/m, while the WRIV limit is 35 mV/m. WRHD's coverage of the EPZ is further hampered by its directional pattern, which concentrates its energy toward the southeast (away from the EPZ), and by its high frequency.

Figures 4 and 5 show the results of the measurements taken on these two stations and projections of the night limit contour. Based upon these measurements, we do not believe WRHD covers the EPZ at all, and believe that WRIV provides only extremely limited coverage.

RADIO STATION WLNG

WLNG is located in Sag Harbor, New York, and operates on 1600 kHz, with 500 watts daytime, and a non-directional antenna. The WLNG night limit is 15.2 mV/m. Figure 7 depicts the measurements taken on WLNG and projections of the night limit contour.

As can be seen from Figure 7, at no point did the WLNG signal even approach the levels required for nighttime service. In fact, it was only at point 43 that the signal level reached 0.5 mV/m (the level required for daytime service), and even at that point, there was interference. It therefore can be concluded that WLNG fails to provide meaningful or reliable coverage of the EPZ either day or night.

RADIO STATION WGLI

Radio station WGLI is located in Babylon, New York, and operates on 1290 kHz, with 5000 watts and a directional antenna during daytime hours. The station's night limit is 8.3 mV/m.

Figure 3 shows the results of the WGLI measurements with respect to the station's night limit. In fact, none of the measurements taken on WGLI even approached the 0.5 mV/m level required to provide daytime service. Based upon these measurements, we do not believe that WGLI provides meaningful or reliable day or night service to the EPZ.

RADIO STATION WLIM

Radio station WLIM, Patchogue operates on 1580 kHz with 10,000 watts daytime, using a non-directional antenna. The station has a night limit of 12.1 mV/m. For the purpose of this report, we have calculated the night limit based on the station's non-directional operation, since its coverage of the EPZ is most favorable to the LILCO when viewed in that light.

At points 9 and 10, the measured signal from WLIM exceeded the night limit; however, only point 9 is within the EPZ. At all other points, the signal was below the station's night limit. WLIM's coverage of the EPZ is hampered by a number of factors, primarily its high frequency. However, toward the eastern portion of the zone, it also experiences adjacent channel interference from WRHD in Riverhead.

While WLIM provides daytime service to significant portions of the EPZ, this firm concludes that it does not provide meaningful or reliable service to the EPZ at night.

CONCLUSION

Figure 8 of this report is a composite map showing the areas of the EPZ which receive even limited predicted nighttime service from one or more of the AM stations participating in LILCO's proposed EBS network. The shaded area of the EPZ represents the area which does not receive meaningful or reliable nighttime service from any of the AM stations. As can be seen from Figure 8, and the attached tables which reflect measurement point data, stations WICC and WELI, and, to a limited extent, WLIM and WRIV, provide minimal nighttime coverage of the EPZ. The other three stations--WRHD, WLNG and WGLI--fail to provide any meaningful or reliable nighttime service within the EPZ.

MOFFET, LARSON & JOHNSON, INC.

5203 LEESBURG PIKE CONSULTING TELECOMMUNICATIONS ENGINEERS FALLS CHURCH VA 22041

TABLE 1 - COMPARISON OF MEASURED FIELD INTENSITY TO NIGHT LIMIT FOR WJCC (600 kHz)

Point Number	Night Limit (mV/m)	Measured Field Intensity (mV/m)	Ratio of Measured Field Intensity to Night Limit	Night Limit Met
2	4.6	3.65	0.79	No
3	4.6	10.00	2.17	Yes
4	4.6	2.05	0.45	No
5	4.6	0.95	0.21	No
6	4.6	2.81	0.61	No
8	4.6	2.45	0.53	No
9	4.6	1.38	0.30	No
10	4.6	1.85	0.40	No
11	4.6	5.20	1.13	Yes
12	4.6	1.25	0.27	No
13	4.6	1.25	0.27	No
14	4.6	1.16	0.25	No
15	4.6	7.50	1.63	Yes
16	4.6	2.20	0.48	No
17	4.6	2.10	0.46	No
19	4.6	1.85	0.40	No
20	4.6	1.50	0.33	No
21	4.6	1.78	0.39	No
22	4.6	1.31	0.28	No
23	4.6	0.50	0.11	No
24	4.6	1.20	0.26	No
26	4.6	3.00	0.65	No
27	4.6	1.79	0.39	No
28	4.6	2.00	0.43	No
29	4.6	1.05	0.23	No
30	4.6	2.00	0.43	No
31	4.6	1.60	0.35	No
32	4.6	1.40	0.30	No
32	4.6	2.00	0.43	No
33	4.6	1.60	0.35	No
34	4.6	1.40	0.30	No
35	4.6	1.00	0.22	No
36	4.6	1.00	0.22	No
38	4.6	2.70	0.59	No
40	4.6	1.40	0.30	No
43	4.6	1.75	0.38	No
44	4.6	1.55	0.34	No

MOFFET, LARSON & JOHNSON, INC.
5203 LEESBURG PIKE CONSULTING TELECOMMUNICATIONS ENGINEERS FALLS CHURCH, VA 2204

TABLE 2 - COMPARISON OF MEASURED FIELD INTENSITY TO NIGHT LIMIT FOR WELI (960 kHz)

Point Number	Night Limit (mV/m)	Measured Field Intensity (mV/m)	Ratio of Measured Field Intensity to Night Limit	Night Limit Met
2	3.7	1.05	0.28	No
3	3.7	4.50	1.22	Yes
4	3.7	0.88	0.24	No
5	3.7	0.35	0.10	No
6	3.7	1.00	0.27	No
8	3.7	0.52	0.14	No
9	3.7	0.55	0.15	No
10	3.7	0.60	0.16	No
11	3.7	2.33	0.63	No
12	3.7	0.60	0.16	No
13	3.7	0.60	0.16	No
14	3.7	0.78	0.21	No
15	3.7	4.20	1.14	Yes
16	3.7	1.09	0.29	No
17	3.7	1.30	0.35	No
19	3.7	1.30	0.35	No
20	3.7	1.00	0.27	No
21	3.7	0.67	0.18	No
22	3.7	0.72	0.19	No
23	3.7	0.56	0.15	No
24	3.7	0.96	0.26	No
26	3.7	1.68	0.45	No
27	3.7	1.05	0.28	No
28	3.7	1.30	0.35	No
29	3.7	0.80	0.22	No
32	3.7	1.15	0.31	No
33	3.7	1.00	0.27	No
34	3.7	0.72	0.19	No
35	3.7	0.55	0.15	No
36	3.7	0.70	0.19	No
40	3.7	1.25	0.34	No
43	3.7	1.30	0.35	No
44	3.7	1.00	0.27	No

MOFFET, LARSON & JOHNSON, INC.
5203 LEESBURG PIKE CONSULTING TELECOMMUNICATIONS ENGINEERS FALLS CHURCH VA 2204

TABLE 3 - COMPARISON OF MEASURED FIELD INTENSITY TO NIGHT LIMIT FOR WGLI (1290 kHz)

Point Number	Night Limit (mV/m)	Measured Field Intensity (mV/m)	Ratio of Measured Field Intensity to Night Limit	Night Limit Met
1	8.3	0.1	0.00	No
4	8.3	0.12	0.01	No
9	8.3	0.13	0.02	No
16	8.3	inaud	0.00	No
17	8.3	0.1	0.00	No
19	8..	inaud	0.00	No
20	8.3	0.1	0.00	No
21	8.3	0.1	0.00	No
28	8.3	inaud	0.00	No
32	8.3	inaud	0.00	No
38	8.3	inaud	0.00	No
40	8.3	inaud	0.00	No
43	8.3	inaud	0.00	No

MOFFET, LARSON & JOHNSON, INC.
5203 LEESBURG PIKE CONSULTING TELECOMMUNICATIONS ENGINEERS FALLS CHURCH VA 22041

TABLE 4 - COMPARISON OF MEASURED FIELD INTENSITY TO NIGHT LIMIT FOR WRIV (1390 kHz)

Point Number	Night Limit (mV/m)	Measured Field Intensity (mV/m)	Ratio of Measured Field Intensity to Night Limit	Night Limit Met
10	35	0.25	0.01	No
15	35	0.43	0.01	No
16	35	0.21	0.01	No
17	35	0.43	0.01	No
19	35	0.35	0.01	No
20	35	0.36	0.01	No
21	35	0.25	0.01	No
25	35	0.60	0.02	No
28	35	1.38	0.04	No
30	35	0.85	0.02	No
31	35	1.10	0.03	No
32	35	1.80	0.05	No
37	35	4.00	0.11	No
38	35	7.20	0.21	No
39	35	13.00	0.37	No
40	35	10.00	0.29	No
41	35	49.50	1.41	Yes
43	35	35.00	1.00	Yes
45	35	110.00	3.14	Yes
46	35	190.00	5.43	Yes

MOFFET, LARSON & JOHNSON, INC.
5203 LEESBURG PIKE CONSULTING TELECOMMUNICATIONS ENGINEERS FALLS CHURCH, VA 22041

TABLE 5 - COMPARISON OF MEASURED FIELD INTENSITY TO NIGHT LIMIT FOR WRHD (1570 kHz)

Point Number	Night Limit (mV/m)	Measured Field Intensity (mV/m)	Ratio of Measured Field Intensity to Night Limit	Night Limit Met
15	50.8	0.10	0.00	No
16	50.8	inaud	0.00	No
17	50.8	0.10	0.00	No
19	50.8	inaud	0.00	No
20	50.8	inaud	0.00	No
21	50.8	0.10	0.00	No
25	50.8	0.17	0.00	No
28	50.8	0.22	0.00	No
30	50.8	0.20	0.00	No
31	50.8	0.27	0.01	No
32	50.8	0.26	0.01	No
37	50.8	0.80	0.02	No
38	50.8	1.00	0.02	No
39	50.8	3.20	0.06	No
40	50.8	1.60	0.03	No
41	50.8	10.00	0.20	No
43	50.8	7.50	0.15	No
45	50.8	23.00	0.45	No
46	50.8	40.00	0.79	No

TABLE 6 - COMPARISON OF MEASURED FIELD INTENSITY TO NIGHT LIMIT FOR WLIM (1580 kHz)

Point Number	Night Limit (mV/m)	Measured Field Intensity (mV/m)	Ratio of Measured Field Intensity to Night Limit	Night Limit Met
2	12.1	4.70	0.39	No
3	12.1	1.05	0.09	No
4	12.1	7.00	0.58	No
5	12.1	10.50	0.87	No
6	12.1	1.71	0.14	No
7	12.1	2.20	0.18	No
8	12.1	4.35	0.36	No
9	12.1	13.00	1.07	Yes
10	12.1	48.00	3.97	Yes
11	12.1	1.10	0.09	No
12	12.1	5.30	0.44	No
13	12.1	5.30	0.44	No
14	12.1	8.50	0.70	No
15	12.1	0.90	0.07	No
16	12.1	0.45	0.04	No
17	12.1	1.00	0.08	No
18	12.1	1.70	0.14	No
19	12.1	1.80	0.11	No
20	12.1	1.60	0.13	No
21	12.1	1.58	0.13	No
22	12.1	5.40	0.45	No
23	12.1	0.62	0.51	No
24	12.1	1.22	0.10	No
25	12.1	0.45	0.04	No
26	12.1	2.20	0.02	No
27	12.1	0.56	0.05	No
28	12.1	1.00	0.08	No
29	12.1	0.80	0.07	No
30	12.1	0.30	0.02	No
32	12.1	1.00	0.08	No
33	12.1	1.00	0.08	No
34	12.1	0.65	0.05	No
35	12.1	0.80	0.07	No
36	12.1	1.50	0.12	No
38	12.1	0.30	0.02	No
40	12.1	0.37	0.03	No
43	12.1	0.30	0.02	No

MOFFET, LARSON & JOHNSON, INC.
5203 LEESBURG PIKE CONSULTING TELECOMMUNICATIONS ENGINEERS FALLS CHURCH VA 22041

TABLE 7 - COMPARISON OF MEASURED FIELD INTENSITY TO NIGHT LIMIT FOR WLNG (1600 kHz)

Point Number	Night Limit (mV/m)	Measured Field Intensity (mV/m)	Ratio of Measured Field Intensity to Night Limit	Night Limit Met.
15	15.2	0.15	0.01	No
16	15.2	0.10	0.00	No
17	15.2	0.10	0.00	No
19	15.2	inaud	0.00	No
20	15.2	0.10	0.00	No
21	15.2	0.10	0.00	No
25	15.2	0.17	0.01	No
28	15.2	0.10	0.00	No
30	15.2	0.11	0.01	No
31	15.2	0.11	0.01	No
32	15.2	0.13	0.01	No
37	15.2	0.10	0.01	No
38	15.2	0.25	0.02	No
39	15.2	0.17	0.01	No
40	15.2	0.30	0.02	No
41	15.2	0.34	0.02	No
43	15.2	0.50	0.03	No
45	15.2	0.45	0.03	No

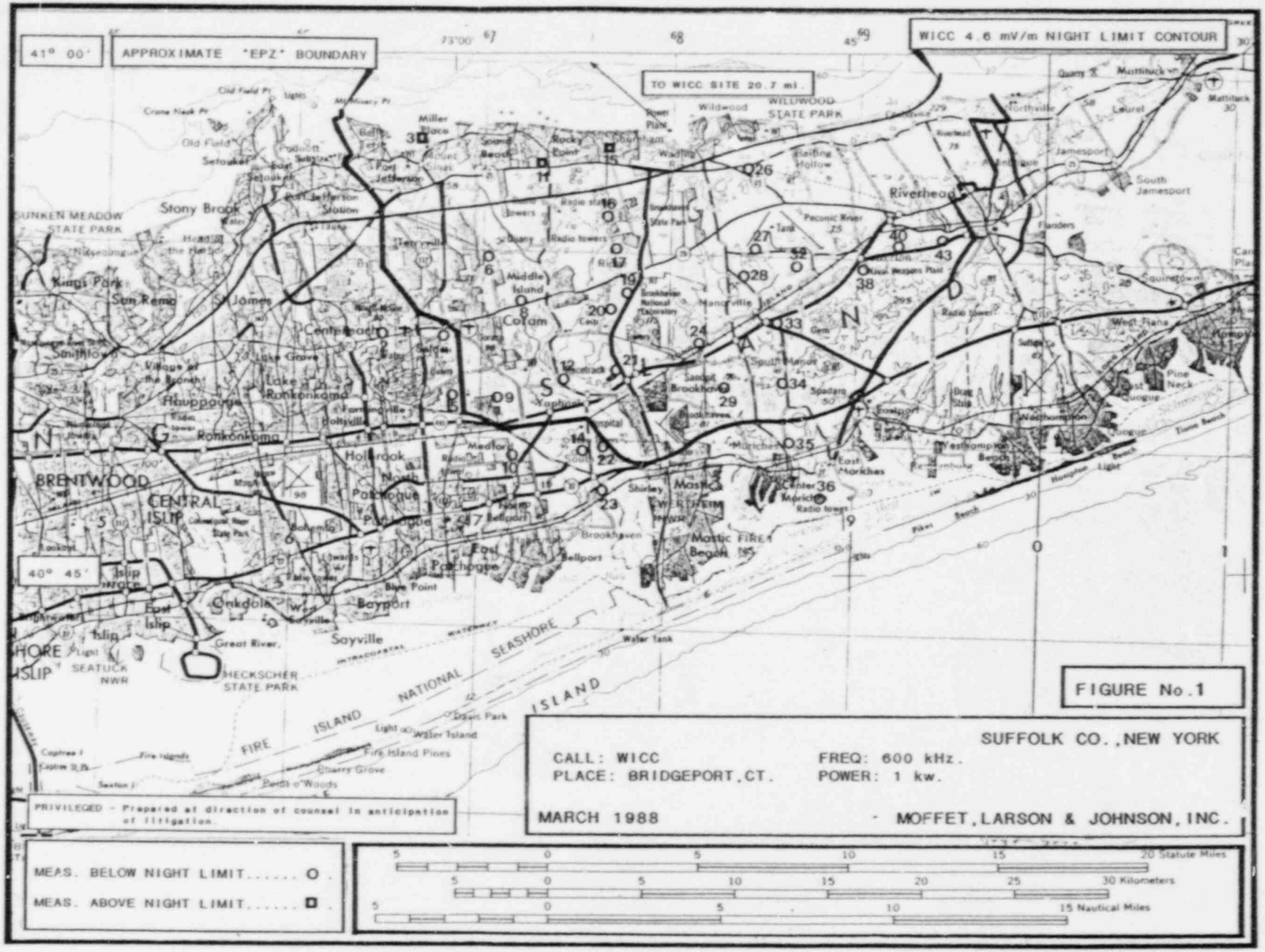
TABLE 8 - COMPARISON OF MEASURED FIELD INTENSITY TO NIGHT LIMIT FOR ALL AM STATIONS

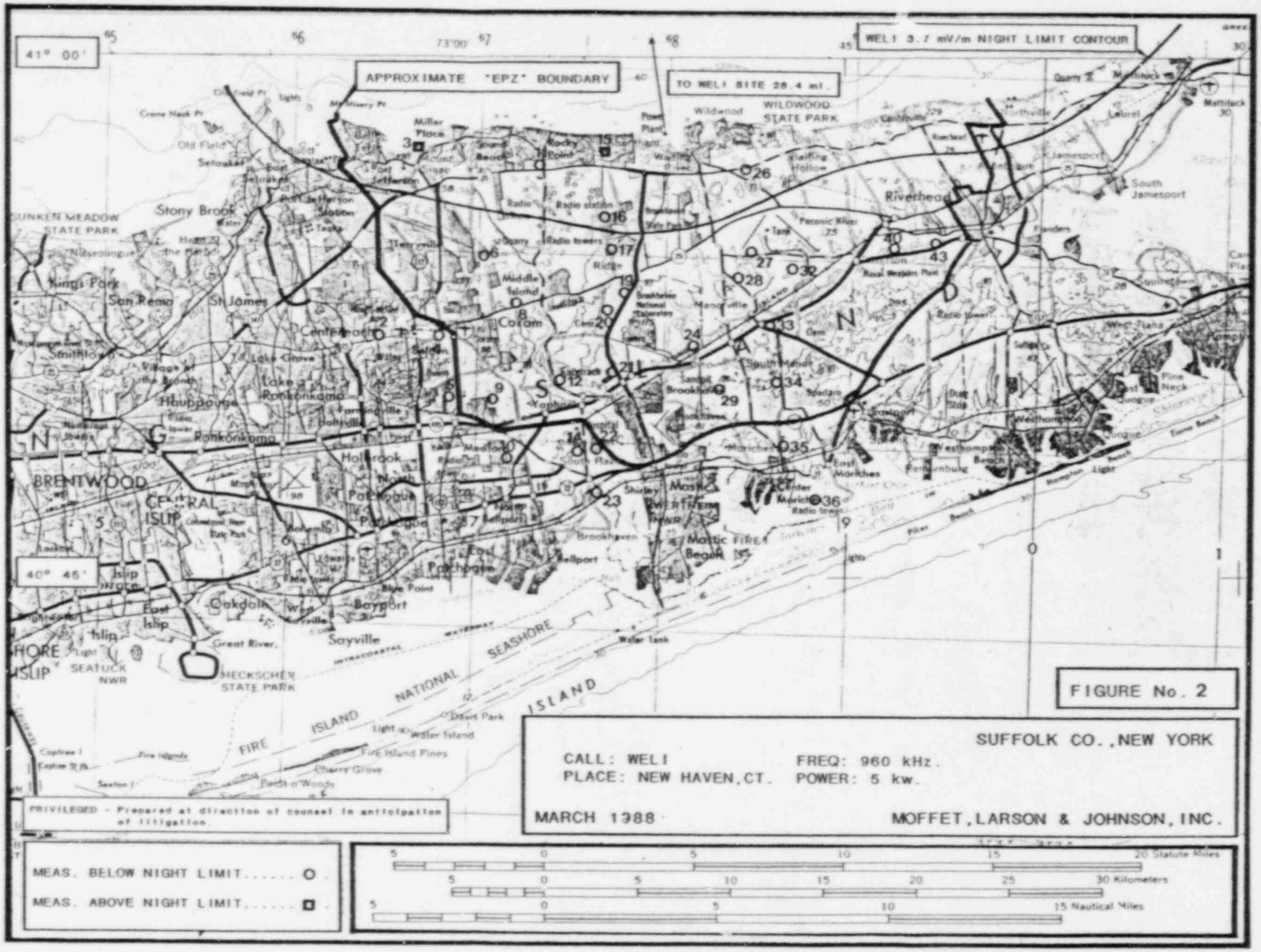
Point Number	(AM) WICC 600 (Night Limit) 4.60	(AM) WELI 960 3.70	(AM) WGLI 1290 8.30	(AM) WRIV 1390 35.00	(AM) WRHD 1570 50.80	(AM) WLIM 1580 12.10	(AM) WLNG 1600 15.20
1			0.1				
2	3.65	1.05				4.70	
3	10.0+	4.50+				1.05	
4	2.05	0.88	0.12			7.00	
5	0.95	0.35				10.50	
6	2.81	1.00				1.71	
7						2.20	
8	2.45	0.52				4.35	
9	1.38	0.55	0.13			13.00+	
10	1.85	0.60		0.25*		48.00+	
11	5.20+	2.33				1.10	
12	1.25	0.60				5.30	
13	1.25	0.60				5.30	
14	1.16	0.78				8.50	
15	7.50+	4.20+		0.43*	0.10	0.90	0.15*
16	2.20	1.09	inaud	0.11	inaud	0.45	0.1
17	2.10	1.30	0.1	0.43	0.1	1.00	0.1
18						1.70	
19	1.85	1.30	inaud	0.35*	inaud	1.80	inaud
20	1.50	1.00	0.1	0.36	inaud	1.60	0.1
21	1.78	0.67	0.1	0.25	0.1	1.58	0.1
22	1.31	0.72				5.40	
23	0.50	0.56				0.62	
24	1.20	0.96				1.22	
25				0.60*	0.17	0.45	0.17
26	3.00	1.68				2.20	
27	1.79	1.05				0.56	
28	2.00	1.30	inaud	1.38	0.22*	1.00	0.1*
29	1.05	0.80				0.80	
30				0.85	0.20	0.30	0.11*
31				1.10	0.27		0.11
32	2.00	1.15	inaud	1.80	0.26*	1.00	0.13*
33	1.60	1.00				1.00	
34	1.40	0.72				0.65	
35	1.00	0.55				0.80	
36	1.00	0.70				1.50	

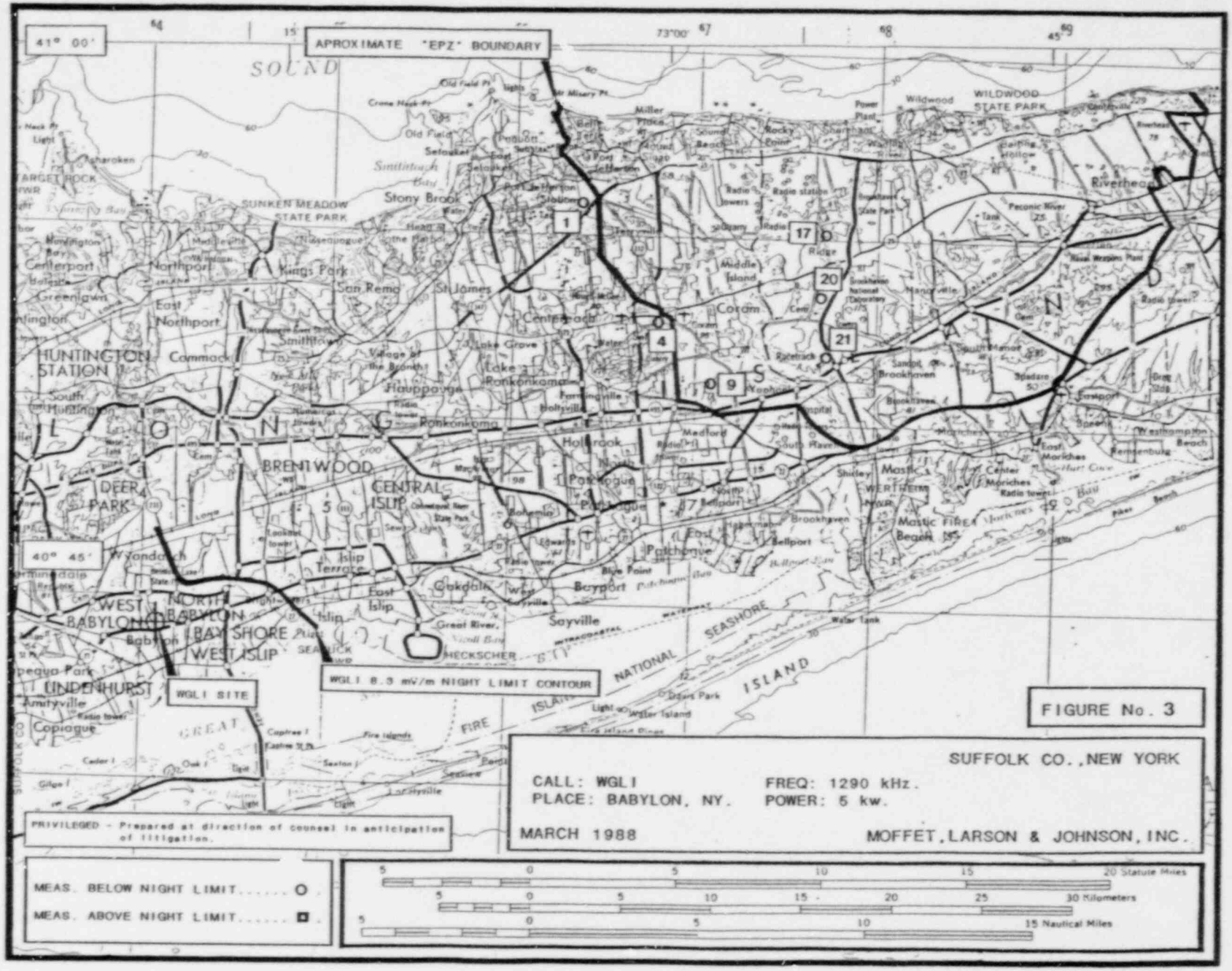
TABLE 8 - COMPARISON OF MEASURED FIELD INTENSITY TO NIGHT LIMIT FOR ALL AM STATIONS (Continued)

	(AM) WICC 600	(AM) WELI 960	(AM) WGLI 1290	(AM) WRIV 1390	(AM) WRHD 1570	(AM) WLIM 1580	(AM) WLNG 1600
37				4.00	0.80		0.10
38	2.70		inaud	7.20	1.00	0.30*	0.25*
39				13.00	3.20		0.17*
40	1.40	1.25	inaud	10.00	1.60	0.37*	0.30*
41				49.50+	10.00		0.34*
42							
43	1.75	1.30	inaud	35.00+	7.50	0.30	0.50*
44	1.55	1.00	NA	NA	NA		NA
45				110.00+	23.00		0.45
46				190.00+	40.00		

+ - Exceeds night limit
* - Interference present


41° 00'
APPROXIMATE "EPZ" BOUNDARY
WICC 4.6 mV/m NIGHT LIMIT CONTOUR
TO WICC SITE 20.7 mi.
40° 45'
PRIVILEGED - Prepared at direction of counsel in anticipation of litigation.
MEAS. BELOW NIGHT LIMIT..... O .
MEAS. ABOVE NIGHT LIMIT..... □ .
5 0 5 10 15 20 Statute Miles
5 0 5 10 15 20 25 30 Kilometers
5 0 5 10 15 Nautical Miles
FIGURE No.1
SUFFOLK CO., NEW YORK
CALL: WICC
PLACE: BRIDGEPORT, CT.
FREQ: 600 kHz.
POWER: 1 kw.
MARCH 1988
MOFFET, LARSON & JOHNSON, INC.


WELI 3.7 mV/m NIGHT LIMIT CONTOUR
APPROXIMATE "EPZ" BOUNDARY
TO WELI SITE 28.4 mi.
41° 00'
40° 45'
73°00'
WILDWOOD STATE PARK
SUNKEN MEADOW STATE PARK
Stony Brook
Kings Park
San Remo
St James
Centereach
Lake Grove
Lake Ronkonkoma
Hauppauge
Ronkonkoma
Holbrook
BRENTWOOD
CENTRAL ISLIP
Patchogue
East Patchogue
Bellport
Brookhaven
Oakdale
Bayport
Blue Point
East Islip
Islip
Sayville
Great River
SEATUCK NWR
HECKSCHER STATE PARK
FIRE ISLAND NATIONAL SEASHORE
FIRE ISLAND
Fire Island Pines
Cherry Grove
Point o' Woods
Water Island
Davis Park
Riverhead
Jamesport
South Jamesport
Mattituck
Laurel
Aquebogue
Manorville
Middle Island
Coram
Selden
Setauket
Miller Place
Rocky Point
Wading River
Calverton
Peconic River
Westhampton
Westhampton Beach
Quogue
Pine Neck
Water Tank
Radio towers
Radio station
Brookhaven National Laboratory
Suffolk Co.
Tank
MEAS. BELOW NIGHT LIMIT..... O
MEAS. ABOVE NIGHT LIMIT..... □
PRIVILEGED - Prepared at direction of counsel in anticipation of litigation.
FIGURE No. 2
SUFFOLK CO., NEW YORK
CALL: WELI
FREQ: 960 kHz.
PLACE: NEW HAVEN, CT.
POWER: 5 kw.
MARCH 1988
MOFFET, LARSON & JOHNSON, INC.
0 5 10 15 20 Statute Miles
0 5 10 15 20 25 30 Kilometers
0 5 10 15 Nautical Miles


APROXIMATE "EPZ" BOUNDARY
41° 00'
40° 45'
73°00'
WGLI SITE
WGLI 8.3 mV/m NIGHT LIMIT CONTOUR
PRIVILEGED - Prepared at direction of counsel in anticipation of litigation.
MEAS. BELOW NIGHT LIMIT..... O
MEAS. ABOVE NIGHT LIMIT..... ■
5 0 5 10 15 20 Statute Miles
5 0 5 10 15 20 25 30 Kilometers
5 0 5 10 15 Nautical Miles
FIGURE No. 3
SUFFOLK CO., NEW YORK
CALL: WGLI
PLACE: BABYLON, NY.
FREQ: 1290 kHz.
POWER: 5 kw.
MARCH 1988
MOFFET, LARSON & JOHNSON, INC.
SOUND
WILDWOOD STATE PARK
SUNKEN MEADOW STATE PARK
HUNTINGTON STATION
BRENTWOOD
CENTRAL ISLIP
DEER PARK
BABYLON
WEST BABYLON
NORTH BABYLON
BAY SHORE
WEST ISLIP
LINDENHURST
Amityville
Copiague
Islip
East Islip
Islip Terrace
Oakdale
Sayville
Bayport
Patchogue
Mastic
Mastic Beach
Shirley
Center Moriches
East Moriches
Westhampton Beach
Remsenburg
Riverhead
Wading River
Stony Brook
Smithtown
Kings Park
San Remo
St James
Centereach
Coram
Middle Island
Lake Grove
Lake Ronkonkoma
Ronkonkoma
Holbrook
Holtsville
Medford
Yaphank
Brookhaven
Northport
East Northport
Centerport
Greenlawn
Commack
Hauppauge
Wyandanch
Babylon
Great River
Fire Islands
NATIONAL SEASHORE
ISLAND
FIRE
GREAT
HECKSCHER

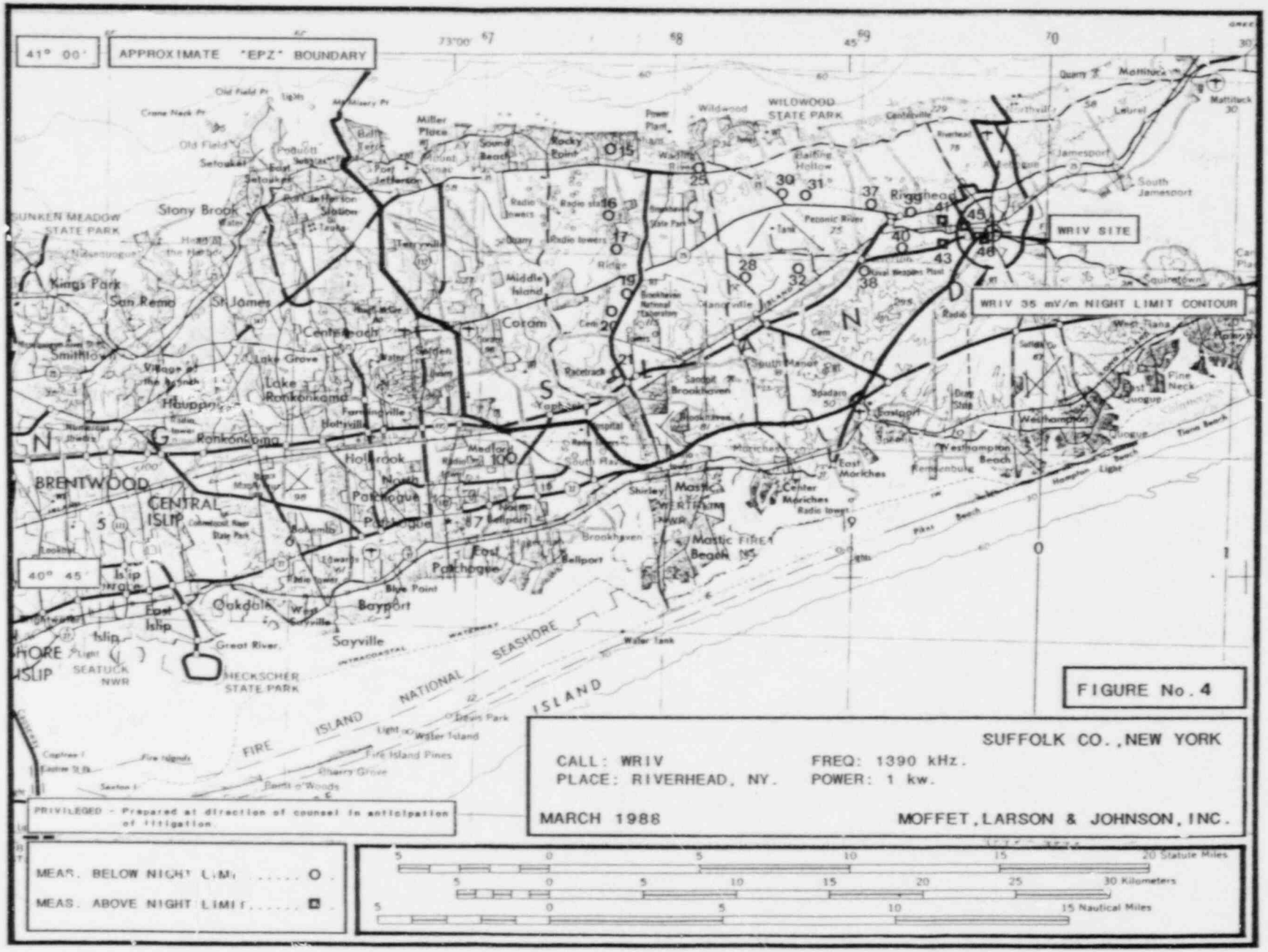


FIGURE No. 4

SUFFOLK CO., NEW YORK

CALL: WRIV FREQ: 1390 kHz.

PLACE: RIVERHEAD, NY. POWER: 1 kw.

MARCH 1988 MOFFET, LARSON & JOHNSON, INC.

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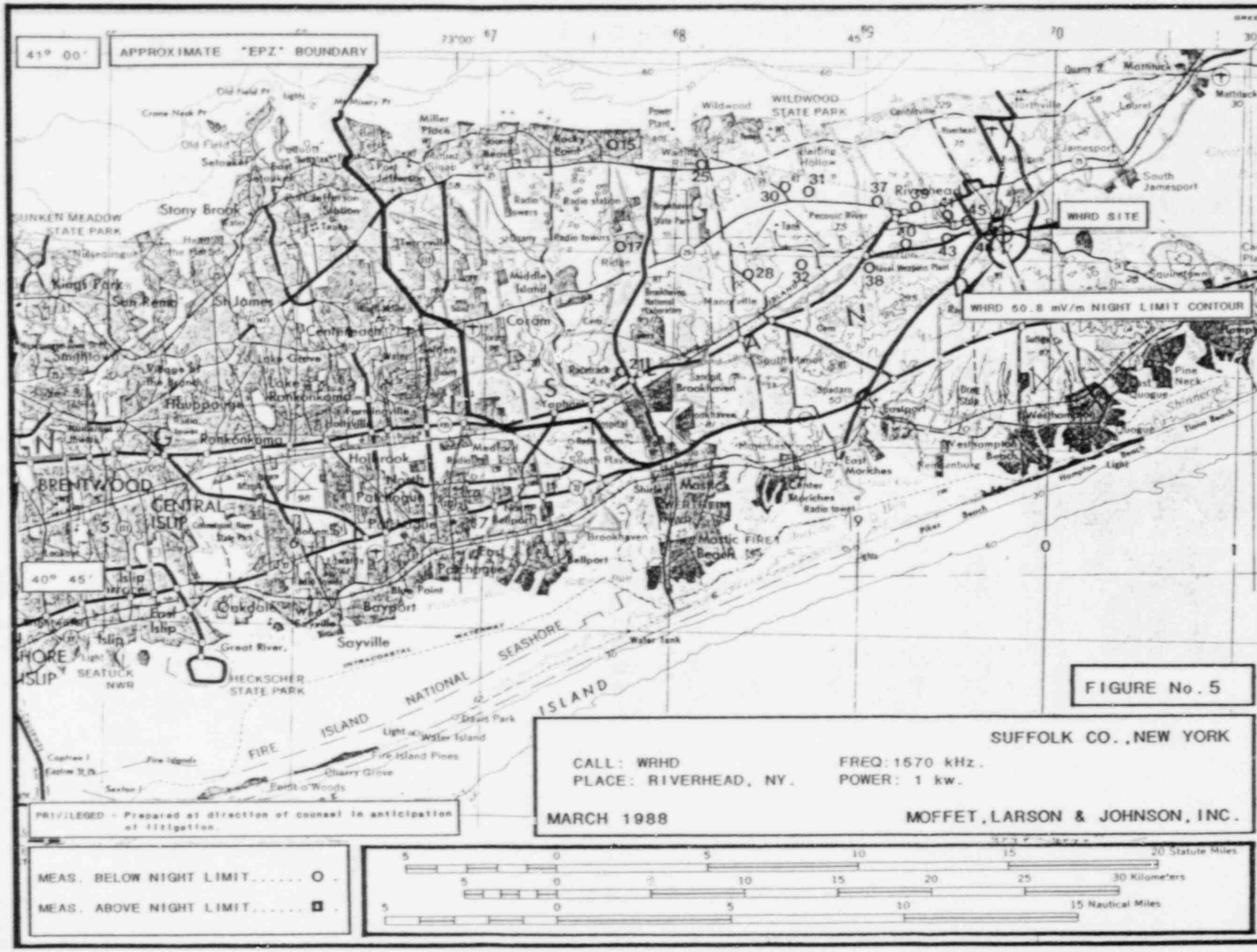
MEAS. BELOW NIGHT LIMIT ...... ○

MEAS. ABOVE NIGHT LIMIT...... ■


41° 00'
APPROXIMATE "EPZ" BOUNDARY
73°00'
67
68
45 69
70
WILDWOOD
STATE PARK
SUNKEN MEADOW
STATE PARK
Stony Brook
Kings Park
St James
Smithtown
Hauppauge
Ronkonkoma
Lake Ronkonkoma
Holbrook
BRENTWOOD
CENTRAL
ISLIP
North
Patchogue
Coram
Middle
Island
Riverhead
Mattituck
Jamesport
South
Jamesport
WHRD SITE
WHRD 50.8 mV/m NIGHT LIMIT CONTOUR
O15
25
30
31
37
O17
28
32
38
40
43
45
211
East
Moriches
Center
Moriches
Westhampton
Beach
Pine
Neck
Shinnecock
Mastic
Brookhaven
Bellport
Bayport
Sayville
Oakdale
Great River
East
Islip
40° 45'
SEATUCK
NWR
HECKSCHER
STATE PARK
FIRE ISLAND NATIONAL SEASHORE
FIRE ISLAND
Fire Island Pines
Cherry Grove
FIGURE No. 5
SUFFOLK CO., NEW YORK
CALL: WRHD
PLACE: RIVERHEAD, NY.
FREQ: 1570 kHz.
POWER: 1 kw.
MARCH 1988
MOFFET, LARSON & JOHNSON, INC.
PRIVILEGED - Prepared at direction of counsel in anticipation of litigation.
MEAS. BELOW NIGHT LIMIT...... O .
MEAS. ABOVE NIGHT LIMIT...... ◘ .
5 0 5 10 15 20 Statute Miles
5 0 5 10 15 20 25 30 Kilometers
5 0 5 10 15 Nautical Miles

ATTACHMENT 1

VITA

Stephen Cole

Birth Date:

June 1, 1941

Home Address:

23 Mt. Grey Road
Stony Brook, New York 11790
Phone: 516-751-6588

Office Address:

State University of New York at Stony Brook
Department of Sociology
Stony Brook, New York 11794
Phone: 516-632-7732

Education:

B.A., Columbia College, 1962
Ph.D., Columbia University, 1967

Academic Appointments:

1964	Lecturer, Barnard College
1965	Lecturer, Columbia University
1966-67	Instructor of Sociology, Columbia University
1966-76	Research Associate, Bureau of Applied Social Research, Columbia University
1967-68	Assistant Professor, Department of Sociology, Columbia University
1968-70	Assistant Professor, Department of Sociology, State University of New York at Stony Brook
1970-73	Associate Professor, Department of Sociology, State University of New York at Stony Brook
1973-Present	Professor, Department of Sociology, State University of New York at Stony Brook
1977-Present	Research Associate, Center for the Social Sciences, Columbia University
1987	Visiting Profesor, Institute of Sociology, University of Warsaw, Poland

Honorary Societies and Awards:

1962	Phi Beta Kappa, Magna Cum Laude, Columbia College
1962	Honorary Woodrow Wilson Fellow
1962-63	National Science Foundation Fellow
1963-66	National Institutes of Health, Public Health Service Fellow
1963	Bobbs-Merrill Award
1965-66	John W. Burgess Honorary Fellow of the Faculty of Political Science, Columbia University
1971-72	Ford Foundation Faculty Research Fellow
1976-Present	Sociological Research Association

Honorary Societies and Awards (continued...)

1978-79	Guggenheim Foundation Fellowship
1978-79	Fellow, Center for Advanced Study in the Behavioral Sciences, Stanford, California
1980	Presented annual paper at Sociological Research Association Dinner
1984-Present	SUNY Faculty Exchange Scholar

Professional Activities:

From 1966 to the present I have served as a consultant to the following organizations on various applied sociological research projects.

1966-68	Social Welfare Research Council, CUNY
1970-71	Center for Research on the Acts of Man, University of Pennsylvania
1973-1987	Newsday
1973-79	Committee on Science and Public Policy (COSPUP), National Academy of Sciences
1977	Brookhaven National Laboratories
1978	The Baltimore Sun
1979	National Bureau of Economic Research
1981	Long Island Lighting Company
1982	The Boston Globe
1982-83	University of California at Irvine
1984	State of California
1982-present	Suffolk County (New York)
1987	Commonwealth of Massachusetts

I have also served on the editorial boards of the following journals: Sociology of Education, Sociological Quarterly, American Journal of Sociology, The American Sociologist.

I have served as a referee for more than a dozen other journals, for the National Science Foundation, the National Institutes of Health, the National Institute of Education, as well as other public and private granting agencies.

Over the last fifteen years I have presented more than 40 invited lectures at professional conferences and educational institutions all over North America and in Europe.

Publications:

BOOKS

1969 The Unionization of Teachers: A Case Study of the UFT. New York: Praeger Press. (Reprinted by Arno Press, 1980).

1972 The Sociological Method, 1980, 3rd enlarged edition. New York: Harper and Row

1973 Social Stratification in Science (with Jonathan R. Cole). Chicago: The University of Chicago Press. (Paperback edition published in 1981).
Translated into Chinese by Gu Xin Light Daily Press 1988 (with a new introduction).

19.5 The Sociological Orientation. 1979 2nd enlarged edition. New York: Harper and Row

1978 Peer Review in the National Science Foundation: Phase I (with Jonathan R. Cole and Leonard Rubin). Washington, D.C.: National Academy of Sciences.

1981 Peer Review in the National Science Foundation: Phase II (with Jonathan R. Cole). Washington, D.C.: National Academy of Sciences.

1988 Social Influences on the Growth of Scientific Knowledge (with Jonathan R. Cole). Cambridge: Harvard University Press. (forthcoming)

PAPERS (an asterisk indicates a refereed journal)

1961 "The Charitable Impulse in Victorian England," King's Crown Essays 9, 3-28.

1964 "Inventory of Empirical and Theoretical Studies of Anomie" (with Harriet A. Zuckerman). In Marshall Clinard (Ed.), Anomie and Deviant Behavior. New York: Free Press, pp. 243-313.

* 1967 "Scientific Output and Recognition: A Study in the Operation of the Reward System in Science" (with Jonathan R. Cole), American Sociological Review 32, 377-390. Reprinted as a Bobbs-Merrill Reprint and as an XIP Publication.

PAPERS Continued....

* 1968 "Visibility and the Structural Bases of Awareness in Scientific Research" (with Jonathan R. Cole), American Sociological Review 33, 397-413.

* 1968 "The Unionization of Teachers: Determinants of Rank-and-File Support," Sociology of Education 41, 66-87. Reprinted in Donald A. Erickson (Ed.), Educational Organization and Administration. Berkeley: McCutchan Publishing Corporation, 1977.

* 1969 "Teacher's Strike: A Study of the Conversion of Predisposition into Action," American Journal of Sociology 74, 506-520. Reprinted as Warner Modular Publication R809. Reprinted in Donald Gerwin (Ed.), The Employment of Teachers, Some Analytical Views. Berkeley: McCutchan Publishing Corporation, 1974.

* 1969 "Determinants of Faculty Support of Student Demonstrations" (with Hannelore Adamsons), Sociology of Education 42, 315-329.

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* 1971 "Measuring the Quality of Sociological Papers" (with Jonathan R. Cole), American Sociologist 6, 23-29.

1972 "Continuity and Institutionalization in Science: A Case Study of Failure." In Anthony Oberschall (Ed.), The Establishment of Empirical Sociology. New York: Harper and Row, pp. 73-129. Reprinted in Wolf Lepennies (Ed.), Geschichte der Soziologie Suhrkamp Verlag (Frankfurt am Main), vol. 4, 31-110, 1981.

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* 1972 "The Ortega Hypothesis" (with Jonathan R. Cole), Science 178 (October), 368-375. Reprinted in Eire Gebhardt, Sociology of Science. New York: Seabury Press, 1980.

1975 "The Growth of Scientific Knowledge: Theories of Deviance as a Case Study." In Lewis Coser (Ed.), The Idea of Social Structure: Papers in Honor of Robert K. Merton. New York: Harcourt, Brace, Jovanovich, pp. 175-220.

1976 "The Reward System of the Social Sciences" (with Jonathan R. Cole). In Charles Frankel (Ed.), Controversies and Decisions: The Social Sciences and Public Policy. New York: Russell Sage, pp. 55-88.

1977 "Peer Review in the American Scientific Community" (with Jonathan R. Cole and Leonard Rubin), Scientific American 237, No. 4 (October), 34-41.

1978 "Measuring the Cognitive State of Scientific Disciplines" (with Jonathan R. Cole and Lorraine Dietrich). In Yehuda Elkana, Robert K. Merton, Arnold Thackray, and Harriet A. Zuckerman (Eds.), Toward a Metric of Science: The Advent of Science Indicators. New York: John Wiley.

1978 "Scientific Reward Systems: A Comparative Analysis." In Robert Alun Jones (Ed.), Research in the Sociology of Knowledge, Science, and Art. Greenwich, Conn.: Johnson Associates, Inc. pp. 167-190.

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* 1979 "Which Researcher Will Get the Grant?" (with J. R. Cole), Nature 279, 575-576.

1979 "Comment on a paper by Michael Overington," The American Sociologist 14 (February), 17-19.

* 1979 "Age and Scientific Performance," American Journal of Sociology 84, 958-977.

1980 "Comments on 'Indicators of Scientific Manpower'," Scientometrics, Vol. 2, No. 5-6, pp. 405-409. Translated into Russian, 1987.

1981 "The Functions of Classical Theory in Contemporary Sociological Research" (with K. Adatto). In F. Kuklick (Ed.), Research in the Sociology of Knowledge, Science, and Art III. Greenwich, Conn.: Johnson Associates, Inc.

* 1981 "Chance and Consensus in Peer Review," (with J. R. Cole and G. Simon), Science 214, (20 November 1981), 881-886.

* 1982 "NSF Peer Review (continued)" (with J.R. Cole and Gary Simon) Science, 215 (22 January, 1982) 344-8.

* 1983 "The Hierarchy of the Sciences?", American Journal of Sociology 89, 111-139. Translated into Polish in J. Niznika, ed. Rozwoj nauki a spoleczny kontekst poznania Warsaw: Panstowowe Wydawnictwo Naukowe, 1987

* 1984 "Little Science Big Science Revisited," Scientometrics (with G.S. Meyer) 7, 443-458

1984 "Experts' Consensus and Decision Making at the National Science Foundation," (with J. R. Cole) in Kenneth Warren, Selectivity and Information Systems: Survival of the Fittest, (New York: Praeger Science Publishers)

* 1986 "Sex Discrimination and Admission to Medical School: 1929-1984," American Journal of Sociology, 92 (545-567).

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* 1987 "Testing the Ortega Hypothesis: Milestone or Millstone?" Scientometrics (with J.R. Cole) 12, 327-335 (Entire issue devoted to examination of 1972 paper "The Ortega Hypothesis.")

1988 "Formation of Public Opinion on Complex Issues: The Case of Nuclear Power" (with R. Fiorentine) in H. O'Gorman, ed. Surveying Social Life: Essays in Honor of Herbert H. Hyman (Middletown, Conn.: Wesleyan University Press)in press.

* 1988 "Do Journal Rejection Rates Index Consensus? A Reply to Hargens." American Sociological Review (with G. Simon and J.R. Cole) forthcoming in February issue.

1988 "Discrimination Against Women In Science: The Confusion of Outcome with Process," (with R. Fiorentine), Harriet Zuckerman, Jonathan R. Cole, and John Bruer, eds. Women and the Pursuit of Science (New York: Norton), in press.

1988 "Confusing Outcome with Process in the Analysis of Sex Discrimination" reply to Gross: (with R. Fiorentine) American Journal of Sociology, forthcoming.

ATTACHMENT 2

RALPH H. TURNER, Professor of Sociology
University of California, Los Angeles, CA 90024
August 1986

BRIEF RESUME

Education:

Ph.D. in Sociology at University of Chicago, 1948;
Graduate study at University of Southern California and University of Wisconsin, 1941-43.

Major Professional Office:

Editor, Annual Review of Sociology, 1980-86
President, Society for the Study of Symbolic Interaction, 1982-83
Vice President, International Sociological Association, 1978-82
President, American Sociological Association, 1968-69
Editor, Sociometry, 1962-64
President, Pacific Sociological Association, 1956-57

Fellowships, Honors, and Special Responsibilities:

Cooley-Mead Award in Social Psychology, Amer. Sociological Assn., 1987;
Annual Faculty Research Lecturer, University of California, Los Angeles, 1986-87;
College of Letters and Science, Faculty Award, University of California, Los Angeles, 1985;
Annual Katz-Newcomb Lecturer, University of Michigan, 1985;
Fellow, American Academy of Arts and Sciences, 1984;
Chairman, Academic Senate, University of California-statewide, 1984;
Visiting Fellow, Nuffield College, Oxford, 1980;
Charles Horton Cooley Award from the Society for the Study of Symbolic Interaction, 1978;
Guggenheim Fellowship, United Kingdom, 1964-65;
Fulbright Research Fellowship, United Kingdom, 1956-57;
Social Science Research Council Faculty Research Fellowship, 1953-56;

Books Published:

Collective Behavior (with L. Killian), Third Edition, 1987 (Prentice Hall), Second Edition, 1972, First Edition, 1957;
← Waiting for Disaster: Earthquake Watch in California (with J. Nigg & D. Paz), 1986 (University of California Press);
Social Psychology: Sociological Perspectives. (M. Rosenberg and R. H. Turner, eds.), 1981 (Basic Books).
Earthquake Threat: The Human Response in Southern California (with J. Nigg, D. Paz, and B. Young), 1979 (UCLA Institute for Social Science Research);
Earthquake Prediction and Public Policy (By the Panel on Public

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Policy Implications of Earthquake Prediction, National Research Council, Ralph H. Turner, Chairman), 1975 (National Academy of Sciences);
Family Interaction, 1970 (John Wiley & Sons);
Robert Park: On Social Control and Collective Behavior (edited and with an introduction by R. H. Turner), 1967 (University of Chicago Press);
The Social Context of Ambition, 1964 (Chandler Press);

Over 150 articles, book chapters, and reviews on collective behavior, social aspects of disaster, theory of social roles, the self conception, social aspects of ambition and upward mobility, racial inequality in the United States, and sociological theory and methods.

List of Publications (excluding book reviews):

1. "Propaganda and the Social Situation," Sociology and Social Research, 27 (May, 1943), 363-72.

2. "The Navy Disbursing Officer as a Bureaucrat," American Sociological Review, 12 (June, 1947), 342-48.

3. "Is Culture Change Cyclical?" in Theories of Social Change (Department of Sociology, University of Chicago, 1947), 170-200 (mimeographed).

4. "Statistical Logic and Social Research," Sociology and Social Research, 32 (January, 1948), 697-704.

5. A Preliminary Survey of Integration of Negroes into Employment in Indianapolis. Chicago: American Council on Race Relations, 1948, p. 136 (mimeographed).

6. "The Nonwhite Male in the Labor Force," American Journal of Sociology, 54 (January, 1949), 356-62.

7. "The Expected Cases Method Applied to the Nonwhite Male Labor Force," American Journal of Sociology, 55 (September, 1949), 146-56.

8. "The Nonwhite Female in the Labor Force," American Journal of Sociology, 56 (March, 1951), 438-47.

9. "The Experience of Vertical Mobility and Personal Values," Proceedings of Pacific Sociological Society, published as Research Studies of the State College of Washington, 19, No. 2 (June, 1951), 89-92.

10. "The Relative Position of the Negro Male in the Labor Force of Large American Cities," American Sociological Review, 16 (August, 1951), 524-29.

11. "Moral Judgment: A Study in Roles," American Sociological Review, 17 (January, 1952), 70-77.

12. "The Quest for Universals in Sociological Research," American Sociological Review, 18 (December, 1953), 604-11.

13. "Children and Women's Work," Sociology and Social Research, 36 (July, 1952), 377-81.

14. "Foci of Discrimination in the Employment of Nonwhites," American Journal of Sociology, 58 (November, 1952), 247-56.

15. "Negro Job Status and Education," Social Forces, 32 (October, 1953), 45-52.

16. "Occupational Patterns of Inequality," American Journal of Sociology, 59 (March, 1954), 437-47.

17. "Value Conflict in Social Disorganization," Sociology and Social Research, 38 (May, 1954), 301-308.

18. "Self and Other in Moral Judgment," American Sociological Review, 19 (June, 1954), 249-59.

19. "Reply to Angell," American Sociological Review, 19 (August, 1954), 477-78.

20. "The Family," Chapter 10 in Leonard Broom and Philip Selznick (eds.), Sociology. New York: Row Peterson, 1955.

21. "Reference Groups of Future-Oriented Men," Social Forces, 34 (December, 1955), 130-36.

22. "International Understanding: An Exercise in Reading National Perspective," Claremont College Reading Conference: Twentieth Year Book, 1955, 13-32.

23. "Role-taking, Role Standpoint, and Reference Group Behavior," American Journal of Sociology, 61 (January, 1956), 316-28.

24. "Zoot-suiters and Mexicans: Symbols in Crowd Behavior," (with Samuel J. Surace), American Journal of Sociology, 62 (July, 1956), 14-20.

25. "The Changing Ideology of Success: A Study of the Aspirations of High School Men in Los Angeles," Transactions of the Third World Congress of Sociology, 1956, V, 35-44.

26. Collective Behavior (text and readings), with Lewis M. Killian, Englewood Cliffs: Prentice Hall, Inc., 1957, 547

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27. "The Normative Coherence of Folk Concepts," Proceedings of the Pacific Sociological Society, published as Research Studies of the State College of Washington, 25 (June, 1957), 127-36.

28. "Needed Research in Collective Behavior," Sociology and Social Research, 42 (July, 1958), 461-65.

29. "Life Situation and Subculture: A Comparison of Merited Prestige Judgments by Three Occupational Classes in Britain," British Journal of Sociology, 9 (December, 1958), 299-320.

30. "An Experiment in the Modification of Role Conceptions," Yearbook of the American Philosophical Society, 1959, 329-32.

31. "Preoccupation with Competitiveness and Social Acceptance among American and English College Students," Sociometry, 23 (September, 1960), 307-25.

32. "Sponsored and Contest Mobility and the School System," American Sociological Review, 25 (December, 1960), 855-67.

33. "Reply to Halsey," American Sociological Review, 26 (June, 1961), 455-56.

34. "The Problem of Social Dimensions in Personality," Pacific Sociological Review, 4 (Fall, 1961), 57-62.

35. "Role-taking: Process Versus Conformity," in Arnold Rose (ed.), Human Behavior and Social Processes, Boston: Houghton-Mifflin Co., 1962.

36. "Some Family Determinants of Ambition," Sociology and Social Research, 46 (July, 1962), 397-411.

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40. "Collective Behavior," Chapter 12 in R. E. L. Faris (ed.), Handbook of Sociology, Chicago: Rand McNally, 1964, pp. 382-425.

41. "Upward Mobility and Class Values," Social Problems, 11 (Spring, 1964), 359-71.

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43. "Some Aspects of Women's Ambition," American Journal of Sociology, 70 (November, 1964), 271-85.

44. "On Neighborhood Context and College Plans," American Sociological Review, 31 (October, 1966), 698-702.

45. "Acceptance of Irregular Mobility in Britain and the United States," Sociometry, 29 (December, 1966), 334-352.

46. Robert Park on Social Control and Collective Behavior, edited and with an introduction by Ralph H. Turner, Chicago: University of Chicago, 1967.

47. "Types of Solidarity in the Re-Forming of Groups," Pacific Sociological Review, 10 (Fall, 1967), 60-68.

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50. "The Self-Conception in Social Interaction," in Chad Gordon and Kenneth Gergen (eds.), The Self in Social Interaction, New York: John Wiley & Sons, Inc., 1968, Vol. I, pp. 93-106.

51. "Soziokulturelle Persenlichkeit," in Werterbuch der Soziologie, Second edition, Stuttgart: Ferdinand Enke, 1969, pp. 1032-1036.

52. "The Social Context of Ambition," in Muzafer Sherif and Caroline Sherif (eds.), Social Psychology, New York: Harper and Row, 1969, pp. 444-447.

53. "The Public Perception of Protest," American Sociological Review, 34 (December, 1969), 815-831.

54. "The Theme of Contemporary Social Movements," British Journal of Sociology, 20 (December, 1969), 390-405.

55. "Determinants of Social Movement Strategies," in Tamotsu Shibutani (ed.), Human Nature and Collective Behavior:

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56. Family Interaction, New York: John Wiley & Sons, 1970, 505 pp.

57. "The Public Perception of the Watts Riot as Social Protest," by Vincent Jeffries, Ralph H. Turner, and Richard T. Morris, American Sociological Review, 36 (June, 1971), 443-451.

58. "Introduction." The Nature of Human Nature, by Ellsworth Faris, Dubuque, Iowa: Brown Reprints, 1971, pp. v-xiii.

59. "Deviance Avowal as Neutralization of Commitment," Social Problems, 19 (Winter, 1972), 308-321.

60. Collective Behavior, Revised Edition. (with Lewis M. Killian), Englewood Cliffs, N.J.: Prentice Hall, 1972. 435 pp.

61. "Integrative Beliefs in Group Crises," Journal of Conflict Resolution, 16 (March, 1972), 26-40.

62. "Campus Peace: Harmony or Uneasy Truce?" (Sociology and Social Research, 57 (October, 1972), 5-21.

63. "Unresponsiveness as a Social Sanction," Sociometry, 36 (March, 1973), 1-19.

64. "Collective Behavior," Encyclopedia Brittanica, Fifteenth Edition, 1974, Volume 4, 842-853.

65. "Rule Learning as Role Learning: What an Interactive Theory of Roles Adds to the Theory of Social Norms," International Journal of Critical Sociology, 1 (September, 1974), 52-73.

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94. "Responses to Uncertainty and Risk: Mexican American, Black and Anglo Beliefs about the Manageability of the Future," Social Science Quarterly, 65 (June, 1984), 665-79. By Ralph H. Turner and K. Jill Kiecolt.

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96. Annual Review of Sociology, Volume 10, Ralph H. Turner, editor, 1984.

97. "Unanswered Questions in the Convergence between Structuralist and Interactionist Role Theories," pp. 22-36 in Horst J. Helle (ed.), Perspectives on Micro-sociological Theory. London & Beverly Hills: Sage Publications, 1985.

98. Annual Review of Sociology, Volume 11, Ralph H. Turner, editor, 1985.

99. "Articulating Self and Social Structure," pp. 119-132 in Terry Honess and Krysia Yardley, eds., Self and Identity: Psychosocial Perspectives. Chichester, England: John Wiley & Sons, Ltd., 1986.

100. Waiting for Disaster: Earthquake Watch in California. By R.H. Turner, Joanne Nigg and Denise H. Paz. University of California Press, 1986. 446 pp.

101. "The Mass Media in Earthquake Warning," by R.H. Turner and Denise H. Paz, pp. 99-115 in S.J. Ball-Rokeach and Muriel Cantor, eds., ~~The Media and the Social Fabric: New Sociological Perspectives~~. Beverly Hills: Sage Publications, 1986. Media, Audience, and Social Structure.

102. Annual Review of Sociology, Volume 12, Ralph H. Turner, editor, 1986.

103. Collective Behavior, Third Edition. By Ralph H. Turner and Lewis M. Killian. Englewood Cliffs, N.J.: Prentice-Hall, 1987.

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ATTACHMENT 3

February 14, 1988

VITA

ALLEN H. BARTON

Born October 7, 1924, Greenwich, Connecticut. Married, 4 children.

Current position: Professor of Sociology, Columbia University

Office address: Department of Sociology, 514 Fayerweather Hall,
Columbia University, New York NY 10027
(Telephone: 212-280-4022)

Home address: 327 Valley Road, Cos Cob, CT 06807

Education:

Attended Brunswick School and Greenwich public schools, graduated from Edgewood School, Greenwich, CT June 1941.
Harvard College, 1941-43, 1946-47; A.B. 1947.
Cornell University, Army Specialized Training Program, Chinese Area and Language, 1943-44.
Columbia University, graduate study in sociology, 1947-53; Ph.D 1957.

Employment:

U.S.Army, 1943-46. Highest rank: Tech Sergeant, Signal Corps.
Lecturer in Sociology, University of Oslo, 1948-49
Social Science Research Council Research Training Fellowship, 1949-50
Bureau of Applied Social Research (BASR), Columbia University:
- Research Assistant, 1947-48, 1950-54
- Research Associate, 1957-62
- Director, 1962-77

Department of Sociology, Columbia University:
- Teaching Assistant 1950-51
- Instructor 1953-54
- Assistant Professor 1958-62
- Associate Professor 1962-71
- Professor 1971- present

University of Chicago Law School:
- Assistant Professor of Sociology, 1954-57

Research projects:

Economic Planning Study, Norway, 1948-50; directed by Paul F. Lazarsfeld, (Social Science Research Council and Norwegian foundations).
Propositional Inventory on Political Behavior, Columbia University, 1952-53; directed by Paul F. Lazarsfeld (Ford Foundation).
Jury Project, University of Chicago Law School, 1954-57; directed by Edward Levi and Harry Kalven (Ford Foundation)
Methodological Documentation Project, Columbia University, 1957-60; directed by Paul F. Lazarsfeld (Ford Foundation)
Review of Disaster Research, 1959-61; project director (National Academy of Sciences)

Sociology of Reading Research, 1960-63; project director (Carnegie Corporation)
Yugoslav Elite Survey, 1967-70; project co-director (Carnegie Corporation)
Columbia Student Demonstrations Survey, 1968; project director (Russell Sage Foundation)
American Leadership Survey, 1970-74; project co-director (NIMH, Ford Foundation)
New York Neighborhood Government Study, 1972-75; project director (National Science Foundation)

Member:

American Sociological Association
American Association for the Advancement of Science (Fellow)
American Association for Public Opinion Research
American Association of University Professors
International Sociological Association: Research Committee on Disasters
Interuniversity Seminar on Armed Forces and Society
Policy Studies Association
Social Research Association
Social Science History Association
Society for the Study of Social Problems
World Association for Public Opinion Research

Publications

"Qualitative measurement in the social sciences," by Paul F. Lazarsfeld and Allen H. Barton, in The Policy Sciences, edited by Daniel Lerner and Harold D. Lasswell. Stanford University Press, 1951, pp. 155-192.

"The psychology of voting: an analysis of political behavior," by S.M.Lipset, P.F.Lazarsfeld, A.H. Barton and J.J.Linz, in Handbook of Social Psychology (2nd edition), edited by Gardner Lindzey. Cambridge, MA: Addison-Wesley, 1954, pp. 1124-1175.

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"The college as a social organization," College Admissions 10: The Behavioral Sciences and Education. Princeton, NJ: College Entrance Examination Board.

"Decision-making in a planning agency," Social Science Information 2 (1962) 57-76.

"Research and practice in the teaching of reading," by Allen H. Barton and David Wilder, in Innovation in Education, edited by Matthew B. Miles. New York: Teachers College Bureau of Publications, 1964, pp. 361-398.

"University resources for survey research on urban problems," by Allen H. Barton and David Sills, in The Universities in Regional Affairs, v. 2 of Urban Research and Education in the New York Metropolitan Region, edited by Harvey S. Perloff and Henry Cohen. New York: Regional Plan Association, 1965.

"Bringing society back in," American Behavioral Scientist 12 (1968) 1-9.

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"Personal influence revisited," in Current Controversies in Marketing Research, edited by Leo Bogart. Chicago: Markham, 1968, pp. 113-126.

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ATTACHMENT 4

SUFFOLK COUNTY SURVEY

Volunteer Firemen

September, 1982

Hello, my name is _____ and I am calling for Suffolk County. We are doing a survey of volunteer firemen to obtain information that will be useful to the County in making plans to deal with a possible nuclear emergency at the Shoreham nuclear power plant. The _____ fire department is cooperating with this research. They have given us a list of members. Do you still work with the _____ fire department? ____ 1 ____ 2 ____ 3

4. For how many years have you worked with this fire district?

0=less than one
1=one
2=two to three
3=four to five
4=six to ten
5=more than ten
DON'T READ [9=Refuse

____ 4

5-9 What is the zip code of your home address?

____ 5 ____ 6 ____ 7 ____ 8 ____ 9

In general, how dangerous do you think it would be to live near each of the following:

(Categories for Q. 10 to Q. 13)

1=very dangerous
2=dangerous
3=not too dangerous

DON'T READ [4=Don't Know
[9=Refuse

10. an airport

10

11. a mental hospital

11

12. a coal fired power plant

12

13. a nuclear power plant

13

14. Would you describe yourself as:

1=a supporter of nuclear power plants as a means of providing electricity.

2=an opponent of nuclear power plants, or

3=you haven't made up your mind yet on this issue?

DON'T READ [9=Refuse

14

15. Do you think that LILCO should complete and operate the Shoreham nuclear power plant?

1=yes
2=no

DON'T READ [3=Don't Know
[9=Refuse

15

16. During <u>normal operation</u>, which type of electricity plant pollutes the air the <u>least</u>:

1=an oil-fired plant
2=a coal-fired plant
3=a nuclear-fired plant
4=you're not sure

DON'T READ [5=all about the same
[9=Refuse

16

17. During normal operation does a nuclear power plant give off a dangerous level of radiation?

1=yes
2=no

DON'T READ [3=Don't Know [9=Refuse

17

18. Assuming that the Shoreham nuclear power plant is licensed and begins to operate, we are interested in knowing what you think you would do if there was an accident at the plant. Suppose that you were at work on a weekday morning and there was an accident at Shoreham. Everyone living within ten miles of the plant was advised to evacuate. Volunteer firemen were expected to help with the evacuation. What do you think you would do first?

1=first, you would report to the fire station so that you could help with fire fighting and evacuation in the evacuation zone, or [SKIP to Q. 23]

2=first, you would make sure that your family was safely out of the evacuation zone, or [ASK Q. 19 to 22]

3=first, you would leave the evacuation zone to make sure that you were in a safe place, or [SKIP to Q. 23]

4=first, you would do something else_____
[SKIP tc Q. 23] Specify

DON'T READ [5=Don't Know [SKIP to Q. 23
[9=Refuse [SKIP to Q. 23]

18

19. How would you make sure that your family was safely out of the evacuation zone?

1=go home and drive your family to a safe place out of the evacuation zone

2=call home and tell your family to leave without you

3=some other way___ _____

_____
(Specify)

DON'T READ [4=Don't Know
[9=Refuse

19

20. Where would you go?

1=someplace in Suffolk County
2=someplace in Nassau County
3=someplace In New York City
4=some other place _____ (Specify) .
5=you don't know [SKIP to Q. 22]

DON'T READ [9=Refuse [SKIP to Q. 22]

20

21. In terms of miles, about how far away is this place from your home?

1=10 miles or less
2=11 to 20 miles
3=21 to 30 miles
4=31 to 40 miles
5=41 to 50 miles
6=more than 50 miles

DON'T READ [7=Don't Know
[9=Refuse

21

22. After your family was in a safe place would you return to the fire house to help with evacuation?

1=yes
2=no

DON'T [3=I would try
[4=Don't Know
READ [9=Refuse

22

23. If there was a nuclear accident at Shoreham requiring the evacuation of people within a ten mile zone, how dangerous do you think it would be for you to spend a day working within the evacuation zone?

1=much more dangerous than normal fire fighting work
2=somewhat more dangerous than normal fire fighting work
3=about equally dangerous
4=less dangerous
5=not dangerous at all

DON'T READ [5=Don't Know [9=Refuse

23

Do you agree or disagree with each of the following statements.

(Categories for Q. 24 to Q. 27)

1=agree 2=disagree DON'T READ [3=Don't Know
[9=Refuse

24. Helping with the evacuation of people from the emergency zone during a nuclear emergency should be the job of specially trained personnel rather than the job of volunteer firemen.

24

25. In the event of a nuclear emergency at Shoreham it would be the obligation of everyone to first look after the health and safety of their family.

25

26. Only firemen who have specifically volunteered should be expected to help with off site evacuation during a nuclear emergency.

26

27. In the event of a nuclear emergency at Shoreham, a volunteer fireman must place duty to the fire department over duty to family.

27

28. Do you currently have any children living at home with you?

1=yes
2=no [SKIP to Q. 32]

DON'T READ [9=Refuse

28

29. How old is the youngest child living at home with you?

1=under 5
2=5 to 12
3=13 to 18
4=over 18

DON'T READ [9=Refuse

29

30-31 In what district do your children attend school?

30

_____
(school district
[99=no children attending school]

31

32. What is your current marital status?

1=married
2=single [SKIP to Q. 34]
3=widowed [SKIP to Q. 34]
4=divorced or separated [SKIP to Q. 34]

DON'T READ [9=Refuse

32

33. Does your spouse currently work full time (30 hours a week or more)?

1=yes 2=no

DON'T READ [9=Refuse

33

34. What is the last grade of school that you completed?

1=some high school or less
2=high school graduate
3=some college
4=college graduate

DON'T READ [9=Refuse

34

35. What is your age category?

1=under 25
2=25-35
3=36-50
4=51-65
5=over 65

DON'T READ [9=Refuse

35

36. What is your sex?

1=male 2=female

36

THANK YOU FOR YOUR COOPERATION

ATTACHMENT 5

1982 FIREMEN SURVEY

Responses Given by Volunteer Firemen to Role Conflict Questions

Assuming that the Shoreham nuclear power plant is licensed and begins to operate, we are interested in knowing what you think you would do if there was an accident at the plant. Suppose that you were at work on a weekday morning and there was an accident at Shoreham. Everyone living within ten miles of the plant was advised to evacuate. Volunteer firemen were expected to help with the evacuation. What do you think you would do first?

first, you would report to the fire station so that you could help with fire fighting and evacuation in the evacuation zone, or	21%
first, you would make sure that your family was safely out of the evacuation zone, or	68
first, you would leave the evacuation zone to make sure that you were in a safe place, or	1
first, you would do something else	7
Don't know	4
Total	100%
	(291)

How would you make sure that your family was safely out of the evacuation zone?

go home and drive your family to a safe place out of the evacuation zone	32%
call home and tell your family to leave without you	51
some other way_____	12
Don't know	5
Total	100%
	(291)

TABLE 2 Continued....

Do you agree or disagree that in the event of a nuclear emergency at Shoreham it would be the obligation of everyone to first look after the health and safety of their family.

agree	92%
disagree	5
Don't know	3
Total	100%
	(291)

Do you agree or disagree that in the event of a nuclear emergency at Shoreham, a volunteer fireman must place duty to the fire department over duty to family.

agree	17%
disagree	77
Don't know	6
Total	100%
	(291)

ATTACHMENT 6

SUFFOLK COUNTY SURVEY

Volunteer Firemen

March, 1988

Hello, my name is _____ and I am calling for Social Data Analysts. Suffolk County has retained us to do some reseach on what might happen if there were an emergency at the Shoreham nuclear power plant. The _____ fire department is cooperating with this research. They have given us a list of members. Do you still work with the _____ fire department? _____ 1 _____ 2 _____ 3

Yes [ASK Q. 5]
No [TERMINATE] _____ 4

5. For how many years have you worked with this fire district?

0 = less than one
1 = one
2 = two to three
3 = four to five
4 = six to ten
5 = more than ten

DON'T READ [9 = Refuse] _____ 5

6. Assuming that the Shoreham nuclear power plant is licensed and begins to operate, we are interested in knowing what you would do if there was an accident at the plant. Suppose that you were at work on a weekday morning and there was an accident at the plant. Everyone living within ten miles of the plant was advised to evacuate as soon as possible. Volunteer firemen were asked to report to the firehouse to help with the evacuation. What do you think you would do <u>first</u>?

1 = <u>first</u>, you would report to the fire station so that you could help with fire fighting and evacuation in the evacuation zone, or [SKIP to Q. 24]
2 = <u>first</u>, you would make sure that your family was safe, or [ASK Q. 7]
3 = <u>first</u>, you would leave the evacuation zone to make sure that you were in a safe place, or [SKIP to Q. 21]
4 = <u>first</u>, you would do something else _____

_____
(specify) [SKIP to Q. 24]

DON'T READ [5= Don't know [ASK Q. 7]
[9= Refuse [ASK Q. 7] _____ 6

7. Do you currently have any children living at home with you who are attending school?

1 = yes [ASK Q. 8]
2 = no [SKIP to Q. 10]

DON'T READ [9 = Refuse [SKIP to Q. 10] _____ 7

8. How would you make sure that your children who go to school were safe?

DON'T READ
[1 = go home or to school and take them out of the evacuation zone [SKIP to Q. 21]
[2 = stay at home with them [SKIP to Q. 23]
[3 = call on the telephone to make sure they were safe [ASK Q. 9]
[4 = something else _____
READ _____ (specify) [SKIP to Q. 10]
[5 = Don't Know [SKIP to Q. 10]
[9 = Refuse [SKIP to Q. 10] _____ 8

9. What would you do if you could not get through on the telephone or you could not find out on the telephone whether your children were safe?

DON'T READ
[1 = go to get them and take them out of the evacuation zone [SKIP to Q. 21]
[2 = stay at home with them [SKIP TO Q. 23]
[3 = something else _____ _____
READ _____ (specify) [ASK Q. 10]
[4 = Don't Know [ASK Q. 10]
[9 = Refuse [ASK Q. 10] _____ 9

10. Do you currently have any young pre-school aged children living at home with you?

1 = yes [ASK Q. 11]
2 = no [SKIP to Q. 14]

DON'T READ [3 = Don't Know [9 = Refuse [SKIP to Q. 14] _____ 10

11. How would you make sure that these children were safe?

DON'T READ

[1 = go home and take them out of the evacuation zone [SKIP to Q. 21]

[2 = stay home with them [SKIP to Q. 23]

[3 = call home and ask wife or other care taker to take them out of the evacuation zone [ASK Q. 12]

[4 = something else _____

READ

_____ (specify) [SKIP to Q. 14]

[5 = Don't know [ASK Q. 13]

[9 = Refuse [ASK Q. 13] _____ 11

12. What would you do if you could not get through on the telephone?

DON'T READ

[1 = go to get them and take them out of the evacuation zone [SKIP to Q. 21]

[2 = stay at home with them [SKIP TO Q. 23]

[3 = something else _____

_____

READ

(specify) [ASK Q. 13]

[4 = Don't Know [ASK Q. 13]

[9 = Refuse [ASK Q. 13] _____ 12

13. What would you do if your spouse [or other care taker] asked you to come home and go with them out of the evacuation zone?

DON'T READ

[1 = go home and take them out of the evacuation zone [SKIP to Q. 21]

[2 = stay at home with them. [SKIP TO Q. 23]

[3 = insist that they go by themselves or try to get someone else to take them [SKIP to Q. 24]

[4 = something else _____

READ

_____ (specify) [SKIP to Q. 24]

[5 = Don't know [ASK Q. 14]

[9 = Refuse [ASK Q. 14]

_____ 13

14. Are you currently married?

1 = yes [ASK Q. 15]
2 = no [SKIP to Q. 18]

DON'T READ [9 = Refuse [SKIP to Q. 18]

_____ 14

15. How would you make sure that your spouse was safe?

DON'T READ

[1 = go home and take spouse out of evacuation zone [SKIP to Q. 21]

[2 = stay at home with her/him [SKIP TO Q. 23]

[3 = call home [ASK Q. 16]

[4 = something else _____

READ

_____ (specify) [SKIP to Q. 17]

[5 = Don't Know [SKIP to Q. 17]

[9 = Refuse [SKIP to Q. 17]

_____ 15

16. What would you do if you could not get through on the telephone?

DON'T
[1 = go to get her/him and take her/him out of tne evacuation zone [SKIP to Q. 21]
[2 = stay at home with her/him [SKIP TO Q. 23]
[3 = something else _____

_____
(specify) [ASK Q. 17]

READ
[4 = Don't know [ASK Q. 17]
[9 = Refuse [ASK Q. 17]

16

17. What would you do if your spouse asked you to come home and take her [him] out of the evacuation zone?

DON'T
[1 = go home and take her/him out of the evacuation zone [SKIP to Q. 21]
[2 = stay at home with her/him [SKIP TO Q. 23]
[3 = insist that she go by herself or try to get someone else to take them [SKIP to Q. 24]
[4 = something else _____

READ
_____
(specify) [SKIP to Q. 24]

[5 = Don't Know [ASK Q. 18]
[9 = Refuse [ASK Q. 18]

17

18. Do you currently have parents or anyone else living at home with you?

1 = yes [ASK Q. 19]
2 = no [SKIP To Q. 24]

DON'T READ [9 = Refuse [SKIP to Q. 24]

18

19. How would you make sure that these people were safe?

[1 = go home and take them out of the evacuation zone [SKIP to Q. 21]

DON'T

[2 = stay at home with them [SKIP TO Q. 23]

[3 = call on the telephone to make sure they were safe [ASK Q. 20]

[4 = something else _____

READ

_____ (specify) [SKIP to Q. 24]

[5 = Don't know [SKIP to Q. 24]

[9 = Refuse [SKIP to Q. 24]

19

20. What would you do if you could not get through on the telephone or you could not find out on the telephone whether these people were safe?

DON'T

[1 = go to get them and take them out of the evacuation zone [ASK Q. 21]

[2 = stay at home with them [SKIP TO Q. 23]

[3 = something else _____

_____ (specify) [SKIP to Q. 24]

READ

[4 = Don't Know [SKIP to Q. 24]

[9 = Refuse [SKIP to Q. 24]

20

21. Where would you go?

1 = someplace in Suffolk County
2 = someplace in Nassau County
3 = someplace in New York City
4 = some other place _____ (specify)
5 = you don't know [SKIP to Q. 23]

DON'T READ [9 = Refuse [SKIP to Q. 23]

21

22. In terms of miles, about how far away is this place from your home?

1 = 10 miles or less
2 = 11 to 20 miles
3 = 21 to 30 miles
4 = 31 to 40 miles
5 = 41 to 50 miles
6 = more than 50 miles

DON'T READ [7 = Don't know
[9 = Refuse

22

23. After you made sure your family was safe, would you return to the fire house to help with the evacuation?

1 = yes
2 = no

DON'T READ [3 = I would try
[4 = Don't know
[9 = Refuse

23

24. If there was an accident at Shoreham and everyone living within ten miles of the plant was asked to evacuate, do you think it would be dangerous for a member of your family to remain in the evacuation zone for several hours?

1 = yes [ASK Q. 25]
2 = no [SKIP to Q. 26]

DON'T READ [3 = Don't Know [9 = Refuse [SKIP to Q. 26]

24

25. How dangerous do you think it would be?

1 = very dangerous
2 = somewhat dangerous
3 = not too dangerous

DON'T READ [4 = Don't Know [9 = Refuse

25

26. If there was an accident at Shoreham requiring the evacuation of people within a ten mile zone of the plant, do you think that it would be dangerous for you to spend a day working within the evacuation zone?

1 = yes [ASK Q. 27]
2 = no [SKIP to Q. 28]

DON'T READ [3 = Don't know [9 = Refuse [SKIP TO Q. 28]

26

27. How dangerous do you think it would be?

1 = much more dangerous than normal fire fighting work
2 = somewhat more dangerous than normal fire fighting work
3 = just as dangerous as normal fire fighting work
4 = less dangerous than normal fire fighting work

DON'T READ [5 = Don't Know [9 = Refuse

_____ 27

28. About how many miles is your home from the Shoreham nuclear power plant?

1 = less than 5
2 = between 5 and 10
3 = between 11 and 15
4 = more than 15

DON'T READ [5 = Don't know [9 = Refuse

_____ 28

29. What is your age category?

1 = under 25
2 = 25 - 35
3 = 36 - 45
4 = 46 - 65
5 = over 65

DON'T READ [9 = Refuse

_____ 29

30. What is your sex?

1 = male 2 = female

_____ 30

THANK YOU FOR YOUR COOPERATION

[Interviewer: Please verify and record respondent's telephone number]

_____ 31 _____ 32 _____ 33 _____ 34 _____ 35 _____ 36 _____ 37