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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)
) (School Bus Driver Issue)
)

TESTIMONY OF DOUGLAS M. CROCKER,
ROBERT B. KELLY, MICHAEL K. LINDELL, AND
DENNIS S. MILETI ON THE REMANDED ISSUE
OF "ROLE CONFLICT" OF SCHOOL BUS DRIVERS

Hunton & Williams
707 East Main Street
P.O. Box 1535
Richmond, Virginia 23212

April 13, 1988

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I. IDENTITY AND QUALIFICATIONS OF WITNESSES

1. Q. Will the witnesses please identify themselves and provide a brief description of their professional qualifications and background?

A. [Crocker] My name is Douglas M. Crocker. As Manager of the Nuclear Emergency Preparedness Division for LILCO, I oversee all aspects of the Shoreham onsite and offsite (LERO) emergency preparedness program. I am responsible for the development and maintenance of facilities, plans, procedures, training, and drill programs to satisfy NRC and FEMA requirements. My professional qualifications, and those of the other witnesses, are Attachments A-D to this testimony.

[Kelly] My name is Robert B. Kelly. I am a Senior Project Manager for Roy F. Weston, Inc., an environmental engineering consulting firm. I have been retained as a consultant by LILCO to collect data on how bus drivers have responded in actual emergencies. I have developed and implemented emergency preparedness programs for federal, state, and local government agencies, chemical plants, pharmaceutical firms, nuclear power plants, and others. I have done a study of 50 major U.S. evacuations that have occurred since 1980. The purpose of this research was to identify those factors which made for a successful evacuation.

[Lindell] My name is Michael K. Lindell. I am an Associate Professor of Psychology at Michigan State University. I am a consultant to LILCO on human behavior in emergencies. My area of research and writing can be

defined broadly as individual and organizational response to emergencies. In this area I have conducted three types of research dealing with (1) "risk perception," (2) "warning response," and (3) "emergency planning."

[Mileti] My name is Dennis S. Mileti. I am Professor of Sociology and Director of the Hazard Assessment Laboratory at Colorado State University. I am a consultant to LILCO on human behavior in emergencies.

2. Q. What emergencies have you actually been to and for which have you personally collected data?

A. [Lindell] My own research has included primary data collection on four communities struck by floods (Sumner, Washington on December 2, 1977; Valley, Nebraska on March 19, 1978; Fillmore, California on March 14, 1978; and Snoqualmie, Washington on December 2, 1977) and four communities (Cougar, Woodland, Longview, and Toutle/Silverlake, Washington) affected by the eruption of Mount St. Helens on May 18, 1980.

[Mileti] I studied the following disasters shortly after they occurred: the Wray, Colorado tornado in 1971; the Rapid City flood in June 1972; and the 1986 eruption of the Nevada del Ruiz volcano in Columbia.

I have also studied actual warnings of earthquakes for which the threat did not materialize: the Wilmington, North Carolina earthquake prediction in 1976; the Kawasaki and Tokyo earthquake predictions in 1975; the Parkfield earthquake prediction in 1985; and the San Diego earthquake prediction in 1985.

I also studied the 1982 Livingston, Louisiana train derailment; the 1983 Coalinga earthquake; and the 1979 Three Mile Island accident, though I was not at these during the immediate impact.

3. Q. What experience have the rest of you had with real emergencies?

A. [Crocker] I was living on Long Island when Hurricane Gloria hit in 1985. While I did not participate in any emergency response during the hurricane, I volunteered to serve in LILCO's restoration efforts and performed survey work for damage in the community and later served as a messenger and coordinator of line crew activities for 7-9 days.

In 1978 I was living in Massachusetts when the state was hit by its worst blizzard in decades. My town was hit hard with snow and coastal flooding. Many beach houses were washed away and parts of the area had to be evacuated. The National Guard was called out to assist the community with traffic and access control.

[Kelly] I have been involved in emergency responses to several natural and technological emergencies: the Lynn, Massachusetts fire in 1982; the 1984 spring floods in western Massachusetts; a 1984 winter storm in eastern Massachusetts; a Massachusetts state employees' strike in 1982; the Salem, Massachusetts fire in 1984; the Cuban refugee program in 1980; the 1980 Hurricane Allen recovery program; and many smaller emergencies.

4. Q. What experience do you have in emergency planning?

A. [Crocker] At the time of the Three Mile Island accident, I was working in Stone & Webster's environmental engineering department. After TMI the area of emergency planning grew extensively, and I was recruited by management to be trained and to participate in an emergency planning project that was just beginning at the William H. Zimmer Nuclear Power Station. From May 1980 to January 1984 I worked on and ended up managing all of Stone & Webster's offsite emergency preparedness activities for the five

counties and two states surrounding Zimmer in conjunction with those counties and states.

From September 1982 to January 1984, I developed the emergency response plans for the Commonwealth of Kentucky and the Kentucky EPZ counties for the Marble Hill Nuclear Generating Station. During this time I was the Project Engineer responsible for all emergency planning work in the New York office of Stone & Webster. This included work for the Salem, Shoreham, Indian Point, and Oyster Creek nuclear power plants.

Since 1984 I have been working for LILCO, first as a Stone & Webster employee and later as a LILCO employee. Initially I worked onsite as the Onsite Emergency Preparedness Supervisor. In 1986 I moved to the equivalent position responsible for offsite emergency preparedness activities offsite. Now I oversee both the onsite and offsite emergency preparedness efforts for Shoreham.

[Mileti] My experience regarding emergency planning is of several types. First, I have conducted academic studies that are related to the topic, and I have written publications based on these studies. Second, I have been involved in non-academic practical applications of emergency planning knowledge; I have shared knowledge applicable to emergency planning with varied user groups, for example, through speeches and guest lectures as well as through long-term working relationships.

The academic studies I have performed that are related to emergency planning are varied. These include synthesizing literature reviews as well as collecting primary field data. The former is illustrated by the document entitled Disaster Relief and Rehabilitation in the United States, which appeared in 1975 through the Institute of Behavioral Science at the

University of Colorado and was written as part of work for the National Science Foundation. Another example is the recent report Evacuation: An Assessment of Planning and Research by J. Sorensen, B. Vogt, and me, which appeared in 1987 for the Federal Emergency Management Agency. In the decade between the appearance of these works, I also participated in well over a dozen other efforts to appraise knowledge that was in one way or another related to emergency planning issues, and I wrote several dozen papers and reports related to the topic.

My experience with the collection of primary field data on topics related to emergency planning is illustrated by my most recent trip to a disaster site in January 1986 to study preparedness and response issues related to the eruption of a volcano in Colombia, South America, in which some 24,000 people died. That research was sponsored by the National Academy of Sciences. I have also conducted primary field data collection efforts in other studies that amount to probably several thousand interviews; these were mostly research efforts funded by the National Science Foundation. In 1984 I and others completed the report Interface in Reactor Emergency Planning and Response for the Nuclear Regulatory Commission, in which we sought to determine empirically if current regulations for nuclear power plant preparedness result in integrated emergency plans.

I have also been involved in non-academic practical applications of emergency planning knowledge. For example, I have consulted with about a half-dozen utilities on the topic, as well as a variety of governments and organizations, including the State of California, the City of Los Angeles, the Tokyo Metropolitan Government, the Paris fire brigade, the International and American Red Cross, IBM, the Governor's Office in the State of Colorado, and others.

In 1981 I helped begin the Southern California Earthquake Preparedness Project, which is a California-federal cooperative effort to prepare for a major earthquake. I am also a member of the Committee on Natural Disasters in the National Academy of Sciences (NAS), as well as a member of the Subcommittee on Earthquake Research of the Board on Earth Sciences to the U.S. Geological Survey (USGS), also within the NAS. I recently helped the USGS develop its emergency plan for an impending earthquake prediction.

Finally, from time to time I am called upon to make preparedness-related presentations to seminars on emergency planning and hazard mitigation hosted by, for example, the Federal Emergency Management Agency, General Public Utilities (GPU-Nuclear), and others.

[Kelly] I have worked for FEMA and the Massachusetts Civil Defense Agency. I worked both as an emergency planner and in a emergency operations role.

I have reviewed and developed state-level emergency plans for the Commonwealth of Massachusetts, including the State Emergency Broadcast System Plan, the State In-Place Shelter Plan, the State Comprehensive Emergency Management Plan, and the State Disaster Recovery Plan. I also directed the development of 165 local community emergency plans.

I have also developed and conducted emergency training programs and conducted capability assessments and hazard analyses studies. As a private consultant, I have developed industrial and community emergency preparedness plans.

I have been involved with radiological emergency planning for the Pilgrim, Seabrook, Yankee Rowe, and Vermont Yankee nuclear power

plants. My duties included reviewing local, area, and state emergency plans and implementing those plans during emergency drills and exercises. During these drills and exercises I was in charge of the Emergency Broadcast System and as a member of the operations staff was responsible for intelligence-gathering and resource management.

[Lindell] I would cite my AIF study and the workshop for emergency personnel in the Three Mile Island area. These are mentioned elsewhere in this testimony.

5. Q. What have you done specifically on role conflict?

A. [Lindell] Role conflict is addressed in my study (with Patricia Bolton, Ronald Perry, and others) for the Atomic Industrial Forum entitled Planning Concepts and Decision Criteria for Sheltering and Evacuation in a Nuclear Power Plant Emergency, AIF/NESP-031 (June 1985). I also made an oral presentation on role conflict at the 1986 Three Mile Island area executive seminar on emergency preparedness.

[Mileti] I discussed role conflict in Mileti, Drabek, and Haas, Human Systems in Extreme Environments (1975); Sorensen, Vogt, and Mileti, Evacuation: An Assessment of Planning and Research, (1987); "Emergency Role Performance in Disaster Response Organizations," Environmental Sociology (1985); and "Role Conflict and Abandonment in Emergency Workers," Emergency Management Review (1984). Additionally, as I stated in testimony in this proceeding in 1983, I gathered information with the assistance of a student from organizational respondents concerning role abandonment during the Three Mile Island emergency. I have also gathered information while in Japan about role abandonment from some victims and other informants in reference to the atomic bombing of Hiroshima.

II. "ROLE CONFLICT" OF REGULAR SCHOOL BUS DRIVERS

A. Literature and Theory

6. Q. What does the scholarly literature on disaster behavior tell us about "role conflict"?
- A. [Mileti] Russell Dynes, John Sorensen, and I reviewed the literature in our testimony in this proceeding in 1983. Testimony of Matthew C. Cordaro, Russell R. Dynes, William G. Johnson, Dennis S. Mileti, John H. Sorensen, and John A. Weismantle on Behalf of The Long Island Lighting Company on Phase II Emergency Planning Contention 25 (Role Conflict) (Nov. 18, 1983), ff. Tr. 832, at 51-71.
7. Q. Have there been new publications since you last testified on this issue?
- A. [Mileti] Several publications about role conflict and/or role abandonment have appeared since testimony was originally submitted in these hearings in 1983.

Since then I myself have published two articles on this issue, "Role Conflict and Abandonment in Emergency Workers," Emergency Management Review 2(1):20-22 (1984) and "Emergency Role Performance in Disaster Response Organizations," Environmental Sociology, 42:6-10 (1985). These are little different from each other and little different from my 1983 testimony and its conclusions. The essential point is that emergency workers who have a clear perception of their emergency roles do their jobs in emergencies. The reason is that they use many ways to resolve role conflict other than abandoning their emergency roles.

A recent attempt to summarize findings in the field of disaster research has been provided by Thomas E. Drabek, Human System Responses to Disaster: An Inventory of Sociological Findings (New York:

Springer-Verlag, 1986). At page 145 he makes the following overview conclusion and citations regarding "role conflict" in emergencies:

A few early researchers, especially Killian (1952), proposed that helping behavior might be curbed at times by forms of "role conflict." That is, persons might experience conflicting obligations (Moore et al., 1963). Killian, in particular, argued that disasters would leave many with conflicts between family and organizational responsibilities. But subsequent research has recast the matter significantly (Mileti, Drabek, and Haas, 1975: 67-68). The conclusions of Dynes and Quarantelli appear to be on target (see also, the Proceedings from an NIMH-FEMA sponsored conference, Role Stressors and Supports For Emergency Workers, 1985).

ID2.5 "In our experience over the years, in over 100 disasters and in the course of interviewing over 2,500 different organizational officials, we found that role conflict was not a serious problem which creates a significant loss of manpower. . . . In fact, we have had difficulty in finding any illustrations of the phenomena, let alone documenting the pervasiveness of it" (Dynes and Quarantelli, 1976:237).

ID22.5a(H) [Three propositions as to why role abandonment is not found empirically:] "[1.] The total role structure, thus, becomes more coherently organized around a set of value priorities and, at the same time, irrelevant roles which could produce strain are eliminated until the emergency is over. [p. 239] . . . [2.] Because of the assurance that these organizational members on duty will remain, other organizational members not on duty have the reassurance that they have time to check personal and familial damage and also to engage in limited amounts of non-occupational role behavior before reporting. [p. 240] [3.] . . . family units can make internal allocative decisions which facilitate the assumption of various emergency roles on the part of various family members [e.g., wife may go to EOC with husband and serve as secretary] [p. 240]" (Dynes and Quarantelli, 1976:239-240). (See also

Dynes, 1970a:154-155; Instituut Voor Sociaal Onderzoek Van Het Nederlandse Volk Amsterdam, 1955; Form and Nosow, 1958:102.)

Drabek (at p. 30) also refers to Quarantelli as follows:

IIIA1.2 Role conflict experienced by organizational personnel does not precipitate role abandonment; the tendency is to remain on the job, often for too long. (Based on Quarantelli, 1982b:10.)

Reviewing a variety of studies of the type that I will summarize in the next chapter, Quarantelli concluded that organizational planners should recognize that what many fear rarely occurs. That is, upon learning of a disaster, personnel do not flock to their homes. If they reside in the impact area, however, efforts may be made to ascertain family member safety. Instead of role abandonment, ". . . there is a strong tendency for staff members to remain on the job too long, or to overuse all personnel concurrently" (Quarantelli, 1982b:10). Analytic qualities that might define "outlying" events wherein role abandonment may occur remain undefined and controversial.

A 1987 book chapter, "The Concept of Role in Disaster Research," by Russell Dynes also addresses "role conflict." Russell R. Dynes, Bruna de Marchi, and Carlo Penanda, Eds., Sociology of Disasters (Milan: Franco Angeli, 1987), 71-102. In that chapter (see pp. 80-85) Dynes reports on the findings of field experience by the Disaster Research Center regarding role abandonment by emergency workers. He reports the following:

The results . . . show that among those persons at work . . . none abandoned his/her emergency role responsibilities. About 15 percent engaged in search behavior at some time, most of that was done in connection with their job responsibilities (see pp. 82-84). . . . For those who were at home . . . , sixty-two percent were involved in what we called an active response, meaning that they quickly entered the emergency social system, either in their work role or in terms of some reaction to an emergency-created need. The rest were involved in what we called a passive response in that they did not take any immediate action to assume their organizational responsibilities. Such a stance, however, is not necessarily

inappropriate since most worked for organizations which followed a pattern of notifying them if they were needed for work. For those who were neither at work nor at home . . . eighty-two percent were involved in an active response, some went directly to work while others went home before they reported to work or stayed home to await notification (p. 84). . . . 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 familial-role obligations. For those who were at home, or away from home, or at the work site at the onset of the emergency, the most common response was to report to work, or to react in some fashion to needs created by the emergency. Of those persons who were not at work at the time of the emergency, some 28, or less than one percent of the sample, indicated some delay in reporting to work (p. 84).

Role conflict/abandonment was also considered as part of a comprehensive effort to assess issues and criticisms of evacuation planning for all hazards. This work was performed for the Federal Emergency Management Agency by Oak Ridge National Laboratory. See John H. Sorensen, Barbara M. Vogt, and Dennis S. Mileti, Evacuation: An Assessment of Planning and Research (Oak Ridge, Tennessee: Oak Ridge National Laboratory, 1987).

The conclusion reached (at page 147) is as follows:

Role abandonment has been a controversial issue for some hazards. Research suggests that total role abandonment has not been prevalent in disasters and certainly has not been dysfunctional in organizational behavior. Some people have hypothesized that role abandonment would be greater and likely problematic in a nuclear power plant accident or during a nuclear war threat. This remains somewhat speculative. Research suggests that in the former case there may be an increased potential for conflict and role strain, but emergency functions would not be threatened. In the latter case, the issue is highly uncertain. Additional research on role conflict would be confirmatory but is not of high priority.

A paper, "Role Conflict and Role Abandonment in Disasters: A Need for Empirical Reorientation," by Barbara J. Friedman was presented at the

Annual Meeting of the Eastern Sociological Society in April 1986. This paper is now part of the Preliminary Paper Series at the Disaster Research Center at the University of Delaware. This paper made several observations. Interestingly, at page 17 the author states the following: "In many respects Mileti's argument is very similiar and agreeable with the work done by Barton some twenty years earlier." The reference to my work is to my 1985 article in the Emergency Management Review (which is in essence the same as my 1983 testimony in these hearings); the reference to Barton's work is to his book Communities in Disaster, (A. Barton, Communities in Disaster (New York: Doubleday, 1969)), and to his original 1963 report, Social Organization Under Stress: A Sociological Review of Disaster Studies, for the National Academy of Sciences on which his Doubleday book is based.

The conclusions made by Friedman (see pages 22-26) can be paraphrased as follows. First, role conflict does exist during disasters and emergencies just as it does during normal times. Second, role conflict may increase or decrease during disaster, depending on how the researcher defines the term. Third, role conflict and role abandonment are not the same nor indicative of each other. Fourth, it is more than plausible that individuals use other methods of resolving role conflict in disasters besides role abandonment. Finally, future research should be directed at how individuals resolve role conflict in disaster, since many alternatives exist.

Barbara Vogt, a graduate student at the University of Tennessee, is doing a very comprehensive study of evacuations of special facilities. As an adjunct professor at the Univerity of Tennessee, I am on her dissertation committee. I asked her what she has found so far. She said that in general

about twice as many people show up to evacuate special facilities (nursing homes and hospitals) as there are people who need to be evacuated from them.

Finally, James H. Johnson, Jr., a witness for Suffolk County earlier in these proceedings, has published a 1985 article, "Role Conflict in a Radiological Emergency: The Case of Public School Teachers," in the Journal of Environmental Systems 15(1) (1985). This article is based on a survey during normal times of the behavioral intentions of teachers in California with respect to a future, as yet unexperienced emergency. The following conclusion is made on page 83 of this article:

Almost one-third of the teachers surveyed indicated that, under the conditions outlined in the nuclear reactor accident scenario, other loyalties or responsibilities would take precedence over assisting in a full scale evacuation of schools (Table 1).

Similarly, on page 87 of this article the author makes the following statement:

Nearly one-third of the teachers surveyed stated unequivocally that they would not assist in an emergency evacuation of schools. A strong sense of obligation to family in crisis situations and concern for personal safety appear to be the most important factors in distinguishing these teachers (group 2). . . .

These additional publications and research, except for Professor Johnson's, confirm the conclusions reached in our testimony in this proceeding in 1983 regarding the actual behavior of emergency workers and in no way suggest that those conclusions would be inapplicable to school bus drivers. In general, these conclusions are that emergency workers who have clearly defined emergency roles do not abandon their jobs. In other words, role clarity facilitates role performance.

We also concluded in 1983 that training is one means by which role clarity can be achieved. Nothing in the literature since 1983 changes this view; it is consistent with the empirical evidence and prevailing contemporary theory in disaster research.

Professor Johnson, on the other hand, represents a view that is incorrect for the reasons I gave in 1983 and in this testimony.

8. Q. What does this mean for regular school bus drivers in an emergency at Shoreham?

A. [Mileti] Although it is likely that regular bus drivers would understand their emergency job in an actual emergency, they have not yet been trained in the specifics of a radiological emergency, and consequently they have not been exposed to all the factors known to enhance role clarity and emergency role performance.

As a practical matter, however, this would not likely result in their abandoning school children evacuees. In a real emergency, most untrained bus drivers would undoubtedly realize what their role in a school evacuation would be because of the normative overlap between their routine daily job (driving school children to and from school in buses) and their emergency function (driving school children in buses in the evacuation), and then perform that role.

9. Q. Professor Cole has suggested (Deposition of Stephen Cole, Jan. 28, 1988 at 61-80) that bus drivers have low commitment to their jobs. I think the implication is that blue-collar workers or part-time employees or women are more likely to abandon their jobs than, say, police or firemen. What is your opinion of this?

A. [Lindell] Work motivation -- people's willingness to expend effort to accomplish their assigned tasks -- is commonly considered to be of two types. The first of these is "intrinsic" motivation, which refers to rewards

inherent in the work itself. Intrinsic motivation comes from factors such as the challenge provided by the job or from its significance -- the degree to which it "makes a difference." In "extrinsic" motivation, on the other hand, the rewards comes from external inducements such as money and the social approval of others.

The Intervenor's witnesses appear to be saying that in normal circumstances school bus drivers are not likely to be highly committed to their jobs because these jobs provide little intrinsic (job significance) or extrinsic (money or social recognition) reward for performance. But this would not be so in an emergency. The opportunity to play an instrumental role in removing school children from potential danger would have high significance and would be likely to earn these drivers an unusual amount of social approval. So whatever the levels of commitment to their duties these bus drivers may have in normal situations, they are likely to have a high level of motivation to accomplish their tasks under emergency conditions.

[Mileti] There are many different classifications or ways to categorize people (male vs. female, blue-collar workers vs. white-collar, part-time vs. full-time employees, and so on). It is no surprise that sociologists have thought of an elaborate list of such distinctions and then shown that such distinctions correlate with behavior.

This approach to the study of human behavior is labeled "role theory" and is based on the premise that a person's position in a complex stratified modern society influences his behavior. A social psychological explanation or interpretation of the same premise would be, for example, that women are socialized into different roles and adhere to different values and norms from men, perceive the world differently from men, and consequently behave differently from men.

There is an empirical basis for "role theory" regardless of whether one adheres to a sociological or a social psychological interpretation. Typically social categories such as sex and occupational status do correlate with observed variation in human behavior. These statistical correlations are often somewhat weak; they rarely exceed .30 or .35 at best, which suggests that the social category can explain perhaps as much as 9% to 12% of the variance in the human behavior being observed. Also, statistical correlations, particularly weak ones, do not constitute evidence of cause and effect.

Factors such as sex (male vs. female), occupational prestige (blue collar vs. white collar), and employment (full-time vs. part-time), as well as other social categories, might well be found in any particular emergency to correlate with observed variation in behavior in a general public. For example, these categories would likely correlate weakly with the rate at which people in the general public volunteered for emergency response work. For example, Professor Barton has showed that males volunteer more frequently than females. See Barton, Communities in Disaster, at 82-83.

The correlation of social categories with behavior does not necessarily hold, however, for specialized behavior of specialized populations such as emergency workers. Occupational prestige (blue collar vs. white collar) weakly correlates with volunteering from the general public for emergency work, but it does not correlate with variation in performing emergency work by emergency workers. Sex (male vs. female) does correlate with volunteering from the general public for emergency work, but it does not correlate with variation in performing emergency work by emergency

workers. The same is true for employment status (full- or part-time). The reason is that role clarity or specification, not social category, determines the behavior of emergency workers.

In simple terms, less educated, part-time blue-collar females do their emergency work for the same reason that better educated, full-time white-collar males do: role clarity exists.

The notion that being a part-time bus driver (a blue collar worker) is just a job (particularly to women who are more inclined to be interested in other things) is not a surprising opinion. It might be expected to be found among full-time employed, well-educated males in nonemergency times. But it is not likely to characterize the viewpoint of emergency bus drivers during an emergency, be they male or female. The reason is that emergencies re-prioritize the elements of social life and place emphasis on those that are central to health and safety. In such a context, the social system would elevate to prime status the task of evacuating school children. What may now to some appear to be "just a job" would take precedence in an actual emergency over most other routine aspects of social life.

10. Q. Dr. Lindell, does the literature of social psychology tell us anything about the issue of bus driver role abandonment?
- A. [Lindell] Yes it does. The literature suggests that those who are trained as bus drivers and who normally drive school children, quite aside from feeling obligated to help in an emergency, are likely to want to help. This conclusion is based on the results of studies on "bystander intervention" that are cited in most introductory social psychology texts, as well as more advanced sources, such as a book by Piliavin, Dovidio, Gaertner, and Clark,

Emergency Intervention (New York: Academic Press, 1981). Deaux's and Wrightsman's Social Psychology in the 80's, for example, contains a chapter that reviews a number of studies of bystander intervention, which can be defined as actions taken by an onlooker to help the victim of an emergency. Deaux and Wrightsman, Social Psychology in the 80's, 4th ed. (Monterey, Calif.: Brooks-Cole Publishing Co., 1984). Bystander intervention involves behavior that is voluntary and which benefits the victim more than the helper.

11. Q. What precisely does the research tell us?

A. [Lindell] Research on bystander intervention has shown that people are motivated to become involved when they see that others have a need that arises from a personal emergency. This research has identified a number of characteristics of the victim, the helper, and the situation that influence whether and how the helper becomes involved.

In general, the factors identified by this body of research are consistent with the idea that bus drivers are likely to be motivated to involve themselves in evacuating school children. The attributes of the victim that tend to invoke the helping response are the following:

1. The need is temporary and basic (i.e., the victim's safety is at risk).
2. The victims are blameless and unable to help themselves.
3. The victims are attractive (especially children) rather than stigmatized (e.g., convicts).

The attributes of the helper that promote the helping response are the following:

1. The helper has the ability to act (for example, the helper is not ill), especially a special competence to act.

2. The helper has a perceived obligation to act.

These are all factors that facilitate a response by the helper. The need to evacuate is temporary; the need is basic (safety); the school children are blameless and unable to evacuate by themselves; they are attractive; and most bus drivers would be able to act and would perceive themselves as having special competence to do so.

The last relevant factor is diffusion of responsibility. If a person feels that he has no more responsibility for a victim than any of a number of other would-be helpers, then his feeling of obligation to help is diminished. Conversely, if a bus driver feels that alternative sources of assistance are not readily available and that there are not others who are as qualified or more qualified as he is, then he is more likely to be motivated to involve himself in contributing to a resolution of the emergency. It is likely that bus drivers whose ordinary job is to drive children would feel especially qualified.

12. Q. Is there anything else?

A. [Lindell] Yes. In addition, as noted above, there is "extrinsic" motivation to help.

13. Q. What do you mean by extrinsic motivation?

A. [Lindell] As contrasted to the "intrinsic" desire to help others, explained above, extrinsic motivation comes from the expectation of the bus driver's employer and community.

The extrinsic motivators are rewards and punishments administered by external sources. In the case of the bus companies' management, an extrinsic motivation to perform arises from managers' ability to monitor bus

drivers' performance of their tasks and willingness to administer rewards for compliance or sanctions for noncompliance with expectations.

Another source of extrinsic motivation would come from the members of the community at large, and specifically the parents of the school children. To the extent that they perceive the bus drivers as failing to act, even though the drivers have especial competence to do so, these parents are likely to be vocal in their disapproval of the bus drivers' failure to act. Conversely, bus drivers who do help evacuate school children are likely to receive social approval, especially by the parents.

[Crocker, Lindell, Milet] In a real emergency, it would not be just LILCO wanting school bus drivers to drive. Suffolk County and New York State would also be making a "best efforts" response, and they would want the school bus drivers to drive. The school districts would want them to drive. The bus companies would want them to drive. And the community would want them to drive.

14. Q. But Professor Turner says that the community will eventually approve those who protect their own families, even if that means abandoning school children (Deposition of Ralph H. Turner, Feb. 26, 1988 at 27-29).
- A. [Lindell] The community may well tolerate bus drivers going to the aid of their own families. But it is hard to believe they will actually approve their failing to act in their area of special competence, where the bus drivers have a special skill.

Also, Professor Turner's analysis applies in the long run. In the short run (that is, during an accident) what will be obvious is that the bus drivers have the ability to move the children from a place of danger to a place of safety. That is what would be salient at the time of the emergency.

[Mileti] The community's reaction would depend on the plight of the driver's family. The community would indeed be tolerant of a bus driver who left his job to protect a family that was threatened in a direct, drastic way. The community would be much less tolerant of a bus driver who left to be with his relatively unthreatened family and in doing so left threatened school children to shift for themselves.

15. Q. Are you saying that LILCO can rely on nothing more than this tendency of bystanders to intervene in personal emergencies?

A. [Lindell] No, the motivation of bystanders to help is an important factor, but there are other factors that should be considered as well.

The studies of bystander intervention have focused largely on individual, rather than communitywide, emergencies. A communitywide emergency requires an effective organizational mechanism by which to translate high levels of individual motivation into effective communitywide action. This means there should be an effective organizational design that includes planning and training.

16. Q. Have you read Allen Barton's book Communities in Disaster (1969)?

A. [Mileti] Yes, and I do not think Professor Barton and I differ on the essential points. Consider this passage from his book:

The results of [Meda] White's study need careful checking in additional disaster situations, both to overcome the problem of eight-year retrospection and to cover systematically cases of other types, including the Texas City type, where the distribution of certainties is different. 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 disaster -- exemplified by the Texas City 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

detectable extent of radiation might create a certainty of family danger over a wide area, similar to the Texas City situation.

A. Barton, Communities in Disaster (New York: Doubleday, 1969), 120 (emphasis in original).

The "conditions" that prevailed in the Texas City explosion are also described in Professor Barton's book:

This finding [Meda White's] contradicts the conclusion that has frequently been drawn from the Killian study. White finds an explanation in the unusual ecology of the Texas City disaster studied by Killian: the workers' homes were next to the dock area where the ship exploded. These homes caught fire, and the workers could see that they had caught fire. The distribution of members in the typology of role conflicts was thus heavy in the direct, drastic conflict that is totally missing in White's interviews from the three tornado cities, with their long, narrow strips of destruction surrounded by safe areas.

Id. at 119-20.

[Lindell, Mileti] We believe that the difference between Professor Barton's and Turner's conclusion that a significant level of role abandonment would occur and our conclusion that role abandonment would not be a problem can be accounted for by the difference in the nature of the radiological emergency that is being assumed. We agree with them that bus drivers might not drive buses if a radiological plume threatened their families in a "direct, drastic" way similar to that of a person seeing his own house on fire.

[Crocker, Lindell] However, to assume that such a threat would inevitably occur during a radiological emergency is quite inconsistent with the results of reactor accident consequence analyses.

[Mileti] The difference between the Texas City type of situation and a radiological emergency is this. If a worker sees his house on fire and thinks his family is inside, he is likely to think that there is something he could do to help, if he were there, that his family could not do by itself. In a radiological emergency, if the worker's house were immersed in a radioactive plume, the appropriate protective action would be to shelter or to evacuate. Most workers' families can take those actions with or without the worker's being present.

17. Q. How do you think the Licensing Board should resolve this issue?

A. [Lindell, Mileti] Suffolk County has drawn a conclusion, based on the fact that people care about their families and fear radiation and on their reading of early disaster research and role theory literature. We have a contrary conclusion, based on more recent and more pertinent literature on role abandonment and upon a more accurate understanding of the nature of the radiological emergency -- as portrayed by reactor accident consequence analyses.

The best way to resolve the dispute is to look at empirical data in light of the current literature. The history of science is replete with examples of false theories that were thought to be true for a long time, until they fell in the face of empirical data. If one finds that many bus drivers have abandoned their jobs in real-life emergencies, it tends to support Suffolk County. If one finds no such thing, it supports LILCO.

B. Empirical Data

18. Q. Have any of you witnessed, or heard of, role abandonment in real emergencies in which you were involved?

A. [Crocker] No. As Hurricane Gloria approached Long Island in September 1985 LILCO activated two of its emergency response organizations. The SNPS Emergency Response Organization (ERO) and the Emergency Restoration Organization were called out in advance of the hurricane's arrival to wait out the storm at their duty posts. This represented approximately 120 people in the SNPS ERO and 2200 people from the Restoration Organization. Hurricane Gloria made landfall on Long Island at approximately 10:30 a.m. By 8:00 a.m., 1115 people were stationed at 102 substations across Long Island to ride out the storm and then perform the prompt initial damage survey immediately after the storm. An 1100 additional personnel assigned to line crews waited at their normal dispatch centers for the storm to pass. All these personnel left their families to cope with the hurricane while they performed their emergency functions. As far as we know, there were no cases in which LILCO personnel did not report due to family concerns.

Also, none of the approximately 46 emergency planning professionals in LERIO, who have a total of approximately 176 person-years' experience, knows of any actual case of role abandonment in an emergency.

[Kelly] No. As mentioned earlier in my testimony, I have been involved in many natural and technological emergencies. At the state level, I never observed or heard of any instances of role abandonment. I also never heard of instances of role abandonment at the local response level.

[Lindell] No.

[Mileti] No, except as follows. When I was inquiring about role conflict in Japan for my testimony earlier in this proceeding, I did hear anecdotes describing medical personnel who at first attempted to treat victims but then gave up the attempt. These stories, if true, are explained by the unusual nature of the Hiroshima disaster. It was unusual because it resulted in almost total physical destruction. The bomb destroyed all emergency response organizations in the community. What this means is that the only emergency response available was from volunteers. The small percentage of persons with skills relevant to the post-impact situation (for example, doctors and nurses) did volunteer to perform emergency duties, but some of them were overwhelmed and gave up the effort.

19. Q. Have you looked for actual cases of role abandonment?

[Kelly, Lindell, Mileti] Yes.

[Kelly] At LILCO's request, I reviewed information on fifty U.S. evacuations. I had previously collected the information for a project for another client which was unrelated to this project. For that project I narrowed the set of evacuations to 50 based on the following factors: size, type, geographic location, proximity to a nuclear power plant, special problems, and location type (population density). The goal of this narrowing process was to select 50 incidents that tended to entail large, quickly developing, problem-laden evacuations in densely populated areas, particularly if they occurred near a nuclear power plant.

After reviewing the documentation on these 50 cases, I identified 16 large-scale evacuations in which buses had been used to evacuate people. I reviewed secondary sources such as the following:

- articles from major media sources (AP, UPI)
- local newspaper clippings
- after-action reports
- communications logs
- police/emergency services reports
- sociology reports

A review of these secondary sources revealed no evidence that any bus driver had failed to drive. This study is documented in Attachment E to this testimony.

Since that study was completed, I have identified three additional evacuations in which buses were used, making a total of 19.

20. Q. Isn't it possible that there might have been cases of role abandonment that the secondary sources didn't pick up?

A. [Lindell, Milet] It is unlikely. Newspapers are quick to publish reports of looting and panic even when they don't occur. See Cordaro et al., ff. Tr. 832, at 79. Defections of emergency workers would be "news"; if there were even unsubstantiated rumors of such a thing happening, the newspapers would likely mention it.

21. Q. Did you gather any other information?

A. [Kelly, Lindell, Milet] Yes. To gather additional information, Bob Kelly and people under his supervision phoned knowledgeable people who had emergency responsibility at each of the 19 disasters. Two separate studies were done. The first surveyed organizational respondents and the second surveyed bus drivers who actually responded to these emergencies. The survey instrument used in the first study is Attachment F to this testimony

and the results of that study is Attachment G. The survey instrument for the bus driver study is Attachment H and its results are found at Attachment I to this testimony.

Of the 19 evacuations investigated, 17 involved technological hazards and two involved natural hazards. The evacuations involved from 1000 to 300,000 people. Most of the evacuations involved the use of buses to evacuate non-school populations; although, four involved the evacuation of two to seven schools.

22. Q. What did the organizational respondents study find?

A. [Kelly, Lindell, Mileti] The completed surveys of the 19 cases showed that all people who needed to be evacuated were in fact evacuated in time. There were no instances of role abandonment by bus drivers. Pertinent findings include the following:

- There were no refusals to drive the buses by any notified bus drivers.
- All bus drivers reported for duty after being contacted. In the Nanticoke incident, one woman was determined to drive an evacuation bus because she thought it was her civic duty -- despite her husband's protests. In Marysville, two "mechanics" could not physically make it to the bus yard but proceeded to a nearby rest home to assist in its evacuation.
- With the exception of one case, no bus driver arrived late for duty. In the one exception, one bus company in the Marysville incident reported that 1 or 2% of the drivers were delayed due to traffic congestion.

- After receiving the duty call, no bus drivers helped evacuate their families before showing up for duty, despite the fact that in nine evacuations, 5% to 100% of the drivers had families in the area at risk during the emergency.
- There were no reports of bus drivers not doing their job as well as they could have.
- In seven of the 19 evacuations, bus drivers did not know beforehand that they had an emergency role.
- In all of the evacuations, there were enough drivers to drive evacuation buses. In Denver, rosters of evacuation bus drivers have been prepared as a standard emergency preparedness procedure. Bus drivers wanted to participate in evacuations and volunteered to do it.
- In all cases everyone who needed to be evacuated was evacuated.

There were a few isolated instances of problems such as traffic congestion, and difficulties in contacting drivers due to busy telephone circuits, but in no case did these problems have a negative impact on the outcome of the evacuation.

23. Q. What did you find out from the Bus Driver Interview Study?

A. [Kelly] By the time we wrote this testimony we were able to reach 27 bus drivers who had participated in ten of the 19 evacuation cases we studied.

[Kelly, Lindell, Miletic] We found that the data collected from the bus drivers are in line with the data we collected in the organizational respondents study. No bus drivers refused to drive buses during the evacuation

and only two drivers reported doing something else before beginning their bus driver functions. As to these two drivers, the first driver reported a few minutes later and the other 20 minutes later. We have summarized some of our findings below.

Eighteen of the 27 respondents had other family members at home when they received the activation message (Question 11). Nine of the 18 answered Question 7 about whether they thought their household would be threatened by the hazard agent. Seven of the respondents in this group said that the danger to their homes was either extremely or very likely or even odds. Even with this perceived danger to their households, six of the seven proceeded immediately with their bus driver duties (i.e., reported to drive or called other drivers). The one exception in this group took an extra 20 minutes to evacuate her children before reporting to drive an evacuation bus.

With respect to the nine respondents who did not answer the question about the perceived degree of danger to their household, we found the following:

- Two respondents said their families were closer to the impact area than they were (Question 10). Nonetheless, both went directly to the reporting location after being called.
- Two bus drivers said they were with their families in the impact area at the time they received the activation message (Question 10). One driver made arrangements for his family to evacuate and then reported to work a "few minutes" later. The other respondent said he felt a great sense of personal responsibility to help his family by staying at home but instead "gave instruction to [his] son to

evacuate the family." This driver said he "felt [his] obligation [was] to drive the bus and felt [his] son could evacuate the family."

- The remaining five reported that they were with their families outside the impact area or were closer to the impact area than their families were (Question 10). All respondents felt their families could protect themselves and felt either no sense or some sense of responsibility to stay home with their families (Questions 13 and 12).

We also discovered that 12 of the 27 respondents felt that to a "great extent" "those in the risk area would be protected even if [the bus drivers] did not go to help" them (Question 15). Notwithstanding this fact, all bus drivers directly reported to drive or helped call out other drivers. Eight of those drivers reported even though they had families at home (Question 11). Of these eight, four reported even though there was a perceived threat to their household (a threat perceived as extremely or very likely or even odds) (Question 7).

Seven of the 27 drivers reported that, according to the activation message, the people who needed to be evacuated were in only slight danger or that the message indicated no clear sense of threat (Question 3). Nonetheless, six of the bus drivers responded immediately and one driver reported after a "few minutes" (during which he prepared his family to evacuate). Of this group, four of the seven had family at home and two of the four lived in the impact area (Question 10) and one felt that it was very likely that her home would be threatened (Question 7).

24. Q. Did you find out anything about the level of training these bus drivers had?

A. [Kelly, Lindell, Milet] Yes, we did. Seven of the 27 drivers said that they had received no emergency training about their evacuation bus driver role before the emergency began (Question 23). (One said he had received minimal training then later said he hadn't received any.) All reported to drive directly, or, in one case, in a few minutes. This was true even for four of the respondents who had families at home.

Ten of the drivers said they had received a minimal amount of emergency training beforehand (Question 23). The training included first aid or CPR training (three respondents), "flood evacuation training" (one respondent), how to operate a wheel chair lift (one respondent), and disaster and evacuation training by the fire department (one respondent). One respondent said she received training at the bus garage during the emergency and another said she was "just told [she] might have to drive." Only one respondent in this category had "in-service training with film strips."

The remaining ten drivers said that they had received a moderate or a great amount of training beforehand. This training included school evacuation and fire drills (three respondents), use of special equipment (oxygen masks and jump suits) (two respondents), and regular school bus driver training (one respondent). Others reported that they train once, twice, or three times a year.

25. Q. Did you look anywhere else for cases of role abandonment?

A. [Kelly] Yes. Since November 1986 FEMA has encouraged local jurisdictions involved in major emergencies to evaluate the strengths and weaknesses of their emergency response operations by completing a Disaster

Response Questionnaire (DRQ). Among other things, these DRQ's are used to report problems encountered during emergencies.

I phoned FEMA headquarters to find out whether the DRQ's show role abandonment to be a significant problem in past emergencies. The person I talked to at FEMA made a quick review of the "problems" section of the DRQ's FEMA has on file and told me that he found nothing to suggest that role abandonment has been a problem.

26. Q. But the Intervenor will claim that radiological emergencies are different.
- A. [Mileti] Yes, but we addressed their theory of the uniqueness of radiation fully in 1983, Cordaro et al., ff. Tr. 832, at 93-98; Cordaro et al., ff. Tr. 1470, at 112-15, and again last summer in the Reception Centers remand proceeding, LILCO Ex. 1 (Crocker et al. direct testimony) at 20-23, 25-29.

If one is inclined to take their theory seriously, he should look at the empirical data from radiological emergencies, Three Mile Island and Ginna being the principal candidates. (In 1983 we addressed Hiroshima and Nagasaki as well. Cordaro et al., ff. Tr. 832, at 46-51.)

Three Mile Island was perhaps the "worst case" for producing role conflict. Risk information was terrible; offsite emergency plans were poor or nonexistent; the Catholic Church granted general absolution of sins, presumably on the theory that many people would die; and the expert agency (the NRC) predicted that the reactor would explode, which probably meant a nuclear bomb-type explosion to many people. Yet, as we testified in 1983, there is no evidence of role abandonment by emergency workers at TMI. Cordaro et al., ff. Tr. 832, at 73-76.

27. Q. Professors Cole, Zeigler, and Johnson, in their testimony in the Seabrook proceeding, cited a number of papers about shortages of medical personnel during the Three Mile Island accident. Do these demonstrate role abandonment?
- A. [Mileti] Earlier in these hearings LILCO (Cordaro et al., ff. Tr. 832, at 72, 83-85) and Suffolk County witnesses discussed several publications that, on the surface, appeared to reveal role abandonment by hospital workers during the Three Mile Island accident. See, for example, Christopher Maxwell, "Hospital Organizational Response to the Nuclear Accident at Three Mile Island: Implications for Future-Orientated Disaster Planning," American Journal of Public Health 72(3): 275-79 (1982); J. Stanley Smith, Jr., and James H. Fisher, "Three Mile Island: The Silent Disaster," Journal of the American Medical Association 245(16): 1656-59 (1981); Gordon K. Macleod, "Some Public Health Lessons from Three Mile Island: A Case Study in Chaos," AMBIO 10(1): 18-23 (1981).

Other publications apparently reach the same general conclusion. See, for example, Dennis L. Breo, "Nuclear Scare Tests Hospital's Disaster Plan," Hospitals, J.A.H.A., (1 May): 33-36 (1979); K. Haglund, "At Hershey: Medical Systems Near Failure During Three Mile Island," New Physician 28(6): 24-25 (1979); E. Kuntz, "Hospitals Prepare Radiation Plans in Wake of Nuclear Plant Accident," Modern Healthcare (9 July): 16 (1979); E. Kuntz, "Ready to Evacuate Area? Nuclear and Chemical Accidents Test Hospital Disaster Plans," Modern Healthcare (May): 14-16 (1979); Stanislav V. Kasl, Rupert F. Chisholm, and Brenda Eskenazi, "The Impact of the Accident at the Three Mile Island On the Behavior and Well-Being of Nuclear Workers, Part I: Perceptions and Evaluations, Behavioral Responses and Work-Related Attitudes and Feelings," American Journal of Public Health 71(5): 472-83 (1981); Stanislav V. Kasl, Rupert F. Chisholm and Brenda

Eskenazi, "The Impact of the Accident at the Three Mile Island on the Behavior and Well-Being of Nuclear Workers, Part II: Job Tension, Psychophysiological Symptoms, and Indices of Distress," American Journal of Public Health 71(5): 484-95 (1981); William A. Weidner, Kenneth L. Miller, Robert F. Latshaw, and G. Victor Rohrer, "The Impact of a Nuclear Crisis on a Radiology Department," Radiology 135 (June): 717-23 (1980); William E. DeMuth, Jr., and Joseph J. Trautlein, "The Luck of Three Mile Island," The Journal of Trauma 19: 792-94 (1979); and others.

These publications do not, however, reveal role abandonment by emergency workers during the Three Mile Island accident. They document the need for emergency planning at hospitals for emergency response in which the hospital is a "victim." At no time during Three Mile Island was there a medical emergency. Hospital workers who were off for the weekend or in San Francisco at a convention did not abandon emergency roles by not inventing one during the accident.

Suffolk County witnesses have also pointed to a publication by the Pennsylvania National Guard (After Action Report: Three Mile Island Nuclear Incident (Pennsylvania: Department of Military Affairs, 1979)) as evidence of role abandonment by national guardsmen during the accident. In fact, this report states the following at page 12:

a. Personnel. A review of personnel problems of PNG personnel revealed that an evacuation could have resulted in significant conflicts between personal responsibility to the members family and the individual responsibility to the PNG when mobilized to deal with the emergency. This was evidenced when many Guard personnel residing in the immediate vicinity of TMI could not be contacted during the condition white of the operation. It was later learned that many personnel evacuated their families from the area before being notified of possible NG participation. These problems were compounded when the radius of the area to be evacuated increased from five to ten and eventually 20

miles. Additional complications could have resulted from the confusion and frustration of a direct mass evacuation.

It is difficult to understand how guardsmen who evacuated with their families can be cast as persons who abandoned their emergency roles, since those roles were not activated when their evacuation occurred.

28. Q. Does the experience at Chernobyl tell us anything?

A. [Mileti] We must make the usual caveats that (1) the Soviets do not freely make information available, (2) their culture is different from ours, and (3) no one of whom we are aware has done systematic research on human behavior at Chernobyl. We can say, however, that many people were evacuated from the Chernobyl accident. Reportedly city buses from Kiev were used:

Soviet officials began to evacuate the local population in the town of Pripyat about 36 hours after the explosion. The evacuation was carried out by 1,100 city buses brought in from Kiev, 130 kilometers to the south. The town of Chernobyl was evacuated beginning May 2.

C. Hohenemser, M. Deicher, A. Ernst, H. Hofsass, G. Linder, and E. Recknagel, "Chernobyl: An Early Report," Environment 28(5): 6-13, 30-43 (1986), at 13. We have been able to find no evidence that any Soviet bus driver failed to perform. In fact, all we have been able to find on the point is the following:

The revelation [by Pravda] that 1,100 buses were marshaled for the evacuation was coupled with the assertion that no Kiev driver refused to volunteer, and the fact that 92,000 people were evacuated was couched in an account of the care taken of the refugees.

Serge Schmemmann, "Reporter's Notebook: Bit by Bit, Soviet Gets News," New York Times, 14 May 1986, Section A, p. 10, col. 3. There were also

reports of some officials shirking their duties, of firemen displaying extraordinary heroism, and of discontent and strikes by Estonians conscripted to decontaminate the area. But nothing that we can find suggests role abandonment by bus drivers.

29. Q. But if the bus drivers came from Kiev, their families wouldn't have been in danger.

A. [Lindell, Milet] Yes. But, as we testified last summer, people in Kiev were advised to keep their windows closed and wash their fruits and vegetables. LILCO Ex. 1 (Crocker et al. direct testimony) at 22 in the Reception Centers remand proceeding (June-July 1987). We were responding to a County witness's claim in her deposition (which she did not offer in her written testimony) that there had been a "near riot" at the Kiev train station. Id. at 26. Apparently people did perceive that there was a radiological risk in Kiev.

30. Q. Newspaper articles don't count as scientifically reliable data, do they?

A. [Lindell, Milet] No. But there are no scientifically sound, reliable reports of role abandonment in radiological emergencies. We have therefore looked for any reports of role abandonment at Chernobyl -- even if they are of uncertain reliability -- and still we find few or none.

[Milet] In the same spirit, we have looked for anecdotal accounts of role abandonment in other radiological emergencies, and again we find few reports at all and none that is reliable. There have been several radiological accidents; some of them may not have required an offsite emergency response but did require an emergency response of some sort. Examples are the NRX reactor accident at Chalk River, Canada in 1952; the Windscale

fire in England in 1957; the SL-1 accident in Idaho in 1961; the Fermi Unit 1 accident in Detroit in 1966; the Browns Ferry fire in 1975; the rupture of a cylinder of UF₆ at the Sequoyah Fuels Facility in Gore, Oklahoma in 1986; and contamination by cesium-137 in Goiania, Brazil in 1987.

The only thing we have found suggesting "role conflict" in these events is a popular account that a reporter interviewed a scientist who had packed his wife and children off when the fire broke out at the Windscale plant. See John G. Fuller, We Almost Lost Detroit (New York: Reader's Digest Press, 1975), 85. For obvious reasons, we have reason to doubt even this report.

31. Q. Professor Cole mentioned a case of a policeman who had abandoned his role.
- A. [Mileti] I am aware of that case. It was so remarkable it was featured on the Phil Donahue Show.

As I recollect the television program, the policeman in question was assigned to man a desk and take phone calls during the emergency, which was a flood in Illinois. While performing his duties, the policeman phoned home to check on his wife and two young daughters. His wife told him that the floodwaters had covered the first story of their house and were rising; she had no one to help her evacuate. The policeman called several friends and relatives to help but reached none of them.

At this point the policeman asked his superior if he could leave to help his wife. The superior (who allegedly was looking for an excuse to fire this particular police officer) said no. The policeman left anyway to help his family. Reportedly, he intended to return to work after helping his family, but when he called the station, he was told he had been suspended.

This anecdote illustrates the process people typically go through in a "role conflict" situation. This police officer went through the usual steps:

1. He called his wife. Often the threatened spouse is able to evacuate without help, but in this unusual case she could not.
2. He called friends and relatives. Often there are others who can help the threatened spouse, but in this unusual case there were not.
3. He asked his boss if the organization could cover for him while he left temporarily. Usually the organization can.

In short, this case illustrates a highly improbable case in which all of the usual role conflict resolution mechanisms did not work. Moreover, the policeman's job (taking phone calls) may or may not have been essential to the emergency response, but it seems to have been of the type that others could cover.

Of course, an interview of this policeman on the Donahue Show, with his lawyer present, does not constitute good sociological data. If the facts are as stated, all the case of the policeman shows is that role abandonment can occur, which we have never denied.

32. Q. Will you summarize?

A. [Kelly, Lindell, Milet] If you look at the empirical facts, Suffolk County's theory of role conflict simply does not hold up.

In 19 cases of nonradiological emergencies in which real bus drivers were used to evacuate real people, no reports of role abandonment were found.

In the peacetime radiological emergencies that have been addressed in this proceeding (particularly Three Mile Island, Ginna, and Chernobyl) there is likewise no evidence of role abandonment such as Suffolk County predicts.

C. Polls

33. Q. Why do you say that measures of behavioral intentions (polls, for example) do not predict actual behavior?

A. [Mileti] I have repeatedly stated in testimony in these hearings that behavioral intentions poll data gathered in non-emergency times should not be taken as indicative of behavior in future, unexperienced actual emergencies. I will not repeat all the reasons I have already stated in prior testimony for why I hold this opinion. I would, however, like to give an empirical example of how pre-event behavior intentions did not match actual behavior when an event actually did occur.

I and several others conducted one of the largest, most elaborate, and perhaps best-funded surveys of behavioral intentions in relation to disasters or emergencies ever performed. This study sought to explore the impacts and response of people to a scientifically credible prediction or warning of an earthquake. We interviewed well over one hundred organizations and several hundred families to ask what people would do if scientists were to predict an earthquake. Our interview techniques were detailed and complex; they went to great lengths to present people with detailed scenarios and questions about behavioral intentions.

The interviews with families are illustrative. We interviewed families as a group. Prediction scenarios were tape recorded and even visually illustrated on flip-charts. We interviewed respondents in a face-to-face situation. We played the audio tapes that described the prediction at the same time that flip-charts illustrated the scenarios. At pre-designated points the audio and visual presentations were stopped, questions were asked, and behavioral intentions were measured.

Our study concluded that a scientifically credible earthquake prediction would result in large social and economic costs for society resulting from the response to the prediction. Subsequently, a "near-prediction" was actually issued. It was empirically studied by Professor Ralph Turner and colleagues to determine actual public response to this actual event. Their study did not document any behavior that supported the conclusion we had reached based on our behavioral intentions study. Professor Turner concluded, for example, that "the people of Los Angeles County showed few of the perverse effects that are often given as reasons for withholding soundly based but uncertain earthquake forecasts"; that there was an "absence of negative effects" (see Ralph H. Turner, "Waiting for Disaster: Changing Reactions to Earthquake Forecasts in Southern California," International Journal of Mass Emergencies and Disasters 1(2): 335, 334 (1983)); that "the earthquake threat was not salient in relation to other everyday concerns" (see Ralph H. Turner, "Individual and Group Response to Earthquake Prediction," paper presented to the International Symposium on Earthquake Prediction, Unesco Headquarters, Paris, p. 7 (26 Feb. 1987)); and that "[e]xcept for a great deal of informal discussion and attention to media reports and occasional massive minor waves, life went on as usual" (see Ralph H. Turner, Joanne M. Nigg, and Denise Heller Paz, Waiting for Disaster: Earthquake Watch in California (Los Angeles: University of California Press, 1986), 416).

There are many reasons why these two studies may have documented a wide gap between behavioral intentions and actual behavior. For example, behavioral intentions and behavior are different, particularly in regard to emergency behavior. Also, the prediction scenarios used in the study of

intentions differed from the prediction situation that actually occurred. Consequently, what people took into account or were thinking when they offered intentions was not an accurate estimate of what was operating in the actual situation when it was experienced. But that is precisely the point.

34. Q. What is your assessment of the practical significance of Stephen Cole's behavioral intention polls?

A. [Lindell, Milet] Suffolk County appears to have concluded that the reported intentions of respondents can be taken at face value -- that is, that the bus drivers do not presently intend to, nor will they in the future, drive buses to evacuate school children in a radiological emergency. We, and others, are mindful of the limitations of behavioral intentions data. As Gordon Wood has written:

Some people who claim that they would intervene in fact would do so. However, in other cases, the self-report procedure (relative measure) would yield a different set of results from the nonreactive measure obtained by actually staging a crisis. If you were to ask a number of people whether they would come to the aid of an elderly person being mugged, it is likely that a number of the respondents would indicate a willingness to help. We have no idea, however, whether they actually would help a victim in a real mugging. Imagine that a close relative (brother, sister) needs a kidney transplant. Would you be willing to donate one of your kidneys? Most of us are likely to say yes when the need is far distant (in a hypothetical situation). How many of us would actually give up a kidney? We simply do not know unless faced with the situation.

Gordon Wood, Fundamentals of Psychological Research, 3d ed. (Boston: Little, Brown and Co., 1981), 35. We believe, moreover, that there are other, more plausible interpretations of these data and their relevance to the LERO emergency plan.

35. Q. What are these alternative interpretations?

A. [Lindell, Mileti] One alternative explanation for these data is that the questions that were asked are assessing only the bus drivers' attitudes toward protecting their families. The fact that they have clear concerns about family safety does not mean that they would refuse to help in an actual emergency in the future.

Another alternative is that the survey questions are assessing the bus drivers' attitudes toward the utility company. The fact that the respondents have negative attitudes toward LILCO in normal circumstances does not imply that they would refuse to help children in an emergency. Both the social entity (LILCO vs. school children) and the situational referent (normal circumstances vs. an emergency) differ between the circumstances of questionnaire administration and the circumstances under which the action would be performed.

36. Q. Suppose that one were to accept the interpretation that the polls do in fact mean that bus drivers do not intend to cooperate. Doesn't this present a problem to LERO?

A. [Lindell, Mileti] Not necessarily, even if the bus drivers' current intention is to refuse to cooperate. In fact, Professor Cole's questionnaire itself has helped to communicate to bus drivers what behavior is expected of them in an emergency, and thus may help, however slightly, to clearly communicate the expectation that they drive an evacuation bus in a radiological emergency.

Moreover, a bus driver's present decision not to drive is not irreversible. Respondents may drive (and we believe that they are likely to drive) in an emergency even if they currently are not inclined to do so. The reason they would be inclined to participate in an emergency is the high

degree of helping behavior that has been demonstrated in emergencies, ranging in scope from minor individual emergencies to communitywide disasters involving threats to life and health.

In light of the evidence we have cited regarding the strong motivations that people have for helping in a broad range of emergencies, we are extremely skeptical that the role rejection that may have been expressed in order to prevent LILCO from obtaining an operating license would be extended into an emergency situation when the health and safety of school children would be at stake.

37. Q. What do you think of the methodology of the County's polls?

A. [Mileti] As I testified in 1983, I believe there are several methodological flaws in the way the questions are worded and the order in which they were asked. Cordaro et al., ff. Tr. 832, at 89-93. The 1983 testimony is Attachment J to this testimony.

[Lindell, Mileti] However, we think that focusing on such flaws in behavioral intention polls diverts attention from the main point, which is that such polls, no matter how well constructed, cannot predict actual behavior in future, unexperienced emergencies.

38. Q. Suffolk County witness Stephen Cole has conducted another firemen survey in March 1988. Do you have any comments on the new survey?

A. [Mileti] I was provided a copy of one of the survey answer forms only a few days ago, and thus I have not had time for an in-depth review. I do have a few comments though, based upon a necessarily brief review.

My first impression of Dr. Cole's new fireman survey is that it appears that the sorts of factors that scientific, empirical data have shown to be the determinants or causes of behavior in emergencies could not be operating in this survey of intentions. As a matter of fact, it appears that no attempt was made to have them operate in this poll at all. I do believe, however, that Dr. Cole agrees that these factors are important, because he did try to include some of these factors in the survey he presented last summer during the OL-5 exercise hearing.

39. Q. Could you give us some examples of what you mean by this?

A. [Mileti] Yes, I can. For example, Question 26 reads as follows:

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?

As this question shows, no attempt was made to simulate what would be going on during an evacuation. The respondent here doesn't have the benefit of the vast array of information that would be available to him during an emergency, such as EBS messages or what his supervisors would tell him. Also, in answering this question, the respondent has no idea what he would be doing, where he would be located in the 10-mile EPZ, or whether he would have special protective clothing or dosimetry, all of which would influence his opinion about how safe it was to be in the EPZ. To more accurately measure the fireman's behavioral intentions, the respondent should have been given more situation-specific factors before being asked to make any judgment about what he thought he might do in the situation.

Question 8 also has methodological flaws in it. First, this question presumes that people who have children in school will want to check on them. (Of course, we all believe that they would in absence of information about school children, but from a methodological standpoint it is incorrect to automatically assume this is so.) Second, this question also did not permit the respondents to take any other situational factors into consideration before stating their behavioral intentions. For example, the respondents weren't told that there are protective measures in place for school children.

Another flaw in Dr. Cole's most recent survey is evident in Question 6. This question asks the respondents what they would do first. The notion in this question of what they would do "first" precludes all other behavior (especially since the survey didn't inquire how long the "first" action would take or what the respondents would do next). The respondent is given no opportunity to respond that he would do more than one thing. In reality, though, if a person says he would make sure his family was safe first, that does not mean that he wouldn't report to work a few minutes later. The results from our bus driver interview study bear out this fact.

Also, Question 6 in Professor Cole's latest poll and its answers are confusing because the question has the respondent assuming at the start that he is already at work. But the first answer to this question has the respondent reporting to work. Why would the respondent pick this answer if he were already at work?

40. Q. Suffolk County's witnesses argue that emergency planners should use opinion polls in planning. What is your opinion?
- A. [Lindell, Miletì] If we accept their thesis, we conclude that planners

should provide more personnel than are necessary to carry out an emergency response because a large percentage of personnel will not be available because of role conflict. But the empirical fact, demonstrated in many past emergencies, is that there is often an oversupply of personnel. See Cordaro et al., ff. Tr. 832, at 17.

[Mileti] That is why I have advised against using opinion polls, at least in the way Suffolk County urges, for emergency planning. It is not just that they are unreliable; they are harmful. If believed, they focus the planner on the wrong problem -- indeed on a hypothetical problem that is the opposite of what actually happens in emergencies.

[Crocker:] Even in the unlikely event that regular school bus drivers were not available, LILCO has alternate provisions for evacuating school children. We have provided many additional bus drivers so that, even if we assume many defections by regular bus drivers, we can still get the job done, as I discuss in Part III of this testimony below.

41. Q. Apparently a number of school bus drivers on Long Island have signed statements saying that they "cannot and will not agree to drive a school bus in the event of an accident at Shoreham." Does this mean that the signers would in fact not help evacuate school children in a radiological emergency?

A. [Lindell, Mileti] No. It is likely that these statements, like Professor Cole's polls, reflect opposition to the utility or the nuclear plant rather than real future behavior.

[Mileti] I testified in 1983 that I had no doubt that school teachers could be found to come forward, in advance of an emergency, and say they would not help in an emergency. Cordaro et al., ff. Tr. 832, at 36. The same is

true of bus drivers. That does not mean these people would not drive in an emergency, no matter what they may say now.

[Lindell] It is possible that the bus drivers who signed the statements are slightly less likely than others to drive, because in a sense they have made a public "commitment" not to drive. To this small extent the soliciting of such statements may lessen the public safety. But this has little or nothing to do with "role conflict." More important, I would not expect this commitment to override the extrinsic and intrinsic motivation to drive that I discussed above.

D. Conclusion

42. Q. So what is your conclusion?

A. [Lindell] Whenever I have raised the hypothetical problem of role conflict with people associated with offsite preparedness for emergencies at nuclear power plants (for example, at a workshop for emergency planning personnel sponsored by General Public Utilities in the Three Mile Island area in 1985), reaction has ranged from surprise to indignation that anyone would think it would happen. Emergency planning professionals simply do not regard "role conflict" as a real problem in emergencies.

[Mileti] It is inconceivable to me that third-graders (for example) would be left on the curb with no transportation during a radiological emergency because their drivers had "role conflict" or for any other reason. I know of no scrap of empirical evidence that any such thing has ever happened in any emergency of any kind.

III. LILCO'S AUXILIARY SCHOOL BUS DRIVER PROCEDURE

43. Q. Mr. Crocker, would you please give us a brief overview of LERO's auxiliary school bus driver procedure?
- A. [Crocker] Yes. First of all, LILCO believes that the regular school bus drivers will do their job in an emergency. LERO provides enough LERO school bus drivers, however, to evacuate all public and private schools in the 10-mile EPZ around Shoreham in a single wave. With LERO's auxiliary school bus driver procedure, there will be a "backup" LERO school bus driver for every regular school bus driver. The LERO "backup" driver would drive a school bus only if a regular driver was unable to drive, or decided not to drive, during a Shoreham emergency. Also, there will be enough additional LERO auxiliary school bus drivers to drive the extra number of buses needed to evacuate all EPZ schools in a single wave. These extra drivers are referred to as "primary" LERO school bus drivers.

Briefly stated, LERO's procedure requires that all LERO auxiliary school bus drivers, that is both backup and primary drivers, will be called out to help evacuate schools during an emergency at Shoreham. They will report directly to pre-designated bus yards and (1), if they are "primary" bus drivers, they will pick up a bus and go directly to one of the schools or (2), if they are "backup" drivers, they will inform the bus company dispatcher that they are ready to drive an evacuation bus in place of a regular bus driver if they are needed. Once at the school, the LERO bus drivers will let the school officials in charge know that they are ready to help evacuate the school children. At the direction of school personnel, the LERO bus drivers will evacuate the children to safety.

44. Q. What do you mean by a "single-wave" evacuation?

A. [Crocker] A single-wave evacuation means that enough buses and drivers are allocated to each school to ensure that no driver makes more than one trip. As a result, all schools are evacuated as quickly as possible. This practice is consistent with the school evacuation plans for counties around other nuclear power plants in New York State.

45. Q. If LILCO believes that the regular school bus drivers will drive during a Shoreham emergency, why did LILCO develop this procedure?

A. [Crocker] LILCO developed its auxiliary school bus driver procedure to remove any lingering doubt that there won't be enough bus drivers to transport school children safely out of the EPZ. LILCO also developed this plan so that all EPZ schools could be evacuated as quickly as possible in a single wave.

46. Q. How many school bus drivers are needed to evacuate all schools in the EPZ in a single wave?

A. [Crocker] In all, 488 school bus drivers are needed to evacuate all public and private schools in the EPZ: 449 are needed for public schools, 15 for parochial schools, and 24 for nursery schools.

47. Q. How did LILCO arrive at these numbers?

A. [Crocker] For the public and parochial schools we first determined the population of each school, reduced that number by 5% for daily absences, and then further reduced the number for high schools by an additional 20% to account for students who would evacuate in their own cars or with someone else. Since the Longwood Junior High School is on split session, we also reduced its student population by half. The final number for each school is the number of students who might need to be evacuated by bus for

that school. For nursery schools we used the student population numbers given to us by the nursery schools themselves.

Next we calculated the number of buses needed to evacuate each school based on 40 students per bus for high school and 60 students per bus for lower grades. These bus capacities are standardly applied in the industry. The results of these calculations are Attachment K to this testimony.

48. Q. Why did you reduce the school populations by 5% for daily absences and by 20% for those students using other transportation?

A. [Crocker] These assumptions are the same assumptions litigated during the 1984 emergency planning hearings. See Cordaro et al., ff. Tr. 9154, Vol. II, at 55. LILCO believes they are still valid today. In 1984 all school populations were also reduced by 3% for split sessions. Since only one school is on split sessions, however, we reduced only that school's population number by half in our current calculations to more accurately reflect its population at any given time.

49. Q. How many regular school bus drivers are used by the school districts to transport students who go to school inside the 10-mile EPZ?

A. [Crocker] According to information LERO has been collecting over the past several months, there are approximately 301 regular school bus drivers contracted to or employed by the school districts to drive school buses for public and parochial schools in the EPZ. Parochial schools are figured into this number because public school districts regularly transport parochial school children. Attachment L to this testimony shows the breakdown of regular school bus drivers per school district.

Since nursery schools normally do not provide transportation for their students, LERO will provide all of their transportation needs unless

they decide to provide their own. This practice is consistent with earlier revisions of the LERO Plan. Recently one nursery school told us that it would provide its own transportation during a Shoreham emergency. Thus, LERO will not provide this school any additional transportation.

50. Q. How many LERO emergency workers will be auxiliary school bus drivers?

A. [Crocker] Presently LERO is training LERO emergency workers to be auxiliary school bus drivers. Once the training is completed, LERO expects to have 582 auxiliary school bus drivers to implement its school bus driver procedure. The number of drivers will be adjusted yearly according to current school-student populations to ensure that there are always enough bus drivers to do the job.

51. Q. How many of the LERO auxiliary school bus drivers live in the 10-mile EPZ?

A. [Crocker] I don't have an exact count of the number of LERO school bus drivers who live in the EPZ. In response to an interrogatory from Suffolk County, I asked my staff to figure a best estimation of the number based on the street addresses of all LERO school bus drivers. Based on that count, about 46 of 562 bus drivers recruited at that time live in the EPZ.

This number is conservatively high, because a LERO worker was considered to live in the EPZ if we were unsure from his address whether he lived just inside or just outside the boundary. Of course, some bus drivers who do not live in the EPZ may have relatives who do live in it. Conversely some drivers who live in the EPZ may have no family living in the EPZ. Consequently 46 of 562 is likely to be a slightly conservative estimate of the LERO drivers who might have family in the EPZ.

52. Q. If only 488 bus drivers are needed, why are there so many more when you add the number of LERO and regular bus drivers together?

A. [Crocker] In the interest of conservatism LERO customarily recruits more emergency workers than are needed, providing a 150% call-out for all of its LERO emergency worker positions. LERO's auxiliary school bus driver procedure has enough auxiliary school bus drivers to back up all 301 regular school bus drivers on a one-to-one basis. That covers 301 of the 488 bus driver positions needed for a one-wave evacuation, which, when counting both regular and LERO school bus drivers, provides 200% coverage for the 301 regular bus driver positions. The remaining 187 bus driver positions will be covered by the rest of the LERO school bus drivers; that is, 281 LERO drivers will fill the 187 positions. This provides 150% coverage for these positions.

53. Q. When and how would LERO mobilize the auxiliary school bus drivers?

A. [Crocker] According to page II-20a of the LERO Plan, which is Attachment M to this testimony, LERO will mobilize its school bus drivers if one of the following events occurs during an emergency at Shoreham:

- 1) LERO makes a recommendation to evacuate or shelter schools; or
- 2) A public school district decides not to dismiss early or cancel classes when recommended by LERO.

To mobilize the LERO school bus drivers, pagers would be set off to a selected group of bus drivers, who in turn would call the rest of the bus drivers. The callers would instruct the bus drivers to report to their pre-assigned bus company yard. This procedure is similar to how the rest of LERO's emergency workers are mobilized.

54. Q. How will the LERO school bus drivers know where to go?

A. [Crocker] LERO school bus drivers will be trained to report directly to a pre-designated bus yard.

55. Q. What will they do once they get to the bus yard?

A. [Crocker] LERO auxiliary school bus drivers will serve either as "backup" or "primary" drivers. A LERO "backup" driver will go to a pre-designated bus yard that normally services an EPZ school. Once there, he will tell the bus company dispatcher that he is available to drive a bus if any of the regular school bus drivers elect not to drive. A LERO "backup" driver will drive only if the bus company dispatcher directs him to. If the bus dispatcher asks the LERO driver to drive, the driver will select an Assignment Packet from the LERO box, put on dosimetry, and fill out the emergency worker dose record form. Then he will obtain a bus from the dispatcher and head to the school indicated in the Assignment Packet.

A "primary" LERO school bus driver will go directly to a pre-designated bus yard that does not normally service an EPZ school and select an Assignment Packet from the LERO box. After putting on dosimetry and completing the necessary forms in the packet, the LERO primary bus driver will request that a bus be provided to him according to existing contracts between LILCO and the bus company. He will then drive directly to the school indicated in the packet.

56. Q. Explain what the "LERO boxes" are and tell us where they will be kept.

A. [Crocker] LERO boxes contain the Assignment Packets that will be used by the bus drivers who will drive school evacuation buses during an emergency at Shoreham. The contents of the Assignment Packet is listed in the

"LERO School Bus Driver Procedure" which is Attachment N to this testimony. There will be a separate LERO box for each bus yard that normally serves an EPZ school and for each additional bus yard that LERO will use to supplement the number of buses needed for a single-wave evacuation. LERO boxes will be stored at each bus yard or will be brought to the bus yard at the beginning of the emergency if LERO has not received permission to keep it there. Almost all boxes will be kept at the bus yards however.

57. Q. How will the bus company dispatchers know what to do?

A. [Crocker] Each LERO box will contain instructions for the bus company dispatcher explaining what he should do. Also, LERO's procedures provide that the LERO bus coordinator in the EOC will explain the process to him over the phone on the day of the emergency. We also intend to explain LERO's procedure to the bus company dispatchers beforehand.

58. Q. How will the drivers know when to go to the schools?

A. [Crocker] LERO primary school bus drivers will go directly to the schools indicated in the Assignment Packets once they pick up their buses. A back-up LERO school bus driver will go to the school indicated in the Assignment Packet only after the bus company dispatcher asks for his help and assigns a bus to him.

59. Q. How do the auxiliary school bus drivers know how to get to the schools?

A. [Crocker] All LERO auxiliary school bus drivers will be trained, like all other LERO bus drivers, on which routes they must take. For example, road rallies and/or drills may be used. In addition, each Assignment Packet will contain a map to the evacuating school.

60. Q. What will they do at the schools?

A. [Crocker] Once at the schools, each LERO school bus driver will report to the school personnel coordinating the evacuation and tell them that he is a LERO bus driver ready to drive the school children out of the EPZ. At the direction of school personnel, the LERO bus driver will help load children onto the bus. Before leaving the school the LERO bus driver will request that a school staff member accompany the children. The regular school bus drivers will also help evacuate the schools in the same manner.

61. Q. Who will supervise the school children before and after getting on the bus?

A. [Crocker] Teachers and other school personnel will supervise the school children before getting on the bus in the same manner they do every day or during early dismissal. We expect that at least one teacher will accompany the children and provide supervision on each bus.

62. Q. Then what?

A. [Crocker] After the bus is loaded, the school bus drivers will drive to the school relocation center designated for that school in the Assignment Packet (or proceed to another facility, if directed to do so by the school personnel on the bus).

63. Q. How will the school personnel know what to do?

A. [Crocker] We continually offer training to the school districts and have repeatedly expressed our interest in discussing school evacuation plans with them. Furthermore, we intend to provide each school in the 10-mile EPZ with guidelines on what to do in the event of an emergency at Shoreham. Also, LERO's Public and Private School Coordinators in the EOC will talk with each public school district and private school during the emergency

about what is happening. In addition, each bus driver will be able to explain the evacuation procedures to school personnel.

64. Q. Why do you believe LERO school bus drivers are qualified to drive school buses during a Shoreham emergency?

A. [Crocker] LERO auxiliary school bus drivers are qualified to transport school children during a Shoreham emergency because they will have the necessary New York State Class 2 operator's license and will be trained in their job-specific and other emergency procedures. We do not believe that LERO's auxiliary school bus drivers would need any other training to transport children, since the evacuation would be a one-time occurrence and since at least one teacher would be on the bus to supervise the children.

65. Q. Are regular school bus drivers approved of by the school districts in the EPZ to drive school buses?

A. [Crocker] According to my staff, bus drivers must be approved before they can drive a bus for a particular school district, either as a regular school bus driver or as a substitute for a regular school bus driver. Various Suffolk County witnesses who are school officials have testified to this fact in their depositions.

66. Q. Will LERO school bus drivers receive the same type of approval? If not, why not?

A. [Crocker] No. LERO does not intend to obtain the school districts' approval for its auxiliary school bus drivers. LILCO does not believe that emergency workers who are used to evacuate schools in a radiological emergency need the approval of the school districts, since they are not being employed as regular or substitute school bus drivers and will drive school buses only in the event of an emergency at Shoreham. We do not

believe that the approval process was intended to apply to such an exceptional situation. Furthermore, if the concern raised here is about supervision, each bus will have at least one teacher on it to provide the necessary care and supervision.

67. Q. Do you know anything about how schools are evacuated in the counties around the other nuclear power plants in New York?

A. [Crocker] Yes. I asked one of LILCO's consultants, Mr. Richard Watts, to call all of the counties within the 10-mile EPZ's of the other nuclear power plants in New York State to find out how they evacuate schools in their EPZ's. The planners he talked with are from Monroe, Oswego, Orange, Putnam, Rockland, Wayne, and Westchester counties. Mr. Watts discovered that all counties evacuate schools in a single wave using both the school districts' regular school bus drivers and other available bus drivers from other bus companies that do not normally serve those schools. Mr. Watts also asked the counties if the additional "non-school" bus drivers were approved by the school districts. Basically, they responded that they had never heard of any requirement that the extra drivers needed the school districts' approval before driving during a radiological emergency.

68. Q. Why do you believe that the school districts in the EPZ will let LERO school bus drivers transport their children out of the EPZ during an emergency at Shoreham?

A. [Crocker, Kelly, Lindell, Milet] We believe that school authorities will use whatever resources are available to them to evacuate their schools. This means that the school districts would use LERO's buses and drivers as well as their own. To take any other course of action would go against the best interest of the children and might endanger their health and safety. If the school districts are concerned about adequate supervision of the

children on the buses, having teachers accompany the children resolves this concern.

69. Q. Will LILCO train regular school bus drivers to implement its school bus driver procedure?

A. [Crocker] LILCO has offered through the school districts to train all regular school bus drivers. This training would address emergency procedures, the drivers' emergency role as a bus driver, radiological information, provisions for families, information about Shoreham, and the use of dosimetry. Recently we offered the same training to the school bus drivers at two of the bus companies that service EPZ schools. That training will be coordinated through the bus companies. We intend to offer training through the other bus companies in the future.

Any regular bus driver who participates in LILCO's school bus driver program will be compensated for his time in training and will receive an annual bonus. In an emergency these drivers would also participate in LERO's family tracking system, and those with families living in the EPZ would be eligible to have their families stay at LERO family congregate care centers.

70. Q. What if a regular school bus driver wants to help with the evacuation but hasn't been trained in LILCO's procedures. How will she know what to do?

A. [Crocker] The bus company dispatcher will know in advance that regular school bus drivers should also use the Assignment Packets to determine what they need to do. So if the regular school bus drivers haven't been trained by LERO and want to help evacuate schools, the bus company dispatcher will tell them to take an Assignment Packet and help evacuate the school described in it. Also, the LERO auxiliary school bus drivers will help

the regular drivers understand what they need to do. If there are a sufficient number of drivers LERO drivers may accompany regular school bus drivers on their assignments.

71. Q. LERO drivers will have dosimetry. What will the regular bus drivers use?
- A. [Crocker] Dosimetry will be available in the LERO boxes for all school bus drivers. Each Assignment Packet will contain two direct reading dosimeters (DRD's) and two thermo-luminescent dosimeters (TLD's). LERO drivers, who will be fully trained in the use of these devices, will use the two DRD's and one of the TLD's. The other TLD will be used by the regular school bus driver who hasn't been trained in dosimetry, so that her exposure may be recorded.

In addition, each Assignment Packet will contain two potassium iodide (KI) tablets, one each for the LERO driver and the regular driver who might together fulfill the bus driver assignment.

72. Q. If, as LILCO believes, the regular bus drivers will assist in the evacuation, what will the extra "backup" drivers do?
- A. [Crocker] When all the required buses have been dispatched, the remaining LERO backup drivers will report to the Patchogue Staging Area for possible reassignment.
73. Q. Does this conclude your testimony?
- A. [Crocker, Kelly, Lindell, Milet] Yes.

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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)
) (School Bus Driver Issue)
)

ATTACHMENTS FOR
TESTIMONY OF DOUGLAS M. CROCKER,
ROBERT B. KELLY, MICHAEL K. LINDELL, AND
DENNIS S. MILETI ON THE REMANDED ISSUE
OF "ROLE CONFLICT" OF SCHOOL BUS DRIVERS

Hunton & Williams
707 East Main Street
P.O. Box 1535
Richmond, Virginia 23212

April 13, 1988

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"ROLE CONFLICT" OF SCHOOL BUS
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- K. "School Transportation Requirements For a One-Wave Evacuation" Chart
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- N. OPIP 3.6.5, Attachment 14, "LERO School Bus Driver Procedure" (Draft)

DOUGLAS M. CROCKER

MANAGER, NUCLEAR EMERGENCY PREPAREDNESS DIVISION
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EDUCATION

Stevens Institute of Technology - B.E. with Honor in Mechanical Engineering, 1972

State University of New York at Stony Brook - M.S. in Marine Environmental Science, 1978

Stone & Webster Radiological Safety Course

Medical Aspects of Radiological Emergencies Course, New York Academy of Medicine, 1983

Harvard School of Public Health, "Planning for Nuclear Emergencies," 1985

Harvard School of Public Health, "Advanced Planning for Nuclear Emergencies," 1986

EXPERIENCE SUMMARY

During the period May 1980 to the present, Mr. Crocker was generally responsible for preparing emergency plans, procedures, training programs, exercise scenarios, and other emergency planning activities. He was actively involved in ASLB licensing hearings on emergency planning. He has participated in many practice exercises and has observed many emergency plan exercises.

Mr. Crocker is presently Nuclear Emergency Preparedness Manager responsible for the SNPS Onsite and Offsite (LERO) Emergency Preparedness Programs. This consists of developing and maintaining facilities, plans, procedures, training, and drill programs to satisfy NRC and FEMA requirements in support of the SNPS licensing effort. He directs a staff of 45 LILCO and consultant personnel.

From May 1986 to December 1987, Mr. Crocker served as Supervisor - Offsite Emergency Preparedness in addition to his duties as Manager of Nuclear Emergency Preparedness.

During the period March 1985 to June 1986, Mr. Crocker was Onsite Emergency Preparedness Supervisor responsible for all onsite planning activities including the onsite portion of the 1986 NRC observed exercise.

From September 1982 to February 1985 Mr. Crocker was Project Engineer responsible for all Stone & Webster Engineering Corp. - N.Y. emergency planning projects. In this capacity, he directed a staff of forty-five engineers and planners in the execution of up to five simultaneous projects for utility clients.

Mr. Crocker joined Stone & Webster Engineering Corporation (SWEC) in May 1976 as an Engineer in the Environmental Engineering Division. Working in the Environmental Impact Analysis Group, his activities included the mathematical modeling of cooling tower visible

plumes, coastal storm surge, and wave effects on shoreline intake structures. He has also had experience with the modeling of thermal discharges from power plants and with the collection and analysis of hydrothermal data. His past assignments include circulating water system performance tests at Shoreham Nuclear Power Station and the preparation of industrial energy survey reports for the petroleum refining and olefins industry. At Shoreham, Mr. Crocker was responsible for the collection and analysis of hydraulic transient data.

Prior to joining SWEC, Mr. Crocker worked as a Research Assistant at the Marine Science Research Center at the State University of New York at Stony Brook, collecting and analyzing oceanographic data during his graduate study from 1974 to 1976.

From 1972 to 1973, Mr. Crocker worked as an Estimator for L. K. Comstock and Co., Inc., preparing bids for electrical construction projects.

PUBLICATIONS

"Radiological Protection Issues Associated with the Establishment and Operation of Public Evacuee Reception Centers on Long Island," D. M. Crocker, D. P. Dreikorn, and R. J. Watts, to be presented at the Health Physics Society Annual Meeting, Boston, Mass., July, 1988.

"Development and Verification of a Synthetic Northeaster Model in Application to Coastal Flooding," Y. J. Tsai, D. M. Crocker, T. J. Burda, and F. K. Chou, Proceedings of National Symposium on Urban Storm Water Management in Coastal Areas, 1980.

"Intake Screenwall Surging Caused by Wave Dynamics," Y. J. Tsai, Y. C. Chang, and D. M. Crocker, Hydraulics in the Coastal Zone, 1979.

"EN-129: Cooling Tower Visible Plume Model - User's Manual," Y. J. Tsai and D. M. Crocker, Stone & Webster Engineering Corp., April 1977.

"EM-128 - Intake Surge Model - User's Manual," D. M. Crocker and Y. C. Chang, Stone & Webster Engineering Corp., August 1977.

AWARDS

Stone & Webster Engineering Corporation's "Ten Best Papers Award," 1980.

DETAILED EXPERIENCE RECORD
DOUGLAS M. CROCKER

LONG ISLAND LIGHTING COMPANY, SHOREHAM NUCLEAR POWER STATION (May 1984 to present)

Manager, Nuclear Emergency Preparedness Division (July 1986 to present)

Mr. Crocker is responsible for all Nuclear Emergency Preparedness activities for the Shoreham Nuclear Power Station. He oversees the onsite and offsite (LERO) emergency preparedness programs to ensure a satisfactory level of preparedness. He is responsible for plans, procedures, drills, training, exercises, and facilities for the 3600 member emergency response organization. In this effort, he directs a staff of 45 LILCO and consultant personnel. Additional duties include providing technical support and testimony in ASLB licensing hearings, coordinating with legal support organizations, and coordinating exercise activities with NRC and FEMA. During the period July 1986 to December 1987, Mr. Crocker also served as Acting Offsite Emergency Preparedness Supervisor.

Offsite Emergency Preparedness Supervisor (May 1986 to July 1986)

Mr. Crocker was responsible for the development and maintenance of the Local Emergency Response Organization (LERO). He was responsible for the LERO plan and procedures, training, drills, and facility maintenance. He supervised a staff of twelve LILCO and consultant personnel. Additional duties included support of ASLB licensing hearings on emergency preparedness issues and the resolution of FEMA plan and exercise comments.

Onsite Emergency Preparedness Supervisor (March 1985 to May 1986)

Mr. Crocker was responsible for the Onsite Emergency Preparedness Program. He directed the preparation and maintenance of: (1) SNPS Emergency Plan and Procedures, (2) Emergency Response facilities, (3) Emergency Preparedness Training Program, and (4) Emergency Preparedness Drill Program. He was responsible for preparations for the successful onsite portions of the first NRC observed exercise. He directed a staff of ten LILCO and consultant personnel in this effort.

Onsite Emergency Preparedness Coordinator (acting) (May 1984 to February 1985)

Mr. Crocker came to SNPS as a Stone & Webster employee in May 1984 to serve as an interim replacement for the departing LILCO coordinator. He was responsible for the onsite emergency preparedness preparations for the first NRC observed exercise. Mr. Crocker left Stone & Webster to work for LILCO in the same capacity.

STONE & WEBSTER ENGINEERING CORPORATION, NEW YORK, N.Y. (May 1976 to February 1985)

Assignments:

Project Engineer - 1982

Environmental Engineer - 1982

Engineer - Environmental - May 1976

Emergency Planning, SWEC-NY (September 1982 to February 1985)

Mr. Crocker was PROJECT ENGINEER, responsible for all emergency planning work in SWEC-NY, supervising a group of approximately forty-five planners.

Long Island Lighting Company (September 1982 to February 1985)

Mr. Crocker was PROJECT ENGINEER, coordinating planning support services by SWEC personnel at LILCO headquarters and the Shoreham site.

Public Service Company of Indiana (September 1982 to January 1984)

Mr. Crocker was PROJECT ENGINEER for emergency planning for the Kentucky portions of the Marble Hill NGS emergency planning zone. He was responsible for the preparation of state and county plans, procedures and training.

State of Delaware (September 1982 to November 1983)

Mr. Crocker was PROJECT ENGINEER, directing emergency plan, procedure, and training program development for the Delaware Department of Emergency Planning and Operations.

Cincinnati Gas & Electric Company (May 1980 to January 1984)

Mr. Crocker was PROJECT ENGINEER for emergency planning for the Wm. H. Zimmer Nuclear Power Station in Moscow, Ohio. He was responsible for all offsite emergency plans, procedures, and training, and provided licensing support to CG&E during its ASLB hearings.

Brookhaven National Laboratory (March 1980 to April 1980)

Mr. Crocker was assigned to a feasibility study of alternative fuel uses in industrial boilers and furnaces.

Long Island Lighting Company (November 1979 to February 1980)

Mr. Crocker was assigned to the pressure and performance testing of the cooling water circulating system at the Shoreham Nuclear Power Station, where he was responsible for data collection and analysis.

U.S. Department of Housing and Urban Development, Federal Flood Insurance Administration (FIA) (March 1978 to December 1978)

Mr. Crocker conducted Flood Insurance Studies for nine coastal communities in Maine. He was PRINCIPAL COASTAL INVESTIGATOR, responsible for the development of a synthetic northeaster storm model and for the analysis of coastal flood elevations.

U.S. Department of Housing and Urban Development, Federal Flood Insurance Administration (FIA) (June 1977 to March 1978)

Mr. Crocker was SUPPORT COASTAL ENGINEER for the Maine flood study. He was assigned to northeaster computer model development.

National Oil Company, Libya (May 1977 to June 1977)

He was responsible for a wave and surge study for intake design. Mr. Crocker determined design parameters of an intake structure located on the Mediterranean Sea.

Indiana Power & Light Company (March 1977 to July 1977)

Mr. Crocker analyzed the hydrothermal characteristics of a cooling tower blowdown discharge into the Ohio River.

Millstone Unit No. 3, Northeast Utilities (May 1977)

Mr. Crocker conducted a hurricane surge and wave study for the design of a cooling water intake structure.

Long Island Lighting Company (January 1977 to April 1977)

Mr. Crocker participated in hurricane surge and wave analysis. He developed a computer model of intake screenwell surging in response to storm waves. He also calculated storm surge elevations caused by a modified probable maximum hurricane.

Koshkonong Units 1 and 2, Wisconsin Electric Power (January 1977 to March 1977)

He analyzed hydrothermal characteristics of a cooling tower blowdown discharge into the Rock River.

Mystic Station Unit No. 7, Boston Edison Company (August 1976 to January 1977)

Mr. Crocker conducted a hydrothermal field survey and data analysis. He was responsible for a temperature and dye field survey and subsequent analysis to determine the hydrothermal characteristics of a fossil power plant once through cooling system discharge and its effects on circulation in the Mystic River Estuary.

Jamesport Units 1 and 2, Long Island Lighting Company (July 1976 to August 1986)

Mr. Crocker conducted an analysis of wave forces in the interior of the cooling water intake structure.

Montague Units 1 and 2, Northeast Utilities (May 1976 to July 1976)

Mr. Crocker was responsible for the modification and verification of a cooling tower visible plume model. He incorporated upper air sounding data into the analysis of plumes.

State University of New York at Stony Brook (1975 to 1976)

As a RESEARCH ASSISTANT, Mr. Crocker developed computer models of tidal circulation in New York Harbor and the Peconic Estuary.

RESUME OF ROBERT B. KELLY

EDUCATION

Lesley College, M.S., Management, 1984

Tufts University, B.A., Political Science, 1980

Federal Emergency Management Agency-Professional Development Courses

FEMA Courses and Seminars:

- ° Nuclear Civil Protection Seminars
- ° Emergency Management - Introduction
- ° Radiological Home Monitoring Course
- ° Radiological Defense Officers Course
- ° Shelter Seminar
- ° Population Protection Seminar

EXPERIENCE

Roy F. Weston, Inc., 1987 to Present

NUS Corporation, 1985 - 1987

Massachusetts Civil Defense Agency, 1981 - 1985

Federal Emergency Management Agency, 1980 - 1981

Roy F. Weston, Inc. - As a Senior Project Manager in the Expert Systems Department, is responsible for developing emergency management and community right-to-know programs for clients. Currently is managing a major evacuation database project; developing functional specifications for an emergency response expert system; and working on other emergency management programs.

NUS Corporation - As Supervisor of the Emergency Preparedness Section, directed the development of emergency preparedness programs for nuclear utilities, chemical plants, hospitals, and other industrial facilities, and government agencies. Prepared emergency plans and implementing procedures and conducted capability assessments to ensure program effectiveness. Reviewed and integrated facility and local response agency preparedness programs to ensure compatibility and compliance with government regulations. Developed and presented training programs for emergency planning and response. Developed emergency drill and exercise programs including scenario preparation, MSEs, exercise conduct, and evaluation reports.

Examples of projects at NUS:

- ° Reviewed the emergency plan for a community near a DOE facility
- ° Reviewed a waste water treatment plant's emergency preparedness program
- ° Developed an emergency plan for a waste water treatment plant

- ° Reviewed the emergency plan for a pharmaceutical plant, a chemical plant, and an electronics facility
- ° Developed an industrial park emergency plan
- ° Developed an industrial emergency annex of a city emergency operations plan
- ° Designed exercise plans (MSEL, scenario development, etc.) for two community exercises
- ° Evaluated drills and exercises (community and plant level)
- ° Developed an audit procedure for hospital emergency plans
- ° Developed an emergency public information booklet for a pharmaceutical plant
- ° Conducted a training needs analysis for a pharmaceutical plant
- ° Developed a video-based training program for a major industry association
- ° Developed and conducted a course for industrial emergency preparedness for the American Society of Safety Engineers

Massachusetts Civil Defense Agency - As Assistant Planning Director, managed professional planning office staff. Coordinated the Commonwealth's Disaster Assistance Program. Responsible for the development and implementation of the State's Comprehensive Emergency Management Plan, Emergency Broadcast System plan, and nuclear civil protection plans. Developed programs for disaster recovery activities. Developed public information and educational programs. Developed emergency management databases. Directed development of comprehensive emergency management plans and hazard analyses studies for 165 local communities.

In conjunction with local officials, developed training programs and exercises. Assisted in testing the State's radiological emergency plan. Coordinated the Agency's medical services advisory committee. Analyzed current and proposed legislation and prepared impact reports for the Director. Developed the State's Hazard Analysis Study.

As a junior planner for the State, developed support plans covering medical care, hospital relocation, and transportation routes. Educated local officials through seminars and meetings. Assisted in development of radiological plans for local communities. Participated in various emergency operations including but not limited to: Lynn fire, 1984 spring floods, winter storms, Salem fire and State employees strike.

Federal Emergency Management Agency - As Emergency Management Specialist, worked on various disaster response and recovery projects. Coordinated in-processing and out-processing at the Fort McCoy Cuban Refugee Relocation Camp. Served as Verification Specialist during recovery operations in Texas following Hurricane Allen. Responsible for review of damage survey reports and insurance settlements.

Developed after action reports of Cuban Refugee project for the FEMA Regional Director.

Assisted in the recovery program for the "Blizzard of 1978" winter storm.

MEMBERSHIPS

American Society of Safety Engineers
Emergency Management Committee of the International
Association of Fire Chiefs
Association of International Disaster Experts
National Coordinating Council on Emergency Management
American Society for Public Administration

PUBLICATIONS AND TECHNICAL PRESENTATIONS

"Dealing with the Media During Emergencies," HAZMAT 86 Workshop, June 1986.

"Beyond Contingency Planning: Development Strong Emergency Preparedness Capability," Presented at HAZTECH, August 1986.

"Choosing and Developing the Proper Emergency Plans for Your Facility," National Health and Safety News, November 1986.

Presentation to the Buffalo Chapter of the American Society of Safety Engineers - Developing Emergency Plans.

Presentation to the Pittsburgh Chapter of the Association of Industrial Hygienists - Developing Effective Emergency Preparedness Programs.

Presentation to the Louisiana Loss Control Association - Developing Effective Emergency Preparedness Programs.

MICHAEL K. LINDELL
April 1988

EDUCATION

Ph D	Social/Quantitative Psychology, University of Colorado, 1975
BA	Psychology, University of Colorado, 1969

PROFESSIONAL POSITIONS

1987 to present	Associate Professor of Psychology Michigan State University
1987 to present	Adjunct Faculty Federal Emergency Management Agency National Emergency Training Center
1986 to 1987	Visiting Associate Professor of Psychology Georgia Institute of Technology
1981 to 1987	Adjunct Assistant Professor of Psychology University of Washington
1974 to present	Research Scientist Battelle Human Affairs Research Centers
1981	Visiting Lecturer in Educational Psychology School of Education, University of Washington
1974	Research Psychologist, K.R. Hammond Associates
1972 to 1974	Data Analyst/Computer Programmer University of Colorado
1971 to 1972	Teaching Assistant University of Colorado
1970 to 1971	Research Assistant University of Colorado

PROFESSIONAL ASSOCIATIONS

American Statistical Association
Human Factors Society
Society for Risk Analysis
Judgment/Decisionmaking Society
American Society of Civil Engineers (Affiliate Member)

PRINCIPAL INVESTIGATOR/PROJECT DIRECTOR

National Institute of Mental Health. Consequences of natural hazards for mental health, 5/77-2/78, \$10,000.

Office of Naval Research. Effects of social structure, technology and job design on job satisfaction, 3/77-8/80, \$77,000.

Energy Research and Development Administration. Public perception and evaluation of risk associated with nuclear waste, 10/77-9/78, \$50,000.

Private Corporation. Analysis of position evaluation system, 5/79-12/79, \$15,000.

Department of Energy. Consumer response to gasoline shortage, 7/79-1/80, \$30,000.

Nuclear Regulatory Commission. Technical assistance in implementing emergency preparedness requirements, 9/79-9/82, \$355,000.

Nuclear Regulatory Commission. Evaluation of licensee emergency response facility designs, 6/81-10/81, \$56,000.

Nuclear Regulatory Commission. Design assistance for NRC headquarters and regional operations centers, 9/81-3/84, \$105,000.

Nuclear Regulatory Commission. Evaluation of emergency exercises at nuclear power plants, 10/81-9/82, \$114,000.

Nuclear Regulatory Commission. Analysis of emergency staffing, 10/82-3/84, \$59,000.

Atomic Industrial Forum. Planning concepts and decision criteria for sheltering and evacuation, 8/83-5/84, \$110,000.

National Science Foundation. Contingent conditions for research-based local emergency planning, 6/83-5/85, \$21,000.

National Science Foundation. Behavioral response to technological hazards, 8/84-11/85, \$60,000.

Westinghouse Corporation. Human factors assistance for the Hanford Emergency Control Center, 1/85-9/85, \$26,000.

Private Corporation. Toxic chemical emergency response plan, 1/86-7/86, \$44,000.

Department of Energy. Human factors assistance for the DOE headquarters emergency operations center, 2/86-11/86, \$66,000.

Nuclear Regulatory Commission. Evaluation of licensee emergency response facilities, 5/86-9/86, \$19,000.

SCIENTIFIC JOURNAL AD HOC REVIEWS

Academy of Management Review
Risk Analysis
Disasters
International Journal of Mass Emergencies and Disasters
Nuclear Safety
Journal of Applied Psychology
Professional Psychology

SCIENTIFIC PEER REVIEW PANEL MEMBERSHIP

National Science Foundation, Community Water Management Program
National Science Foundation, Applied Science and Research Applications
Directorate
National Science Foundation, Earthquake Hazards Mitigation Program
National Science Foundation, Decision and Management Science Program
Brookhaven National Laboratory, Department of Nuclear Energy
University of Washington, Department of Family Medicine
Pennsylvania State University College of Medicine, Department of Behavioral
Science
University of Pittsburgh, University Center for Social and Urban Research
University of Southern California, Institute of Safety and Systems Management
National Science Foundation, Geography and Regional Science Program
Argonne National Laboratory, Energy and Environmental Systems Division

EXPERT TESTIMONY

Public Forum on the Operation of the Shoreham Nuclear Power Plant sponsored
by Scientists and Engineers for Secure Energy

Public Hearing on the Operation of the Pilgrim Nuclear Power Plant sponsored
by the Plymouth Board of Selectmen and Boston Edison Company

Litigation of Long Island Lighting Company's Application for an operating
license for the Shoreham Nuclear Power Station conducted by the U.S.
Nuclear Regulatory Commission Atomic Safety and Licensing Board,
Dockets 50-322-OL-3 (Emergency Planning) and -OL-5 (Emergency
Exercise Performance)

PROFESSIONAL COMMITTEES

Committee Member--American National Standards Institute/American Nuclear
Society Committee on Criteria for Emergency Response Facilities

Conference Chair--American Society of Civil Engineers Specialty Conference on
Planning for Hazardous Facilities

Committee Member--Academy of Management Program Committee

BOOKS AND CHAPTERS

- Perry, R.W., Lindell, M.K. and Greene, M.R. Evacuation Planning in Emergency Management, Lexington, MA: Health Lexington Books, 1981.
- Perry, R.W. and Lindell, M.K. Human Adjustment to Volcano Hazards, Pullman, WA: Washington State University Press, in press.
- Perry, R.W. and Lindell, M.K. Handbook of Emergency Response Planning, New York: Hemisphere Publishing, in press.
- Stewart, T.R., Joyce C.R.B. and Lindell, M.K. New analyses: application of judgment theory to physicians' judgments of drug effects. In K.R. Hammond and C.R.B. Joyce (Eds.) Psychoactive Drugs and Social Judgment Theory and Research, New York: Wiley Interscience, 1975.
- Earle, T.C. and Lindell, M.K. Public perception of industrial risks: a free response approach. In R.A. Waller and V.T. Covello (Eds.) Low Probability High Consequence Risk Analysis Issues, Methods and Case Studies, New York: Plenum Press, 1984.
- Perry, R.W. and Lindell, M.K. Communicating threat information for volcano hazards. In L. Walters (Ed.) Communication in Disaster Disseminating Bad News, in press.

JOURNAL ARTICLES

- Lindell, M.K. and Stewart, T.R. The effects of redundancy in multiple cue probability learning. American Journal of Psychology 1974, 87, 393-398.
- Lindell, M.K. Cognitive and outcome feedback in multiple cue probability learning tasks. Journal of Experimental Psychology Human Learning and Memory 1976, 2, 739-745.
- Lindell, M.K. Interpretation of the R^2 index in regression models of judgment. Educational and Psychological Measurement 1978, 38, 69-74.
- Perry, R.W. and Lindell, M.K. Psychological consequences of natural disaster. Mass Emergencies 1978, 3, 105-115.
- Lindell, M.K. and Drexler, J.A., Jr., Issues in using survey methods for measuring organizational change. Academy of Management Review 1979, 4, 13-19.
- Lindell, M.K. and Drexler, J.A., Jr., Equivocality of factor incongruence as an indicator of type of change in OD interventions. Academy of Management Review 1980, 5, 105-107.

- Lindell, M.K. and Perry, R.W. Evaluation criteria for emergency response plans in radiological transportation Journal of Hazardous Materials 1980, 3, 335-345.
- Lindell, M.K. and St. Clair, J.B. TUKKNIFE A jackknife supplement to canned statistical packages. Educational and Psychological Measurement 1980, 40, 71-74.
- Perry, R.W., Greene, M.R. and Lindell, M.K. Enhancing evacuation warning compliance suggestions for emergency planning. Disasters 1980, 4, 433-449.
- Greene, M.R., Perry, R.W. and Lindell, M.K. The March 1980 eruptions of Mt. St. Helens: Citizen perceptions of volcano hazard. Disasters 1981, 5, 49-66.
- Drexler, J.A., Jr. and Lindell, M.K. Training/job fit and worker satisfaction. Human Relations 1981, 34, 907-915.
- Southwick, L., Steele, C., Marlatt, A. and Lindell, M. Alcohol-related expectancies defined by phase of intoxication and drinking experience. Journal of Consulting and Clinical Psychology 1981, 49, 713-721.
- Perry, R.W., Lindell, M.K. and Greene, M.R. Threat perception and public response to volcano hazard. Journal of Social Psychology, 1982, 116, 199-204.
- Lindell, M.K., Perry, R.W. and Greene, M.R. Individual response to emergency preparedness planning near Mt. St. Helens. Disaster Management, 1983, 3, 5-11.
- Perry, R.W., Lindell, M.K. and Greene, M.R. Crisis communications, ethnic differentials in interpreting and responding to disaster warnings. Social Behavior and Personality, 1982, 10, 97-104.
- Lindell, M.K. and Earle, T.C. How close is close enough: public perceptions of the risks of industrial facilities. Risk Analysis, 1983, 3, 245-253.
- Houts, P.S., Lindell, M.K., Hu, T.W., Cleary, P.D., Tokuhata, G. and Flynn, C.B. The protective action decision model applied to evacuation during the Three Mile Island crisis. International Journal of Mass Emergencies and Disasters, 1984, 2, 27-39.
- Lindell, M.K. and Barnes, V.D. Protective response to technological emergency risk perception and behavioral intention. Nuclear Safety, 1986, 27, 457-467.
- Southwick, L., Steele, C. and Lindell, M. The roles of historical experience and construct accessibility in judgments about alcoholism. Cognitive Therapy and Research, 1986, 10, 167-186.
- Kartez, J.D. and Lindell, M.K. Planning for uncertainty: the case of local disaster planning. Journal of the American Planning Association, in press.

Lindell, M.K. and Perry, R.W. Warning mechanisms in emergency response systems. International Journal of Mass Emergencies and Disasters, in press.

OTHER ARTICLES

Lindell, M.K., Perry, R.W. and Greene, M.R. Mount St. Helens: Washingtonians View Their Volcano. Hazard Monthly, 1980, 1(2), 1-3.

Perry, R.W., Lindell, M.K. and Greene, M.R. Flood Warning: How People React After the Warning. Hazard Monthly, 1981, 1(11), 1-6.

Lindell, M.K. and Perry, R.W. Nuclear power plant emergency warning: how would the public respond? Nuclear News, 1983, 26, 49-53.

Lindell, M.K. Review of "Warning and Response to the Mt. St. Helens Eruption" by Saarinen and Sell. Disasters, 1985, 9, 230-232.

Perry, R.W. and Lindell, M.K. Source Credibility in Volcanic Hazard Information. Volcano News, 1986, 22(12), 7-10.

PRESENTATIONS

Lindell, M.K., 1976. Assessment of social values in nuclear waste disposal. Western Psychological Association.

Lindell, M.K. and Maynard, W.S., 1976. Interchange of technical information and public beliefs in energy decisionmaking. Western Psychological Association.

Drexler, J.A. Jr. and Lindell, M.K., 1976. Training/ job fit and worker satisfaction. Western Psychological Association.

Lindell, M.K., 1978. Jackknife, ridge and ordinary least squares estimators of regression parameters: a monte carlo comparison. Psychometric Society.

Lindell, M.K. and Drexler, J.A., Jr., 1978. Issues in using survey methods for measuring organizational change. Western Psychological Association.

Lindell, M.K., 1978. Equal vs. differential predictor weights; testing hypotheses and estimates with restricted regression models. Psychometric Society.

Perry, R.W. and Lindell, M.K., 1979. Predisaster planning to promote compliance with evacuation warnings. National Conference on Hurricanes and Coastal Storms.

Lindell, M.K., Earle, T.C., and Perry, R.W., 1979. Radioactive wastes; public attitudes toward disposal facilities. American Nuclear Society.

- Lindell, M.K., 1980. Ridge and ordinary least squares estimators of relative weights in regression analysis. Psychometric Society.
- Lindell, M.K., Perry, R.W. and Greer, M.R., 1980. Race and disaster warning response. Pacific Sociological Association.
- Lindell, M.K., Perry, R.W. and Greene, M.R., 1980. Consistency of attitudes and behavior related to nuclear power. Western Psychological Association.
- Greene, M.R., Perry, R.W. and Lindell, M.K., 1981. Citizen perception of public action. Western Political Science Association.
- Lindell, M.K., Perry, R.W. and Greene, M.R., 1981. Individual response to emergency preparedness planning. Western Social Science Association.
- Lindell, M.K., Perry, R.W. and Greene, M.R., 1981. Social and psychological factors affecting evacuation decisionmaking. American Psychological Association.
- McGuire, M.V., Lindell, M.K. and Walsh, M.E., 1981. Law enforcement response to an investigative innovation. American Psychology Law Society.
- Perry, R.W., Greene, M.R. and Lindell, M.K., 1981. Evacuation behavior during the May 18th eruption of Mt. St. Helens. Pacific Sociological Association.
- Bolton, P.A., Perry, R.W., Lindell, M.K. and Greene, M.R., 1981. Hazard experience and warning response of older persons. Gerontological Society of America.
- Earle, T.C. and Lindell, M.K., 1982. Public perceptions of industrial risks. Society for Risk Analysis Workshop on Low Probability-High Consequence Risk Analysis.
- Lindell, M.K. and Earle, T.C., 1982. How close is close enough: public perceptions of the risks of industrial facilities. Society for Risk Analysis Workshop on Low Probability-High Consequence Risk Analysis.
- Lindell, M.K., 1982. Judgments, values and the management of conflict over nuclear waste. First International Conference on Social Impact Assessment.
- Lindell, M.K., 1982. Development of a design for the Nuclear Regulatory Commission's emergency operations center. Human Factors Society.
- Lindell, M.K. and Perry, R.W., 1982. Protective action recommendations; how would the public respond? American Nuclear Society.
- Lindell, M.K. and Southwick, L.L., 1982. An analysis of information integration using free response data. American Psychological Association.
- Southwick, L.L., Lindell, M.K. and Earle, T.C., 1982. Attitude polarization in public issues: the roles of cognitive complexity, evaluative consistency and issue importance. Washington State Psychological Association.

Hansvick, C. Archea, J., Hanson, H., Keating, J., Lindell, M.K. and Wise, J.A., 1983. Designing for personal control in hazards and disasters. Environmental Design Research Association.

Lindell, M.K., 1983. Analysis of emergency staffing for nuclear power plants. Human Factors Society.

Lindell, M.K., Moeller, P.A. and Renner, M.S., 1984. Offsite response considerations for appropriate protective actions. American Nuclear Society.

Lindell, M.K. and Perry, R.W., 1984. Social psychological processes and personal risk assessment. Society for Risk Analysis.

Lindell, M.K., 1984. Communicating risk information to the public: a review of research on natural hazards. NSF/EPA Workshop on Risk Communication.

Lindell, M.K., 1985. Tukey's "jackknife" in theory and in practice. American Psychological Association.

Lindell, M.K., 1985. Decision criteria for sheltering or evacuating medical facilities in radiological and hazardous materials incidents. Association for the Advancement of Medical Instrumentation.

SHORT COURSES AND OTHER LECTURES

Lindell, M.K., 1983. Perception of risk at nuclear waste disposal sites and power plants. Lecture for Pacific Lutheran University Center for the Study of Public Policy.

Lindell, M.K., 1983. Emergency preparedness at nuclear power plants. Lecture to University of Washington Department of Environmental Health and Nuclear Engineering.

Lindell, M.K., 1983. Design of emergency response facilities. Pacific Northwest Laboratory Short Course in Emergency Planning.

Lindell, M.K., 1983. Emergency public information. Pacific Northwest Laboratory Short Course in Emergency Planning.

Lindell, M.K., 1984. Emergency staffing. Pacific Northwest Laboratory Short Course in Emergency Planning.

Lindell, M.K., 1984. Emergency public information. Pacific Northwest Laboratory Short Course in Emergency Planning.

Lindell, M.K., 1985. Protective action decisionmaking. Pacific Northwest Laboratory Short Course in Emergency Planning.

Lindell, M.K., 1985. Emergency public information. Pacific Northwest Laboratory Short Course in Emergency Planning.

- Lindell, M.K., 1985. Social and political aspects of nuclear power plant emergency planning. Health Physics Society Short Course on Emergency Planning.
- Lindell, M.K., 1985. Social response to the Mt. St. Helens eruptions. University of Washington Extension Course on Mt. St. Helens.
- Lindell, M.K., 1985. Emergency management planning principles for large-scale emergencies involving technological and natural hazards in developed and developing nations. Administrative Staff College of India Workshop in Risk Analysis in Developing Countries.
- Lindell, M.K., 1986. Concerns about offsite response in a nuclear power plant emergency. GPU Nuclear Annual Training Workshop for TMI Area Emergency Response Agencies.
- Lindell, M.K., 1987. Public Response Considerations and Public Information. Federal Emergency Management Agency National Emergency Training Center Short Course on Evacuation Planning and Response Simulation. Also given in January 1988 and May 1988.
- Lindell, M.K., 1988. Disaster Psychology. Federal Emergency Management Agency National Emergency Training Center Short Course on Multi Hazard Planning (given in February and May).

TECHNICAL REPORTS

Over 40 technical reports to governmental and corporate sponsors of grants and contracts. Titles available on request, reports available through the Battelle Human Affairs Research Centers Technical Library.

ACADEMIC VITA OF DENNIS S. MILETI
March, 1988

PERSONAL

Office:

Department of Sociology
Colorado State University
Fort Collins, Colorado 80523
(303)491-5951 or 6045

Hazards Assessment Laboratory
Clark Hall
Colorado State University
Fort Collins, Colorado 80523

EDUCATION

University of Colorado, Boulder: PhD, Sociology, 1974
California State University, Los Angeles: MA, Sociology, 1971
University of California, Los Angeles: BA, Sociology, 1968

SPECIALIZATIONS

Complex Organizations, Applied (Hazards and Policy), Methods

APPOINTMENTS

1974-date	Faculty, Department of Sociology, Colorado State University, Fort Collins (1985-date, Professor; 1978-1985, Associate Professor; 1974-1978, Assistant Professor).
1984-date	Director, Hazards Assessment Laboratory, Colorado State University, Fort Collins.
1986-date	Adjunct Professor, Department of Sociology, University of Tennessee, Knoxville.
1981-year	Policy Analyst, Seismic Safety Commission, State of California, Sacramento (on leave from university).
1978-1979	Invited Instructor, American Association for the Advancement of Science, Chautauqua Short Course Program.
1975-year	Visiting Assistant Professor, University of Southern California, Graduate School of Public Administration, Intensive Seminar Program.
1971-1972	Instructor, Department of Sociology, University of Colorado, Boulder.

AWARDS

1983-1984	Alumni Honor Faculty Award, Colorado State University Alumni Association for excellence in teaching, research and service
1981-year	Cited in Outstanding Young Men of America
1978-1977	Cited for excellence in teaching, research and service by the Dean, College of Arts, Humanities and Social Sciences

MEMBERSHIPS

American Sociological Association, International Sociological Association, Pacific Sociological Association, Midwest Sociological Society, Earthquake Engineering Research Institute, National Coordinating Council on Emergency Management, Western Social Science Association

RESEARCH GRANTS AND CONTRACTS

1987-1988	Associate Investigator, "Preparation of a Model Response Plan for the Three Mile Island Reactor," Public Education and Warnings Group, subcontract from Clark University for the Three Mile Island Public Health Fund.
1987-1988	Principal Investigator, "Research Applications for Emergency Preparedness," contract for Public Service Company of New Hampshire.
1987-year	Associate Investigator, "Socioeconomic Impacts of the Proposed High-Level Radioactive Waste Site at Hanford, Washington," Risk Assessment Team, subcontract from Social Impact Assessment, Inc. for the State of Washington.
1987-year	Principal Investigator, "Public Perception of Seismic Risk in Santa Clara County," grant from the Bay Area Regional Earthquake Preparedness Project and the California Seismic Safety Commission.
1986-1987	Coprincipal Investigator, "Warning Systems: A State of the Art Review," subcontract from Oak Ridge National Laboratory for the Federal Emergency Management Agency.
1984-1985	Associate Investigator, "Evacuation Liability Issues," subcontract from Oak Ridge National Laboratory for the U. S. Department of Energy.
1984-1985	Principal Investigator, "Assessment of Human Stress Impacts from the Livingston Train Derailment and Chemical Emergency," contract for Illinois Central Gulf Railroad.
1984-1985	Associate Investigator, "State-of-the-Art Assessment: Evacuation," subcontract from Oak Ridge National Laboratory for the Federal Emergency Management Agency.
1984-1985	Associate Investigator, "International Study of Disaster Impact on Domestic Assets," subcontract from the University of Georgia for the National Science Foundation.
1983-1984	Principal Investigator, "Research and Applications for Emergency Preparedness," contract for Long Island Lighting Company (reactivated for 1987-1988).
1983-1984	Principal Investigator, "Intended and Forgotten Audiences for Emergency Warnings," quick-response grant from the Natural Hazards Research Applications and Information Center.
1982-1983	Associate Investigator, "Organizational Interface for Nuclear Reactor Emergency Preparedness," subcontract from Oak Ridge National Laboratories for the Nuclear Regulatory Commission.
1981-year	Principal Investigator, "Nuclear Hazard Warnings and Emergency Evacuation Preparedness," contract for Pacific Gas and Electric Company.
1980-1983	Principal Investigator, "Local Land Use Policy Decisions," Colorado State University Experiment Station.
1979-1982	Principal Investigator, "Behavioral Aspects of the Three Mile Island Incident and Re-start," contract for General Public Utilities via Shaw, Pittman, Potts and Trowbridge.

1977-1980	Principal Investigator, "Migration Impacts of Non-metropolitan Areas in the West," Colorado State University Experiment Station.
1977-1979	Principal Investigator, "Adoption and Organizational Implementation of Policy for Land Use Regulations," grant from the National Science Foundation.
1975-1977	Coprincipal Investigator, "Socioeconomic, Organizational and Political Consequences of Earthquake Prediction," grant from the National Science Foundation.
1972-1974	Research Sociologist, "Assessment of Research on Natural Hazards," grant from the National Science Foundation.

COMMITTEE MEMBERSHIPS

1987-year	Expert panel on Disaster Research and Planning at the National Center for Earthquake Engineering Research at the State University of New York at Buffalo.
1984-1988	National Academy of Science, National Research Council, Commission on Engineering and Technical Systems, Committee on Natural Disasters
1984-1988	National Academy of Sciences, National Research Council, Commission on Physical Sciences, Mathematics, and Resources, Board on Earth Sciences, Subcommittee on Earthquake Research.
1984-1986	National Institute of Mental Health, Public Health Service, Center for Mental Health Studies of Emergencies, Advisory Panel.
1983-year	National Science Foundation, U.S. Delegate on Earthquake Prediction Research to Japan, International Scientific Exchange Section.
1983-1986	Front Range Consortium on Natural Hazards Studies, Colorado State University, University of Colorado, University of Denver.
1983-date	International Sociological Association, Research Committee on Disasters.
1982-1983	Pacific Sociological Association, Nominations Committee for the Standing Committees for 1983.
1982-date	Earthquake Engineering Research Institute, Chair, Committee on Social Science Research, Berkeley.
1981-1983	U.S. Department of the Interior, Geological Survey, Advisory Panel on the Earthquake Studies Program.
1981-1982	Pacific Sociological Association, Program Committee for the 1982 Annual Meetings in San Diego.
1981-1982	Governor's Emergency Task Force on Earthquakes, Threat and Reconstruction Committees, State of California, Sacramento.
1980-1981	Governor's Science and Technology Advisory Council, Committee on the Relocation of Uranium Mill Tailings, State of Colorado.
1979-year	American Association for the Advancement of Science, Committee on Intergovernmental Research and Development on Fire Safety and Disaster Preparedness, Washington, D.C.

1976-1978

National Academy of Sciences, National Research Council,
Commission on Sociotechnical Systems, Committee on
Socioeconomic Effects of Earthquake Prediction,
Washington, D.C.

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- Mileti, Dennis S. 1974. "Change Ratios in Age-Scientific Percent Contributions to Fertility: A New Method with Applications to the United States," Pacific Sociological Review 17(1):3-26. First Prize, student paper competition, Pacific Sociological Association, 1974.
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- Mileti, Dennis S., and Steven Helmericks. 1987. Public Perception of Earthquake Risk During 1976 In Santa Clara County. Report prepared for the Bay Area Regional Earthquake Preparedness Project and the California Seismic Safety Commission.
- Mileti, Dennis S., and Janice R. Hutton. 1987. Initial Public Response to the 5 April 1985 Parkfield Earthquake Prediction. Boulder: Natural Hazards Research Applications and Information Center, University of Colorado.
- Mileti, Dennis S., Randal G. Updike, Patricia A. Bolton, and Gabriel Fernandez. 1986. Recommendations for Improving the Existing Warning System for Possible Nevado del Ruiz Volcanic Eruption, Colombia, South America. Washington, D.C.: National Academy of Sciences.
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- Mileti, Dennis S. 1985. Stress Impacts of a Technological Emergency: An Unobtrusive Indicators Study of Livingston Train Derailment. New Orleans: Lemle, Kelleher.
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"Natural Hazards, Disasters and Social Research," Department of Sociology, University of Denver: December, 1980, 1979.

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OTHER PROFESSIONAL SERVICE

Organizer and Presider

Sessions on the Sociology of Disaster, Annual Meeting of the American Sociological Association, New York City: August, 1986; Session on Nuclear Power, Third International Congress on Emergencies, Washington, D.C.: May, 1985;

Session on Applied Sociology, Pacific Sociological Association, Seattle: April, 1984; Session on Theoretical Assessments, Western Social Science Association, San Diego: April, 1984; Session on Methodological Approaches in the Study of Health Care Delivery Systems, Western Social Science Association, San Diego: April, 1984; Session on Earthquake Hazard Reduction: Is the National Earthquake Hazard Reduction Program Meeting its Congressional Mandate, Seventh Annual Workshop on Natural Hazards Research Applications, Boulder: July, 1982; Session on Disasters and Cataclysms: Can Sociology Help, Pacific Sociological Association, San Diego: April, 1982; Session on Collective Behavior, American Sociological Association, New York: August, 1980; Session on Complex Organizations, Pacific Sociological Association, San Francisco: April, 1980; Session on Complex Organizations, Western Social Science Association, Tempe, 1976.

Discussant

Session on Theoretical Assessments, Western Social Science Association, San Diego: April, 1984; Session on Societal Response to Hazards, American Sociological Association, San Antonio: August, 1984; Session on Public Response to Earth Science Information, Natural Hazards Research Applications Workshop, Boulder: July, 1980; Session on Warning Systems, National Conference on Natural Hazards, Boulder: June, 1976; Session on Warning Systems, National Conference on Natural Hazards, Boulder: July, 1975; Session on Disaster Relief and Warning Systems, National Conference on Natural Hazards, Estes Park: June, 1973.

Participant

Workshop on Research Applications of the National Earthquake Hazards Reduction Program in the Western United States, U.S. Geological Survey, Denver: September, 1987; Review Panel on Disaster Research and Planning, National Center for Earthquake Engineering Research, State University of New York at Buffalo: August, 1987; Use of the Crisis Response Conclusion Retrieval System, University of Pittsburgh Center for Social and Urban Research, Pittsburgh: December, 1985; Panel on Disaster Research, Its Funding and Future, American Sociological Association, San Antonio: August, 1984; Review Panel, Corresponding Member, Task Group on Social and Economic Aspects of Earthquakes, National Academy of Sciences, National Research Council, Commission on Sociotechnical Systems, Washington, D.C.: 1982; Workshop on Disseminating Lessons Learned from Recent Earthquakes, Earthquake Engineering Research Institute, Los Altos: December 1982; Tennessee Valley Authority Flood Plain Evaluation Panel, Boulder: November, 1982; Earthquake Prediction Warning Task Force Workshop, Southern California Earthquake Preparedness Project, Asilomar: December, 1981; Symposium on Earthquake Prediction, Preparedness and Human Response, San Fernando: June, 1976; Seminar on Disaster Research, Colorado State University, Fort Collins: February, 1975; Symposium on Complex Organizations: Research and Applications, Western Social Science Association, El Paso: April, 1974.

Editorships

Member of the Editorial Advisory Board for Industrial Crisis Quarterly, 1986-date; Associate Editor for social science, Earthquake Spectra, Journal of the Earthquake Engineering Research Institute, 1984-date; Corresponding Editor, Organizations and Occupations, Newsletter of the American Sociological Association, Western Region 1984-85; Corresponding Editor on Hazards and

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Role Abandonment by Bus Drivers
During Major Emergency Evacuations

Confidential Work Product
Prepared in Contemplation of Litigation

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Contents

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Purpose

The purpose of this report is to summarize research findings concerning role abandonment by bus drivers during emergencies. Additionally, documentation of fifty major U.S. evacuations was reviewed in order to identify incidents in which buses were used as a means of transporting evacuees out of the the endangered area, and to identify cases where bus drivers refused to participate in the evacuation.

Methodology

A wide range of documents on the general topic of evacuation as well as incident-specific evacuation experiences were reviewed.

In order to accomplish the objective of identifying and summarizing research findings concerning role abandonment of bus drivers, the following sources were consulted:

- Federal agency publication centers and libraries, including:
 - Federal Emergency Management Agency
 - FEMA's Emergency Management Institute Library
 - Department of Transportation
 - National Technical Information Service
- The Natural Disaster Resource Referral Service (PO Box 2208, Arlington, VA)
- The Natural Hazards Research Information and Application Center of the University of Colorado
- The Disaster Research Center at the University of Delaware
- Penn State University

WESTON staff also reviewed case histories and documentation of fifty major U.S. evacuations which have occurred since 1980.¹ These case histories contain one or more of the following:

- articles from major media sources (AP, UPI);
- local newspaper clippings;
- after-action reports;
- communications logs;
- Police/Emergency Services reports;
- sociology reports; and
- others

The primary question asked during the review of these evacuation case histories was: were buses used to transport people out of the endangered area, and if so, did bus drivers refuse to assist in the evacuation? The results of this secondary source analysis are also presented in the following section.

¹ Note: Data on these cases were collected for an ongoing, in-depth study of evacuations for another client. In that study, secondary sources along with some interviews will form the basis of a comprehensive database of major evacuations.

Findings

Several studies have addressed the issue of role abandonment by emergency workers. Some of this research is summarized in a document entitled, "*Planning Concepts and Decision Criteria for Sheltering and Evacuation in a Nuclear Power Plant Emergency*."² A relevant excerpt from this study states:

"A corresponding concern sometimes expressed by the public is that emergency response personnel will abandon their jobs in order to protect themselves, their families or their property. However, Dynes has stated that in disasters "abandonment of organizational roles simply does not occur" (Dynes, 1974, p.153). In his analysis of the reasons for the absence of role abandonment, he emphasizes the operation of two groups of mechanisms suggested by Barton (1969). The first group, priority mechanisms, are established by training members of emergency organizations to give first priority to their jobs and by making organizational membership visible (especially through uniforms) and by the strength of primary group loyalties among organization members that would make the individual feel personally responsible to his or her colleagues, as well as to the community at large. The second set consists of avoidance mechanisms. These operate when members of the emergency organization come from outside the affected area (and, thus, families are unaffected) and when they have few or no family ties within the area. Avoidance mechanisms also operate when members of emergency organizations have unequivocal information about the extent of the affected area that indicates that their families are not threatened, have made prior arrangements for their families to take protective action without their assistance or have established communication with their families to verify that they are safe."

The study goes on to say:³

"Section 4.2.4 noted that designated emergency workers (e.g., police, fire and emergency services personnel) do not abandon their roles during disasters. It is important to recognize, however, that this conclusion does not automatically extend to a group that might be referred to as emergency auxiliary personnel. These can be defined as those members of "emergency relevant" organizations (those possessing resources that may be needed in an emergency) or "community relevant organizations" (those with an orientation toward community service, see Dynes, 1974, p. 18) who may be needed to perform specific emergency tasks. Bus drivers, for example, could be classified within this group. Although they may be needed to assist in evacuating residents of affected areas during a nuclear power plant emergency, bus drivers could not be assumed to have developed priority and avoidance mechanisms to the same degree as designated

² Lindell, M., Bolton, P., and Perry, R. (1985), Planning Concepts and Decision Criteria for Sheltering and Evacuation in a Nuclear Power Plant Emergency, AIF/NESP-031, National Environmental Studies Program of the Atomic Industrial Forum, Washington D.C., July 1985, pp. 4-19 to 4-20.

³ Ibid, p. 8-16

emergency workers. As a result, special provisions may need to be made in order to assure their availability in a nuclear power plant emergency. This can be achieved by special training that explains their role in the emergency response effort. In addition, this training should describe the nature of the radiation hazards to which the emergency auxiliary personnel might be exposed, emphasize the measures that will be taken to avoid exposure, and explain the procedures and equipment that would be used to monitor the magnitude of the exposures if they do occur. Finally, emergency auxiliaries should be informed of actions that will be taken to assist their families in taking protective action, if their homes are located in an affected area. Procedures planned in advance of an emergency would be expected to be particularly effective in avoiding the types of role conflict that could potentially result in role abandonment."

Sorenson, Vogt, and Mileti, in their 1987 study entitled, "*Evacuation: An Assessment of Planning and Research*,"⁴ wrote:

"Mileti (1985) has recently examined the concept as first conceptualized by Killian (1952) and later discussed by Moore (1958), Fritz (1961), Bates et al. (1963), Dynes (1970), Barton (1969), and Quarentelli (no date). The prevailing line of thought on role conflict is that, while people likely will experience conflict between family and organizational responsibilities, roles are rarely abandoned, and performing multiple roles does not jeopardize emergency duties.

Mileti (1985) concludes that when emergency work roles are "certain" perhaps through training, emergency workers do not abandon work roles to attend to roles involving intimate relationships. When emergency work roles are not "certain", than role conflict can occur, and would-be workers could attend to personal or family duties before attending to emergency duties."

They went on to say:⁵

"Role abandonment has been a controversial issue for some hazards. Research suggests that total role abandonment has not been prevalent in disasters and certainly has not been dysfunctional in organizational behavior. Some people have hypothesized that role abandonment would be greater and likely problematic in a nuclear power plant accident or during a nuclear war threat. This remains somewhat speculative. Research suggests that in the former case, there may be an increased potential for conflict and role strain, but emergency functions would not be threatened. In the latter case, the issue is highly uncertain."

4 Sorenson, J., Vogt, B., and Mileti, D. (1987), *Evacuation: An assessment of Planning and Research*, Federal Emergency Management Agency, Washington D.C., July, 1987. p. 90.

5 Ibid p.147

Case Histories:

In a review of reports, articles, and other documents concerning fifty major U.S. evacuations, it was reported that in 16 cases, buses were used to transport people from endangered areas. The other cases did not report the use of buses in the evacuation, however this does not mean that they were not used. There were no documented cases of bus drivers not cooperating or refusing to drive the buses.

The sixteen evacuation incidents that reportedly used buses during the evacuation were:

<u>Date</u>	<u>Location</u>	<u>State</u>	<u>Cause</u>	<u>Number of Evacuees</u>
3 March 87	Nanticoke	PA	Metal Plant Fire	14000
12 June 85	Pine Bluff	AK	Train Derailment	12000
20 February 86	Marysville	CA	Flood	20000
29 August 85	Pinellas County	FL	Hurricane Elena	300000
12 April 87	Pittsburgh	PA	Train Derailment	17000
4 September 85	Canton	OH	Chemical Plant Explosion	2000
29 May 86	Springfield	MA	Chemical Spill	10000
4 August 85	Checotah	OK	Bomb Transportation Accident	6000
14 November 85	Malden	WV	Chemical Plant Explosion	6000
6 May 82	Superior	WI	Chemical Plant Explosion	10000
4 April 83	Denver	CO	Train Derailment	9000
29 March 85	Greenfield	MA	Train Derailment	2000
11 December 82	Taft	LA	Chemical Plant Explosion	17000
28 May 87	Woodburn	IN	Warehouse Accident	5000
14 April 87	Gary	IN	Chemical Tank Leak	2000
3 April 80	Somerville	MA	Train Yard Accident	17000

Conclusions

In conclusion, existing research and an examination of recent major U.S. evacuations suggest that bus drivers would probably not abandon their role during an evacuation and that through training and planning, this possibility can be minimized.

Appendix A

FIFTY MAJOR EVACUATIONS

Date	Location	St	Cause	Evacs
870324	Waticoke	PA	Metal Plant Fire	14000
850716	Cedar Rapids	IA	Fire - Sewage Treatment Plant	20000
860804	St Petersburg	FL	Chemical Plant Accident	6800
860708	Miamisburg	OH	Train Derailment	20000
821211	Taft	LA	Chemical Plant Explosion	17000
850624	Anaheim	CA	Warehouse Fire	7500
850708	San Luis Obispo	CA	Forest Fire	10000
870414	Gary	IN	Storage Tank Leak	2000
850904	Canton	OH	Chemical Plant Accident	2000
870822	Pittsburgh	PA	Train Derailment	5100
870528	Woodburn	IN	Indust. Accident	5000
870412	Pittsburgh	PA	Train Derailment	17000
860529	Springfield	MA	Chemical Spill	10000
851029	New Orleans	LA	Hurricane Juan	6000
850926	Ocean City	MD	Hurricane Gloria	50000
850829	Pinellas County	FL	Hurricane Elena	300000
850321	Plainfield	NJ	Transportation Accident	8250
800403	Somerville	MA	Train Yard Accident	17000
860630	Beaumont	TX	Hurricane Bonnie	30000
851114	Malden	WV	Chemical Plant Explosion	6000
850925	Dare County	NC	Hurricane Gloria	37000
850804	Checotah	OK	Bomb Explosion	6000
850612	Pine Bluff	AK	Train Derailment	12000
850902	LaPlace	LA	Hurricane Elena	15000
841231	Little Rock	AK	Train Car Leak	2500
870404	Minot	ND	Chemical Warehouse Explosion	15000
831118	Lynn	MA	Fire	5600
830816	Houston	TX	Hurricane Alicia	42000
820928	Livingston	LA	Train Derailment	3300
800805	Corpus Christi	TX	Hurricane Allen	400000
861016	Columbus	OH	Dynamite Threat	1500
860609	San Antonio	TX	Train Derailment	1700
860220	Marysville	CA	Flood	20000
840909	Jekyll County	GA	Hurricane Diana	14500
821131	Orange	CA	Chemical Plant Explosion	3000
821112	Irvine	CA	Chemical Plant Accident	2000
820506	Superior	WI	Chemical Plant Explosion	10000
870725	Avon	IN	RR Tanker Leak	2500
870410	Lawrence	MA	Floods	3600
861010	King of Prussia	PA	Gasoline Pipe Rupture	3000
851116	Bay County	FL	Hurricane Kate	2000
850308	Peoria	IL	Floods	3000
830404	Denver	CO	Train Derailment	9000
870602	Cambridge	OH	Transport. Accident	2500
860225	Saline	MI	Chemical Spill - Toluene	2000
850810	Springfield	MO	Industrial Accident	3000
850703	Downington	PA	Chemical Spill	2800
850524	Hollywood	FL	Chlorine Tank Rupture	5000
850329	Greenfield	MA	Train Derailment	2000
840902	Omaha	NE	Unknown	10000

Appendix B

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INTERVIEW SCHEDULE

BUS DRIVER STUDY
FOR
ORGANIZATIONAL RESPONDENTS

Incident _____
Location _____
Interviewer
Name _____
Job Title _____
Phone Number _____

READ: Hello, my name is _____ (insert name). I'm calling from the research firm of Weston, Inc. in West Chester, Pennsylvania. We are doing a study of emergency evacuations, and the _____ (insert name) emergency that occurred in your community has been chosen for study. I'd like to ask you some questions about the emergency and the evacuation. Is now a good time to talk; if not I can call back at a more convenient time.

There are several kinds of questions I will ask you. If you don't know an answer, please feel free to say so; in cases where you don't know an answer to a question I'd very much appreciate it if you could give me the name and number of someone who might know.

- A. The first set of questions I will ask you are general questions about the evacuation that took place as a result of the _____ (hazard agent) on _____ (date).
1. What was the time of impact? By this I mean what was the time at which the _____ (hazard agent) actually became a direct threat to public safety? [Verify that for hazard release, this is time of release, not time of initiating event, such as derailment, if these took place at different times]. _____ AM/PM
2. Did the evacuation take place before, during or after impact?
- _____ Before
- _____ After
- _____ During (Explain) _____
- _____ Mixed (Explain) _____
- 3a. Did emergency response personnel and/or public officials have any advance warning prior to the impact?
- _____ No (go to 4)
- _____ Yes (go to 3b)
- 3b. How much time was there between the first notification of emergency personnel and/or public officials and the time of impact? _____ : _____ (hours/minutes)

4. When did the evacuation begin and when did it end?

	<u>Begin</u>	<u>End</u>
Time	_____	_____
Day	_____	_____
Month	_____	_____
Year	_____	_____

5. How large was the geographical area that was evacuated?

_____ square miles

6. How many people were there in the area that needed to be evacuated?

_____ number of people

- B. READ: The next set of questions are about the people who needed to be evacuated by evacuation buses.

7. How many people in total needed to be evacuated by bus?

_____ number of people

8. How many schools needed to be evacuated by bus?

_____ number of schools

9. How many school children needed to be evacuated by bus?

_____ number of school children

10. Excluding school children, where were the people who needed to be evacuated by bus located? (Record and define each type of location)

- C. READ: The following questions concern the mobilization of bus drivers to drive evacuation buses during the emergency.

11. How many buses were used to evacuate people?

_____ number of buses

12. How many bus drivers were thought to be needed to drive evacuation buses when bus driver mobilization began?

_____ number of drivers

13. How many bus drivers were attempted to be contacted?

_____ number of drivers

14. Of these, how many were actually contacted?

_____ number contacted

15. Why couldn't all bus drivers be contacted? (Explain) _____

16. Of those bus drivers contacted, what percentage refused to drive evacuation buses during the emergency?

_____ percentage (if "0," go to 18)

17. Why did these drivers refuse to drive evacuation buses during the emergency? (Explain) _____

18. Did any of these refusals occur because bus drivers were concerned about the safety of their family?

_____ No

_____ Yes (What _____%) (Explain) _____

19. Of those bus drivers contacted, what percentage did not refuse to drive evacuation buses, but simply did not report for work?

_____ percentage (if "0", go to 21)

20. Why didn't these drivers show up? (Explain) _____

21. Did any of these "no-shows" not report for driving because they were concerned about the safety of their family?

_____ No

_____ Yes (what _____%) (Explain)_____

22. Of those bus drivers contacted who did show up to drive evacuation buses, what percentage showed up late? (That is, they took noticeably longer to arrive than would be expected given the distance from their house to the bus yard.)

_____ percentage (if "0," go to 24)

23. Why did those drivers show up late? (Explain)_____

24. Did any of the bus drivers who showed up late do so because of concern about the safety of their family?

_____ No

_____ Yes (what _____%) (Explain)_____

25. What was the length of delay in reporting for driving evacuation buses among drivers who were concerned about the safety of their family?

a. Longest delay (____ hrs; ____ minutes)

b. Shortest delay (____ hrs; ____ minutes)

c. Average delay (____ hrs; ____ minutes)

26. Did any evacuation bus drivers help to evacuate their family before showing up for duty to drive evacuation buses?

____ No

____ Yes (what ____%)

27. Did any person volunteer to drive evacuation buses (by volunteer we mean people who did not have evacuation bus driving as their job before the emergency began)?

____ No

____ Yes (how many ____) (Explain who they were) _____

D. READ: The questions which now follow address the performance of the bus drivers who actually did drive evacuation buses during the emergency.

28. What percentage of the drivers who actually did drive evacuation buses did not do their job as well as they could have?

____ percentage (if "0," go to 30)

29. What sort of problems did these drivers have? (Explain)

30. Why did they have these problems? (Explain)

31. Did any of the drivers who did drive evacuation buses have any problems because of concern about their family's safety?

_____ No

_____ Yes (what _____%) (Explain)

32. Approximately how much time did evacuation bus drivers spend in the evacuation zone driving evacuation buses?

a. Longest stay (_____ hrs; _____ minutes)

b. Average stay (_____ hrs; _____ minutes)

c. Shortest stay (_____ hrs; _____ minutes)

E. READ: The next set of questions address the kind of things that evacuation bus drivers might or could have thought as they drove evacuation buses.

32a. Did any bus drivers make more than one trip into the evacuation area?

_____ No

_____ Yes

_____ Don't know

_____ No answer

33. Do you know if any evacuation bus drivers thought that they themselves were in danger during the time that they were driving buses in the evacuation zone?

_____ No, they didn't think they were in danger.

_____ Yes, they did think they were in danger. (What _____%)
(Explain why) _____

34. Do you know if any evacuation bus driver thought that they would receive adequate forewarning of any danger to themselves were it to occur during the time that they were driving buses in the evacuation zone?

_____ No, they didn't expect adequate forewarning (explain why) _____

_____ Yes, they did expect adequate warning (what _____%)
(Explain why) _____

35. Do you know if any evacuation bus drivers thought that they could personally detect any danger to themselves without relying on specialized equipment during the time that they were driving buses in the evacuation zone?

_____ No, they didn't think they could personally monitor
(Explain why) _____

_____ Yes (what _____%) (Explain why) _____

36. Do you know if any evacuation bus drivers thought that they could easily reach safety if the hazard impacted where they were during the time that they were driving buses in the evacuation zone?

_____ No, they didn't think they could easily reach safety.
(Explain why) _____

_____ Yes (what _____%) (Explain why) _____

- F. READ: The next few questions concern some background factors about all the bus drivers who were contacted and asked (either successfully or unsuccessfully) to report for evacuation bus driving duty during the emergency.

37. What percentage of these potential bus drivers had families in the area at risk during the emergency?

_____ percentage (if "0," go to 38)

38. What percentage of these families were capable of acting without assistance from the family member who was needed to drive an evacuation bus?

_____ percentage

- G. READ: The next two questions focus on the training, if any, of evacuation bus drivers that occurred before the emergency we have been discussing occurred.

39. Did evacuation bus drivers receive any kind of emergency training about their evacuation bus driver role before the emergency began?

_____ No

_____ Yes (what _____% of drivers received the training)
(Explain the training) _____

40. Did evacuation bus drivers know before the emergency began that they had the role of evacuation bus driver in an emergency like the one experienced?

_____ No

_____ Yes (what _____%) (Explain how known) _____

H. READ: There are only two questions left.

41. Were there enough bus drivers to drive evacuation buses in the emergency?

_____ No (what _____% were available) (Explain why) _____

_____ Yes (Explain why) _____

42. Did everyone who needed to be evacuated by evacuation bus get out in time?

_____ No (what _____% did not) (Explain why) _____

_____ Yes (Explain why) _____

Thank you very much for your help. I appreciate it very much.

Results of the Bus Driver Study
for Organizational Respondents

People familiar with the emergency operations during 19 major evacuations were surveyed for this study. Respondents included emergency managers (i.e., fire chiefs, police, civil defense officials, etc.) who were interviewed for basic information about the emergency (usually questions 1-10) and bus company officials (i.e., owners, managers, dispatchers, etc.) who were interviewed to answer the remaining questions.

The evacuation cases and the number of emergency managers and bus company officials interviewed are listed below:

<u>Case</u>	<u># Emergency Managers</u>	<u>#Bus Company Officials</u>
1. Canton	0	1
2. Pittsburgh	1	1
3. Superior	1	2
4. Malden	1	1
5. Checotah	1	1
6. Pine Bluff	1	1
7. Springfield	1	2
8. Greenfield	2	2
9. Nanticoke	1	1
10. Taft	2	1
11. Denver	1	1
12. Somerville	1	1
13. Elkhart	1	1
14. Gary	1	2
15. Marysville	1	4
16. Pinellas	1	2
17. Miamisburg	1	2
18. Hicksville/Woodburn	1	1
19. Minot	2	1

The Questions and Results:

1. What was the time of impact?

Morning (6:00 am - 11:59 am)	5
Afternoon (12 pm - 5:59 pm)	6
Evening (6:00 pm - 11:59 pm)	3
Night (12:00 am - 5:59 am)	4
No answer	1

2. Did the impact take place before, during or after impact?

Before	4
During	5
After	9
No answer	1

3. Did emergency response personnel and/or public officials have any advance warning prior to the impact?

No	13
Yes	5
No answer	1

- 3b. How much time was there between the first notification of emergency personnel and/or public officials and the time of impact?

Minimum	-	No advance warning
Maximum	-	From 6 hours to 4 days (Pinellas).

4. When did the evacuation begin and when did it end?

The date and time of the evacuations varied.

5. How large was the geographical area that was evacuated?

Smallest area	-	.5 mile radius
Average	-	2-20 square miles
Largest area	-	280 square miles

6. How many people were there in the area that needed to be evacuated?

Minimum	-	1,000 (Malden)
Maximum	-	300,000 (Pinellas)

7. How many people in total needed to be evacuated by bus?

Minimum	-	0 (At Pine Bluff people were loaded onto buses but not evacuated)
Maximum	-	5,000 to 10,000 (Pinellas)

8. How many schools needed to be evacuated by bus?

Minimum	-	0
Maximum	-	7 (Springfield)

9. How many school children needed to be evacuated by bus?

Minimum - 0
Maximum - 6,000

10. Excluding school children, where were the people who needed to be evacuated by bus located?

Nursing homes, shopping malls, hospitals, a barrier island, elderly housing, mobile home parks, old age homes, a beach area, residential areas, a college, a housing project, apartment complexes, a manufacturing plant, and business districts.

11. How many buses were used to evacuate people?

Minimum - 3
Maximum - 235 (Pinellas)

12. How many bus drivers were thought to be needed to drive evacuation buses when bus driver mobilization began?

Answers varied from "I can't remember" or "Don't know" to between 2 and 240.

13. How many bus drivers were attempted to be contacted?

Answers varied from "don't know" to "only those on duty were contacted" to between 3 and 80.

14. Of these, how many were actually contacted?

Answers varied. Answers to question 14 are most relevant when taken together with answers to question 13.

In the 12 cases that had reported firm numbers for both questions, one case reported that more drivers were actually contacted than the number of drivers attempted to be contacted primarily because a number of drivers volunteered after their normal routes were disrupted.

In 3 cases, fewer actual contacts were made than attempted due to the reasons stated in response to question 15.

The remaining 8 cases reported actual contact with all attempts. Respondents in other cases either could not recall or did not know.

15. Why couldn't all bus drivers be contacted?

Reasons varied, but included: not home, Easter, out of town, phone busy, radio system problems, vacation period, and that some drivers were already out on the road.

16. Of those bus drivers contacted, what percentage refused to drive evacuation buses during the evacuation?

No one in any of the cases studied refused to drive evacuation buses.

In the Taft case, a discrepancy exists because there was a report of testimony about the role abandonment of two or three drivers. The emergency coordinator, his assistant, and the transportation officer do not recall any instance of bus driver abandonment.

17. Why did these drivers refuse to drive evacuation buses during the emergency?

N/A

18. Did any of these refusals occur because bus drivers were concerned about the safety of their family?

N/A

19. Of those bus drivers contacted, what percentage did not refuse to drive evacuation buses, but simply did not report for work?

All drivers reported for work in all cases, with two minor exceptions in the Marysville evacuation. According to the information on the Marysville case two "mechanics could not physically reach the bus yard," presumably due to flood waters damaging access roads. Since they were unable to reach the bus yard, the two mechanics proceeded to a nearby nursing home to help in its evacuation.

20. Why didn't these bus drivers show up?

See answer to question 19 above.

21. Did any of these "no-shows" not report for driving because they were concerned about the safety of their family?

N/A

22. Of those bus drivers contacted who did show up to drive evacuation buses, what percentage showed up late? (That is, they took noticeably longer to arrive than would be expected given the distances from their house to the bus yard.)

None of the drivers "showed up late" in 16 of the 19 cases.

One bus company in Marysville reported that 1-2% showed up late due to traffic congestions. This particular company utilized about twenty drivers so presumably the respondent meant 1 or 2 drivers, not 1 or 2% of the drivers showed up late.

During the Pinellas evacuation, about 10% of one bus company's drivers showed up late because they first helped "take care of family."

One bus company in Miamisburg reported that 0% or an unknown number of drivers showed up late. In response to question 24, the respondent stated that "1 or 2 people who had to get families situated first" showed up late.

23. Why did those drivers show up late?

See answer to question 22 above.

24. Did any of the bus drivers who showed up late do so because of concern about the safety of their family?

See answer to question 22 above.

25. What was the length of delay in reporting for driving evacuation buses among drivers who were concerned about the safety of their family?

In the Pinellas case the delay caused by drivers reporting to work late ranged from 20 minutes to 3 hours with an average delay of 1 hour.

26. Did any evacuation bus drivers help to evacuate their family before showing up for duty to drive evacuation buses?

No	-	15 cases
Don't Know	-	2 cases
Yes	-	2 cases

Three to five drivers evacuated their families first during the Miamisburg evacuation.

One driver in the Woodburn/Hicksville evacuation evacuated his family first. However, this was before the evacuation order was given and before the report calls went out to the drivers.

Even though Pinellas respondents said that 10% showed up late in answer to question 22, they responded no to this question.

27. Did any person volunteer to drive evacuation buses (by volunteer we mean people who did not have evacuation bus driving as their job before the emergency began)?

Yes	-	10
No	-	9

In the Checotah case, the respondent answered yes to this question but that was because the drivers were not paid.

28. What percentage of the drivers who actually did drive evacuation buses did not do their job as well as they could have?

All cases - 0%

29. What sort of problems did these drivers have?

While all cases reported 0% to question 28 above, some respondents reported problems such as traffic jams, confusion as to where to go or what to do, confusion of law enforcement about access to evacuation areas, people wanting to take possessions with them, and flood waters impeding the roadways.

30. Why did they have these problems?

Most answers to this question were n/a.

While all cases reported 0% to question 28 above, a few respondents provided the following:

At the Superior evacuation, traffic jams were created because parents went to pick up their children.

During the Columbus evacuation, there was a lack of communication early on among the police, disaster services, and the bus company. This was corrected later by placing a transit company supervisor in the EOC.

31. Did any of the drivers who did drive evacuation buses have any problems because of concern about their family's safety?

No	-	17
Yes	-	2

During the Greenfield evacuation, half of the drivers heard rumors and were scared for families, apparently because the exact nature of the incident and the threat was not known.

During the Pinellas evacuation, officials told drivers they could leave to go home and take care of their families if they so desired. About 1% did so.

32. Approximately how much time did evacuation bus drivers spend in the evacuation zone driving evacuation buses?

Minimum	-	10 minutes
Maximum	-	30 hours

- 32a. Did any bus drivers make more than one trip into the evacuation area?

No	-	2
Yes	-	13
Don't Know	-	1
n/a	-	1
No Answer	-	2

33. Do you know if any evacuation bus drivers thought that they themselves were in danger during the time that they were driving buses in the evacuation zone?

No	-	13
Yes	-	5
Don't Know	-	1

34. Do you know if any evacuation bus driver thought that they would receive adequate forewarning of any danger to themselves were it to occur during the time that they were driving buses in the evacuation zone?

No	-	1
Yes	-	18

35. Do you know if any evacuation bus drivers thought that they could personally detect any danger to themselves without relying on specialized equipment during the time that they were driving buses in the evacuation zone?

No	-	7
Yes	-	10
Don't Know	-	2

36. Do you know if any evacuation bus drivers thought that they could easily reach safety if the hazard impacted where they were during the time that they were driving buses in the evacuation zone?

No	-	11
Yes	-	15
Don't Know	-	3

37. What percentage of these potential bus drivers had families in the area at risk during the emergency?

0%	-	6 cases
1%-50%	-	6 cases
51%+	-	2 cases
Unknown	-	5 cases

38. What percentage of these families were capable of acting without assistance from the family member who was needed to drive an evacuation bus?

0%	-	0
1%-50%	-	0
51%+	-	6
Unknown	-	8
n/a	-	5

In two cases, Pine Bluff and Taft, the respondents said, in response to question 37, that none of the bus drivers lived in the area. Here they said that most (greater than 51%) of the families could act without assistance from the bus driver.

39. Did evacuation bus drivers receive any kind of emergency training about their evacuation bus driver role before the emergency began?

No	-	10
Yes	-	9

In Marysville, some bus companies reported yes while others reported no. This case was considered a yes in this summary.

40. Did evacuation bus drivers know before the emergency began that they had the role of evacuation bus driver in an emergency like the one experienced?

No	-	7
Yes	-	12

In Marysville, some bus companies reported yes while others reported no. This case was considered a yes in this summary.

41. Were there enough bus drivers to drive evacuation buses in the emergency?

All cases - yes

42. Did everyone who needed to be evacuated by evacuation bus get out in time?

All cases - yes

In Pittsburgh, there were some refusals but all who wanted to get out by bus were evacuated.

BUS DRIVER INTERVIEW SCHEDULE

INCIDENT _____

LOCATION _____

INTERVIEWEE NAME _____

JOB TITLE _____

PHONE NUMBER _____

READ: Hello, my name is _____ (insert name).
I'm calling from the research firm of Weston, Inc. in West
Chester, Pennsylvania. We are doing a study of emergency evacua-
tions and the _____ (insert incident)
emergency that occurred in your community during _____
_____ (insert date) has been chosen for study. I'd like to ask
you some questions about the emergency and the evacuation. Is
now a good time to talk? If not, I can call back at a more con-
venient time.

Your name was provided to me as a person who drove L. S.
during this emergency. Is that correct?

_____ Yes

_____ No (if no, do not proceed, thank them for their time)

- A. READ: The first set of questions I will ask you are about your "activation message." By "activation message" I mean the request you received in which you were specifically asked to drive an evacuation bus during the incident.

1. Who did you receive this message from? _____

2. Where were you told to report? _____

3. Which of the following statements best describes the degree of threat to those in the risk area - that is, those who needed to be evacuated - as it was described in the activation message?

___ People in the risk area are in severe danger.

___ People in the risk area are in moderate danger.

___ People in the risk area are in slight danger.

___ There was no clear sense of threat in the message.

___ (Do not read) I don't remember.

4. Which of the following statements best describes the degree of urgency - the need for immediate - action as it was described in the activation message?

___ You are needed now.

___ You will be needed soon.

___ You will be needed later.

___ You may be needed later.

___ There was no clear sense of urgency in the message.

___ (Do not read) I don't remember.

- B. READ: The next set of questions I will ask you are about emergency information that you might have received prior to the activation message.
5. Were you aware that there was an emergency prior to receiving your activation message?
- ___ No (skip to 10)
- ___ Yes
6. How did you find out about the emergency? _____
- _____
7. As a result of the information that you received prior to the activation message, how likely did you think it was that your home would be threatened by the _____ (hazard event)?
- ___ Extremely likely
- ___ Very likely
- ___ Even odds
- ___ Very unlikely
- ___ Extremely unlikely
- ___ (Do not read) I don't remember
8. Did you or the members of your household take any protective action prior to receipt of your activation message?
- ___ Continued normal activities
- ___ Sought additional information
- ___ Prepared to evacuate
- ___ One or more household members evacuated
- ___ Other (specify) _____

9. How much time was there between:

When you first found out about the emergency, and when you received your activation message?

_____ hours/minutes

- C. READ: The next set of questions I will ask you are about your reactions to the activation message.

10. Where were you located at the time of the impact? By this I mean where were at the time the _____ (hazard agent) actually became a direct threat to public safety?

___ With family in impact area.

___ With family in periphery.

___ With family outside area.

___ Separated from family, family closer to impact.

___ Separated from family, respondent closer to impact.

11. What members of your household were at home when you received the activation message?

___ Self

___ Spouse

___ Number of children under 18

___ Number of other dependents (specify) _____

___ Number of others (specify) _____

12. To what extent did you feel a sense of personal responsibility to help those in your household by staying home to help them cope with the emergency?

☐ Great extent
☐ Moderate extent
☐ Minimal extent
☐ Not at all
☐ (Do not read) I don't remember.

13. To what extent did you feel that the members of your household would be protected even if you did not stay to help them?

☐ Great extent
☐ Moderate extent
☐ Minimal extent
☐ Not at all
☐ (Do not read) I don't remember.

14. To what extent did you feel a personal responsibility to help those in the risk area by reporting for duty to drive an evacuation bus?

☐ Great extent
☐ Moderate extent
☐ Minimal extent
☐ Not at all
☐ (Do not read) I don't remember.

15. To what extent did you feel that those in the risk area would be protected even if you did not go to help them?

___ Great extent

___ Moderate extent

___ Minimal extent

___ Not at all

___ (Do not read) I don't remember.

16. After you received your activation message, did you do anything other than proceed directly to the location where you were told to report. (Do not read alternatives).

___ No, I went directly to the reporting location (go to 17).

___ Yes, I tried to get additional information.

___ Yes, I helped my household prepare to evacuate.

___ Yes, I took other actions (specify) _____

17. If you did take any actions between receiving your activation message and arriving at your reporting location, about how much more time did you take than would have been required if you had proceeded directly?

_____ hours and minutes

D. READ: The next set of questions I will ask you are about your reactions during the time you were driving an evacuation bus.

18. How would you describe the sense of threat that you experienced during the time that you were in the risk area?

___ I was in severe danger.

___ I was in moderate danger.

___ I was in slight danger.

___ I had no sense of threat whatsoever.

___ (Do not read) I don't remember.

19. To what extent did you feel that you would receive adequate forewarning of any danger to yourself during the time that you were driving a bus in the evacuation zone?

___ Very great extent.

___ Moderate extent.

___ Minimal extent.

___ Not at all.

___ (Do not read) I don't remember.

20. To what extent did you believe that you would be able to detect any danger to yourself by means of environmental cues such as sights, sounds or smells?

___ Very great extent.

___ Moderate extent.

___ Minimal extent.

___ Not at all.

___ (Do not read) I don't remember.

21. To what extent did you believe that you could easily reach safety if the hazard impacted where you were during the time that you were driving a bus in the evacuation zone?

___ Very great extent.
___ Moderate extent.
___ Minimal extent
___ Not at all
___ (Do not read) I don't remember.

22. Were you or any members of your family injured as a result of this emergency?

___ Family member injured. State relationship to respondent. _____
___ Respondent injured.
___ Family members uninjured.

- E. READ: The next set of questions I will ask you are about any advance preparation that you might have received regarding your role as an emergency evacuation bus driver.

23. To what extent did you receive any kind of emergency training about your evacuation bus driver role before the emergency began?

___ Very great extent.
___ Moderate extent.
___ Minimal extent.
___ Not at all (Go to 23).
___ (Do not read) I don't remember.

24. What type of training was this? _____

25. Did anyone tell you before the emergency began that you might be asked to drive an evacuation bus during an emergency?

___ No (Go to 25).

___ Yes.

26. Please explain who told you, when they told you, and what you were told. _____

F. READ: The next question is about the "lessons learned" from your experience.

27. Are there any lessons that you think would be valuable to pass on to planners so that they could prepare better plans, procedures and training for emergency evacuations? _____

G. READ: I only have one more question that I would like to ask you.

28. How old were you during the time of the emergency?

___ Under 20.

___ 20-44.

___ 45 plus.

DO NOT READ: Below mark the sex of the respondent.

___ Male

___ Female

Thank you very much for your help. I appreciate it very much.

Results Of The Bus Driver Interview Study

As a follow-up to the Bus Driver Study for Organizational Respondents, LILCO talked with individual bus drivers who responded to ten of the 19 emergencies addressed in the previous study. Twenty-seven (27) bus drivers were surveyed who had participated in 10 of the 19 evacuation cases. The evacuation cases and the number of drivers surveyed are listed below:

<u>Case</u>	<u># Bus Drivers Surveyed</u>
1. Marysville	10
2. Greenfield	1
3. Malden	2
4. Taft	3
5. Canton	1
6. Miamisburg	1
7. Springfield	4
8. Pine Bluff	2
9. National City	1
10. Hicksville	2

The Questions and the Results:

1. Who did you receive this message from?

Activation messages were received from co-workers, transportation supervisors, bus dispatchers, transportation directors, emergency coordinators, sheriff's departments, over the television, and by word of mouth.

2. Where were you told to report?

Drivers were told to report to one of the following places: bus garages, nursing homes, senior citizens' homes, downtown areas, central offices, command centers, and police stations.

3. Which of the following statements best describes the degree of threat to those in the risk area - that is, those who needed to be evacuated - as it was described in the activation message?

12 People in the risk area are in severe danger.
5 People in the risk area are in moderate danger.
3 People in the risk area are in slight danger.
5 There was no clear sense of threat in the message.
1 I don't remember.

4. Which of the following statements best describes the degree of urgency - the need for immediate - action as it was described in the activation message?

24 You are needed now.
1 You will be needed soon.
0 You will be needed later.
0 You may be needed later.
1 There was no clear sense of urgency in the message.
1 I don't remember.

5. Were you aware that there was an emergency prior to receiving your activation message?

12 No
15 Yes

6. How did you find out about the emergency?

Answers included: over the radio or scanner; on the television; by supervisor, word of mouth, or passerby; from friends; or by actually seeing the threat.

7. As a result of the information that you received prior to the activation message, how likely did you think it was that your home would be threatened by the hazard event?

3 Extremely likely
3 Very likely
3 Even odds
3 Very unlikely
3 Extremely unlikely

8. Did you or the members of your household take any protective action prior to receipt of your activation message?

6 Continued normal activities
1 Sought additional information
5 Prepared to evacuate
2 One or more household members evacuated
1 Other

9. How much time was there between: When you first found out about the emergency, and when you received your activation message?

Answers ranged from a few minutes (most answers) to about 1-3 hours and in one case 3 days.

10. Where were you located at the time of the impact? By this I mean where were [you] at the time the hazard agent actually became a direct threat to public safety?

2 With family in impact area.
2 With family in periphery.
11 With family outside area.
4 Separated from family, family closer to impact.
8 Separated from family, respondent closer to impact.

11. What members of your household were at home when you received the activation message?

6 Self
10 Spouse
10 Number of children under 18
2 Number of other dependents
4 Number of others
7 N/A

12. To what extent did you feel a sense of personal responsibility to help those in your household by staying home to help them cope with the emergency?

1 Great extent
3 Moderate extent
8 Minimal extent
11 Not at all
4 N/A

One person who responded "not at all" said she took her family with her. Another who responded "minimal extent" said "family [was] already out and safe."

13. To what extent did you feel that the members of your household would be protected even if you did not stay to help them?

19 Great extent
2 Moderate extent
0 Minimal extent
3 Not at all
3 N/A

14. To what extent did you feel a personal responsibility to help those in the risk area by reporting for duty to drive an evacuation bus?

25 Great extent
2 Moderate extent
0 Minimal extent
0 Not at all

15. To what extent did you feel that those in the risk area would be protected even if you did not go to help them?

12 Great extent
4 Moderate extent
6 Minimal extent
5 Not at all

Comments: "duty to go and help;" "Felt he was needed to insure the safety of the residents. Did not think about the situation."

16. After you received your activation message, did you do anything other than proceed directly to the location where you were told to report.

23 No, I went directly to the reporting location.
0 Yes, I tried to get additional information.
1 Yes, I helped my household prepare to evacuate.
3 Yes, I took other actions (specify).

The driver who helped his household prepare to evacuate said that only took a "few minutes." The driver was with his family (spouse and one child) in the impact area at the time he received his activation message.

Those that took other actions did the following: two made phone calls to get out other drivers, and the other evacuated her children (which took 20 extra minutes) because she did not want to leave them alone.

17. If you did take any actions between receiving your activation message and arriving at your reporting location, about how much more time did you take than would have been required if you had proceeded directly?

One respondent said 10 minutes, one said 15 minutes, and the respondent who helped her family evacuate said she took 20 extra minutes.

18. How would you describe the sense of threat that you experienced during the time that you were in the risk area?

7 I was in severe danger.
5 I was in moderate danger.
5 I was in slight danger.
9 I had no sense of threat whatsoever.
1 N/A

One did not respond because was not in risk area but in "standby area."

19. To what extent did you feel that you would receive adequate forewarning of any danger to yourself during the time that you were driving a bus in the evacuation zone?

15 Very great extent
7 Moderate extent
1 Minimal extent
4 Not at all

Comments: "Never thought about it - bus had communications;" used radios; "3 times got wrong information - Drivers were telling police what was going on."

20. To what extent did you believe that you would be able to detect any danger to yourself by means of environmental cues such as sights, sounds or smells?

13 Very great extent
6 Moderate extent
2 Minimal extent
6 Not at all

21. To what extent did you believe that you could easily reach safety if the hazard impacted where you were during the time that you were driving a bus in the evacuation zone?

15 Very great extent

6 Moderate extent

2 Minimal extent

2 Not at all

2 N/A

Comments: "Never thought about this, had an obligation to evacuate the residents and was concerned about only this." One person who responded "not at all" said that she "didn't think of ability to reach safety."

22. Were you or any members of your family injured as a result of this emergency?

0 Family member injured. State relationship to respondent.

0 Respondent injured.

27 Family members uninjured.

23. To what extent did you receive any kind of emergency training about your evacuation bus driver role before the emergency began?

7 Very great extent

3 Moderate extent

11 Minimal extent

6 Not at all

24. What type of training was this?

Seven drivers reported receiving no training before the evacuation. Others received minimal training such as first aid, CPR, and how to operate a wheel chair lift. Others received more training, to include school evacuation and fire drills, use of special equipment, and regular school bus driver training. Some reported training occurred once, twice, or three times a year.

25. Did anyone tell you before the emergency began that you might be asked to drive an evacuation bus during an emergency?

11 No

15 Yes

26. Please explain who told you, when they told you, and what you were told.

Respondents indicated that they were told by their supervisors, emergency planning councils, school boards, or at routine meetings concerning evacuation. One respondent answered that she was told to be "always prepared" to transport school children during an emergency. Another indicated that he was told that his "primary role" during an emergency is to evacuate school children.

27. Are there any lessons that you think would be valuable to pass on to planners so that they could prepare better plans, procedures and training for emergency evacuations?

Comments included that the evacuations went well; everything was perfect; "that those in charge did an excellent job;" that radios should be used to keep drivers posted; have drills once a week; let drivers know which routes are best to take; that it would help if drivers were told what the emergency was all about; communications is most important. One said that it took too long to get out because there were only two main roads out of risk area.

28. How old were you during the time of the emergency?

0 Under 20

16 20-44

9 45 plus

Breakdown of Respondents by Sex:

2 Male

15 Female

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

TESTIMONY OF MATTHEW C. CORDARO,
RUSSELL R. DYNES, WILLIAM G. JOHNSON,
DENNIS S. MILETI, JOHN H. SORENSEN,
AND JOHN A. WEISMANTLE ON BEHALF OF
THE LONG ISLAND LIGHTING COMPANY ON PHASE II
EMERGENCY PLANNING CONTENTION 25 (ROLE CONFLICT)

PURPOSE

The intervenors' Contention 25 is entitled "Role Conflict of Emergency Workers." The contention alleges that "Role conflict . . . creates the possibility that significant numbers of emergency personnel will look to the needs of their families or others for which they have responsibility (including themselves) before they report (if at all) to their designated emergency response positions or otherwise respond to a request by LILCO for assistance."

In general, then, a poll is unnecessary (1) because it is not a valid and reliable instrument for predicting future behavior, (2) because it would not upgrade the list of factors a plan should address, (3) because a plan is mostly based on the actions of organizations, and (4) because past experience suggests that emergency workers perform their assignments.

This is not to say that particular types of surveys might not make important contributions to emergency planning. For example, a survey could be used to identify people who are willing to perform volunteer emergency work. The people identified by the survey could then be given an emergency role and trained. Also, a survey could be useful to help identify facts important to know about for planning; for example, the identification of people with special evacuation needs.

68. Q. Mr. Johnson and Dr. Miletì, have you reviewed the County's survey of bus drivers and volunteer firemen in Suffolk County?

A. [Johnson, Miletì] Yes.

69. Q. What is your opinion of that survey? Does it have any shortcomings?

A. [Johnson, Milet] Questions ¹⁰~~12~~ through ¹⁷~~19~~ on the survey instrument for volunteer firemen and Questions ⁴⁻⁸~~7-11~~ on the survey for school bus drivers are the same as questions 11-16 and 18-19 of the County's survey of the public in general, and thus are subject to the same criticisms as have been mentioned for those questions in LILCO's written testimony on Contention 23.

Question ¹⁸~~20~~ of the survey of volunteer firemen is as follows:

¹⁸~~20~~. 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 10 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 *for*

- 2 = first, you would make sure that your family was safely out of the evacuation zone, *or*
- 3 = first, you would leave the evacuation zone to make sure that you were in a safe place, *or*
- 4 = first, you would do something else (specify) _____.

The response categories to this question are neither mutually exclusive nor exhaustive. Also, the question itself tends to confuse respondents by asking what they think they would do "first." A volunteer fireman could both check to see that his or her family was safely out of the evacuation zone and also help with firefighting and evacuation in the evacuation zone. It is conceivable that a volunteer fireman could be working outside of the so-called evacuation zone when an accident took place. No effort was made to determine if the volunteer fireman does in fact normally work outside the 10-mile evacuation zone.

Question ²³~~21~~ states as follows:

- 23 ~~21~~. 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?

It is impossible to determine what is meant by the term "spend a day working within the evacuation zone." If this was meant to mean a 24-hour day, an 8-hour day, or somewhere in between, it should have been so stated. The way the question is worded now would be subject to different interpretations by different responders.

Question ⁹~~12~~ of the school bus driver questionnaire states as follows:

Suppose that you had completed your morning run ~~on a school day~~ and there was an accident at Shoreham. Everyone living within ten miles of the plant was advised to evacuate. Schoolbus drivers were expected to help evacuate school children. What do you think you would do first?

1. ^{First, I would} report to duty so that ^Iyou could pick up school children in the evacuation zone and drive them to a shelter. First, I would report to work
2. ^{First, I would} ~~go to~~ make sure that ^{my}your family ~~members were safe.~~ ^{was safely} out of the evacuation zone
3. ^{First, I would} leave the evacuation zone to make sure that ~~you were~~ in a safe place. ^{I was}
4. ^{First, I would} do something else _____
(Please specify)

Once again, the suggested response categories are neither mutually exclusive nor exhaustive. Also,

if everyone were advised to evacuate, why would school bus drivers be expected to help evacuate school children? ~~The same comments apply to question 13 of the County survey.~~

Question ¹⁰/~~14~~ asks "how dangerous" does the respondent think it would be to spend "several hours" driving school children out of the evacuation zone. The term "several" in this question leaves much to the imagination of the school bus drivers.

Finally, a serious problem with the survey is that it was self-administered; that is, respondents were given the survey instrument and asked to complete it. It is very possible that the respondents' answers to particular questions were influenced by information or questions that occurred later in the questionnaire.

70. Q. The County polled the opinions of volunteer firemen. What firemen were polled?

A. [Cordaro, Weismantle]. The poll was done by phone to 291 firemen at Miller Place, Ridge, Rocky Point, Sand Beach, and Riverhead.

71. Q. What were the firemen told to assume?

A. [Cordaro, Weismantle] Among other things, they were told (in Question 18) to suppose that volunteer firemen were expected to help with the evacuation.

72. Q. Have these volunteer firemen been assigned a clear role in helping with an evacuation?

A. [Cordaro, Weismantle] No.

73. Q. Did emergency workers abandon their emergency roles during the Ginna steam generator tube rupture incident on June 25, 1982?

A. [Weismantle] No, not at all, as indicated in the NRC report on the Ginna accident, NUREG-0909 (Attachment 8).

F. The "Uniqueness" of Radiation

74. Q. What is your opinion of the County's theory that radiological emergencies are "unique," so that experience with, for example, hurricanes and floods provides little guidance?

A. [Dynes, Mileti, Sorensen]. The ability to transfer the principles of human behavior in emergencies is

SCHOOL TRANSPORTATION REQUIREMENTS
FOR A ONE-WAVE EVACUATION

SCHOOLS	SCHOOL POPULATION		5% ¹		20% ²	BUSES AND DRIVERS NEEDED FOR ONE WAVE
<u>Shoreham-Wading River Central School District</u>						
Briarcliff	170	-	8	=	162	3
Miller Ave.	274	-	13	=	261	5
S-W River Mid.	498	-	25	=	473	8
S-W River High	788	-	39	=	749 - 150 = 599	15 (40 per)
Wading River	386	-	19	=	367	<u>7</u>
					Total	<u>38</u> ==
<u>Rocky Point School District</u>						
Jos. A. Edgar	550	-	27	=	523	9
Rocky Pt. El.	900	-	45	=	855	15
Rocky Pt.-Jun.	400	-	20	=	380	7
-Sen.	800	-	40	=	760 - 152 = 608	<u>16</u> (40 per)
					Total	<u>47</u> ==
<u>Longwood Central School District</u>						
Ridge El.	1,275	-	63	=	1,212	21
W. Mid. Isl. El.	806	-	40	=	766	13
Coram El.	991	-	49	=	942	16
Walters El.	1,042	-	52	=	990	17
Longwood Jun.	2,680	-	134	=	2,546 ÷ 2 = 1,273 ³	22
Longwood High	1,879	-	93	=	1,786 - 357 = 1,429	<u>36</u> (40 per)
					Total	<u>125</u> ===

SCHOOLS	SCHOOL POPULATION		5% ¹		20% ²	BUSES AND DRIVERS NEEDED FOR ONE WAVE
<u>Miller Place School District</u>						
N. Country Rd.	425	-	21	=	404	7
Muller Prim.	786	-	39	=	747	13
Sound Beach	600	-	30	=	570	10
Miller Pl. High	807	-	40	=	767 - 153 = 614	<u>16</u> (40 per)
					Total	<u>46</u> ==
<u>Port Jefferson School District</u>						
Pt. Jeff Jun.	289	-	14	=	275	5
Pt. Jeff El.	563	-	28	=	535	9
Vandermeulen High	1,150	-	57	=	1,093 - 218 = 875	<u>22</u> (40 per)
					Total	<u>36</u> ==
<u>Comsewogue School District</u>						
Clinton Ave El.	492	-	24	=	468	8
Comsewogue Sen.	1,355	-	67	=	1,288 - 257 = 1,031	26 (40 per)
Terryville El.	402	-	20	=	382	7
J.F. Kennedy	589	-	29	=	560	<u>10</u>
					Total	<u>51</u> ==
<u>Patchogue-Medford School District</u>						
Eagle El.	814	-	40	=	774	Total <u>13</u> ==

SCHOOLS	SCHOOL POPULATION		5% ¹		20% ²	BUSES AND DRIVERS NEEDED FOR ONE WAVE
<u>Riverhead Central School District</u>						
Riley Ave. El.	331	-	16	=	315	6
Pulaski Str. El.	544	-	27	=	517	9
Riverhead Jun.	755	-	37	=	718	12
Riverhead High	1,019	-	51	=	968 - 193 = 775	20 (40 per)
					Total	47
						==
<u>South Manor School District</u>						
South Street	500	-	25	=	475	8
Dayton Ave.	425	-	21	=	404	7
					Total	15
						==
<u>Mt. Sinai School District</u>						
Mt. Sinai El.	960	-	48	=	912	16
Mt. Sinai Jun.	854	-	42	=	812	14
					Total	30
						==
<u>BOCES Mid-Island Arena</u>						
	5(a.m.)	-	0	=	5	1 (a.m. & p.m.)
	22(p.m.)	-			22	
					Total	1
						==
					Final Total	449
						===

NOTE: Little Flower Union Free School District is not listed here because LILCO treats the one school in its district as a special facility since its students live there and the school does not have its own transportation.

SCHOOLS	SCHOOL POPULATION		5% ¹		20% ²	BUSES AND DRIVERS NEEDED FOR ONE WAVE
<u>Parochial Schools</u>						
St. Isidore	233	-	11	=	222	5
Infant Jesus	369	-	18	=	351	6
N. Shore Christian	207	-	10	=	197	4
					Total	<u>15</u> ==
<u>Nursery Schools</u>						
Alphabetland Child Enrichment Center	50	-	0	=	50	1
Brookhaven Country Day School	45	-	0	=	45	1
Central Brookhaven Head Start	75	-	0	=	75	2
Coram Child Care Center	50	-	0	=	50	1
Harbor View Nursery School	16	-	0	=	16	1
Just Kids Early Childhood Learning Center	120	-	0	=	120	3
Middle Island Nursery School	13	-	0	=	13	1
Neighborhood Nursery School	12	-	0	=	12	1
Rainbow Cottage	14	-	0	=	14	1
Riverhead Cooperative Nursery School	12	-	0	=	12	1
Sea Port Pre-School	20	-	0	=	20	1
St. Anselm's Nursery School	38	-	0	=	38	1
St. John's Pre-School	17	-	0	=	17	1

SCHOOLS	SCHOOL POPULATION		5% ¹		20% ²	BUSES AND DRIVERS NEEDED FOR ONE WAVE
Sound Beach Pre- School Co-op	19	-	0	=	19	1
Step-by-Step Early Learning Center	30	-	0	=	30	1
Tots'n Toys Pre- School Learning Center	35	-	0	=	35	1
Trinity Lutheran Nursery School	50	-	0	=	50	1
Wading River Cooperative Play School	32	-	0	=	32	1
Whispering Wonders Pre-School	50	-	0	=	50	1
World of Children Pre-School	60	-	0	=	60	<u>2</u>
	100	-	0	=	100	
	(summer pop.)				(summer pop.)	
					Total	<u>24</u> ==

¹ Reduction for daily absences.

² Reduction for those who drive to school or ride with someone who drives to school -- for high schools only.

³ Reduced by half for split session.

REGULAR BUS DRIVERS EMPLOYED
BY OR ON CONTRACT TO SCHOOL
DISTRICTS IN THE SHOREHAM
10-MILE EPZ

<u>School Districts</u>	<u>Number of Regular School Bus Drivers</u>
Shoreham-Wading River Central School District	30
Rocky Point School District	26
Longwood Central School District	94
Miller Place School District	21
Port Jefferson School District	14
Comsewogue School District*	21
Patchogue-Medford School District*	11
Riverhead Central School District*	47
South Manor School District	10
Mt. Sinai School District	27

* These school districts have schools located both
inside and outside of the Shoreham 10-mile EPZ.

For a complete summary of each organization, and its transportation and relocation plans, refer to the Evacuation Procedures of this Appendix.

Schools

This section covers public and private schools, including nursery schools, which are listed in Section IV of this Appendix.

Officials of public and private schools located in the 10-mile Emergency Planning Zone (EPZ) as well as schools located outside the EPZ but with students who live in the EPZ have the responsibility in a radiological emergency of providing their students with the best possible protection. There are three general alternatives available to provide for the safety of the children during an emergency. The first alternative is an early dismissal, whereby all students would be returned to their homes. The second alternative is evacuation, whereby all students would be relocated to reception centers outside the 10-mile Emergency Planning Zone (EPZ). The third alternative is sheltering students at their schools until conditions are safe for the children to either return home or be relocated. The best alternative will depend on the nature of the emergency, plant conditions, weather conditions, and time of day. The specific course of action recommended for each emergency classification is discussed below.

In the event of an emergency, schools in session will be notified of any Alert or higher emergency classification by the Emergency Broadcast System and by telephone. Each public school district, parochial school, and nursery school in the EPZ will have a tone alert receiver which will automatically activate and transmit the EBS message. The EBS message will advise the schools to implement specific protective actions and may contain general information about the condition of the plant, radiological conditions, etc. In addition, each school district superintendent and individual in charge of the private schools in the EPZ will be contacted by telephone by either the Public Schools Coordinator or Private Schools Coordinator to verify that the EBS message was received and to receive requests for additional assistance.

17 While LERO will advise the school officials on what protective actions should be
18 taken, the final decision lies with the School District Superintendant and private school ad-
20 ministrators. LERO will broadcast EBS messages announcing the protective actions taken
21 by each school district and private school.

23
24 If an Alert or higher emergency classification is declared when schools are in the
25 process of opening, and no protective action recommendation has been given to the public,
26 school officials will be advised to have arriving buses return their students to their homes,
28 and to have students who do not normally use buses return home in their usual manner. If
30 school is not in session and an Alert or higher emergency classification is declared, school
31 officials will be advised to cancel classes for all schools in the EPZ until the emergency is
33 terminated.

34
35 If an Alert or Site Area Emergency is declared while schools are in session, schools
36 will be advised to dismiss their students early. If any school district informs LERO that
37 they are not implementing early dismissal, then LERO will mobilize the LERO school bus
39 drivers for all schools. If a parochial or nursery school informs LERO that they are not im-
40 plementing early dismissal, then LERO will mobilize the needed resources from the Patchogue
42 Staging Area as a special dispatch.

43
44 If schools within the EPZ are still in session when a protective action is recom-
45 mended for the general public in any area of the EPZ, the schools will be advised to take
46 the same protective action. That is, if some combination of sheltering and no action is rec-
48 ommended for the general public, then the schools would be advised to shelter and put their
49 buses on standby. If some combination of sheltering and evacuation is recommended for the
51 general public, then the schools would be advised to evacuate to the School Relocation Cen-
52 ters. If schools are in the process of opening, then they will be advised to implement shel-
54 tering or evacuation, as appropriate, when their students arrive.

6
7
8
9
57 Upon a decision by school officials to evacuate schools in the EPZ, school children
58 will be transported by bus directly to one of two centers outside the EPZ that have been
59 designated as relocation centers: the Nassau Coliseum or the Nassau Community College.
61 Facilities at the Coliseum and the Community College are adequate to accommodate all of
62 the apporixmately 28,000 children enrolled in public and private schools in the EPZ. Some
64 schools, however, have made arrangements to use other facilities as relocation centers.

66
67 School districts on Long Island provide bus transportation for approximately one half
68 of their students. School districts also provide some transportation for parochial schools.
70 Private schools provide minimal transportation. Thus, in the event of an emergency
71 requiring evacuation, school districts in the EPZ would be unable by themselves to evacuate
72 all students at the same time. To provide for the capability of a "one-wave" evacuation,
74 LERO has arranged with various bus companies on Long Island to obtain "first-call" rights
75 to enough additional buses so that when combined with buses already provided by the
77 schools, all school children could be evacuated in one "wave" of buses. The number of buses
78 required is based upon 40 high school students per bus or 60 elementary school students per
80 bus.

81
82 LERO will provide additional trained auxiliary bus drivers to ensure that all neces-
83 sary buses are manned. LERO bus drivers will be pre-assigned to designated bus yards and
84 will be mobilized automatically if an evacuation is recommended or if any public school dis-
86 trict does not implement early dismissal while schools are in session. Bus drivers will pick
88 up dosimetry and school assignments at the bus yards. This equipment will be either stored
89 at the bus yard or brought by a LERO school bus driver to the bus yard. LERO bus drivers
90 will be available to drive LERO-supplied buses and any regular school bus for which a regu-
92 lar driver is not available. The plan provides enough LERO bus drivers to ensure 150 per-
93 cent of total bus driver needs.

Students will be transported by bus to a pre-assigned location either at the Nassau Coliseum or the Nassau Community College where they will wait to be picked up by their parents or guardians. LERO bus drivers will park their buses and assist teachers and parents at the school relocation centers. Regular bus drivers will proceed to the EWDF for monitoring and, if necessary, decontamination .

In those situations where school officials have pre-designated relocation facilities on their own, LERO will provide transportation assistance to these facilities as requested.

Those schools outside the EPZ which have students living in the EPZ will be requested to retain those students at the school when the school day ends, if any protective actions are recommended for the general public in any area of the EPZ.

Nursery Schools

Nursery schools will be advised to implement the same protective actions as the public and private schools for each

emergency classification and recommended protective action. If the nursery schools are advised to evacuate the children to reception centers, LERO will provide the necessary transportation.

LERO SCHOOL BUS DRIVER PROCEDURE

1. Upon callout LERO School Bus Drivers should report to bus yard designated on callout sheet. Listen to WPLR (99.1 FM) or other EBS radio station for emergency status. The callout sheet also indicates if you are a primary or backup driver.*
2. At bus yard, proceed to the bus yard dispatcher's office. Inform the bus yard dispatcher that:
 - a) There is a Shoreham emergency and that you are a LERO School Bus Driver.
 - b) You have a current New York State Class 2 Driver's License.
 - c1) (If you are a backup driver)
You are available if needed to drive a bus to support an evacuation of the school children or accompany a regular school bus driver.
 - c2) (If you are a primary driver)
Request that a bus be assigned to you.
3. After a bus has been assigned to you, obtain an Assignment Packet from the LERO box. (The LERO box will either be stored in the bus yard dispatcher's office or brought by one of the LERO bus drivers). If accompanying a regular bus driver, pick a packet for that bus driver's regular school assignment. If all packets have already been taken, report to the Bus Dispatcher at the Patchogue Staging Area.
4. Ensure the Assignment Packet contains:
 - a) One 0-200 mR Direct Reading Dosimeter (DRD)
 - b) One 0-5R DRD
 - c) One Thermoluminescent Dosimeter (TLD)
 - d) Two KI tablets
 - e) Emergency Worker Dose Record Form (OPIP 3.9.1, Att. 2)
 - f) Emergency Worker Bus Driver Badge
 - g) Bus Lease Receipt Form (OPIP 3.6.4, Att. 14)
 - h) Directions to School

* See definition on page 3 of 3

LERO SCHOOL BUS DRIVER PROCEDURE

(Continued)

- i) Directions to School Relocation Center
 - j) Directions to the EWDF
 - k) Directions to Patchogue Staging Area
 - l) School Relocation Center Area Diagram
 - m) School Relocation Center Location Assignments
 - n) School Children Log Out Form
 - o) LERO School bus driver procedure
 - p) Directions to the EWDF
 - q) Pen or Pencil
5. If you heard that a general emergency has been declared, swallow one KI tablet. If you are riding a bus with a Regular Driver provide her with a KI tablet if she has received dosimetry training.
 6. Fill out Part I of the Emergency Worker Dose Record Form. Check both DRDs to ensure they are reading between zero and 20% of full scale. If necessary zero the dosimeter using a dosimeter charger in the box. Enter the readings in the column marked "Initial" in Part II of the Emergency Worker Dose Record Form. Keep all 3 parts of this form with you.
 7. Clip both DRDs and the TLD to your outer clothing on the upper part of your body. Read DRD's every 15 minutes.
 8. Primary Bus Drivers should examine the assigned bus and fill out Bus Lease Receipt Form. Leave Pink Copy with the bus yard dispatcher.
 9. Proceed to the designated school. Identify yourself to a school staff member and inform them you are available to assist in evacuating the school if needed.
 10. When directed by school personnel assist in loading children. Request that a school staff member accompanies the children.

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LERO SCHOOL BUS DRIVER PROCEDURE

(Continued)

11. Take the children to the designated relocation center, unless told differently by the school staff member. The school representative has final say on the bus destination.
12. Provide the school representative with the School Relocation Center Location Assignments and the School Children Log Out Form.
13. Upon arrival at the School Relocation Center drop off children at the location designated on the School Relocation Center Area Diagram.
14. Park the bus and take the keys with you.
15. Proceed to the School Relocation Center Assignment Station shown on the School Relocation Center Area Maps and pick up an assignment packet.
16. Perform the assignment identified in the packet.
17. When told that your job is completed by a School Relocation Center Staff member, proceed to the EWDF.
18. At the EWDF, turn in your dosimetry, two copies of Emergency Worker Dose Record Form and the Yellow Copy of your Bus Lease Receipt Form.
19. Return to the Bus Yard.
20. Primary Bus Drivers fill out Part II of the Bus Lease Receipt Form. Ensure that you sign the form. Give the completed form to the bus company dispatcher before leaving the bus yard.

NOTE: If you have any problems contact the Special Facilities Evacuation Coordinator at the EOC at _____.

LERO SCHOOL BUS DRIVER PROCEDURE

(Continued)

Definitions

- Primary Driver - LERO School Bus Driver who drives a bus from a bus yard that does not normally provide buses to schools within the EPZ.
- Backup Driver - LERO School Bus Driver who drives a bus from a bus yard that normally provides buses to schools within the EPZ. The drivers will drive buses when directed by the bus yard dispatcher or accompany the regular driver.
- Regular Driver - A bus driver who regularly drives school buses on a daily basis. An employee of the Bus Company or School District.

LILCO, April 13, 1988

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USNRC

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CERTIFICATE OF SERVICE

OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

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

I hereby certify that copies of TESTIMONY OF DOUGLAS M. CROCKER, ROBERT B. KELLY, MICHAEL K. LINDELL, AND DENNIS S. MILETI ON THE REMANDED ISSUE OF "ROLE CONFLICT" OF SCHOOL BUS DRIVERS were served this date upon the following by Federal Express as indicated by one asterisk, or by first-class mail, postage prepaid.

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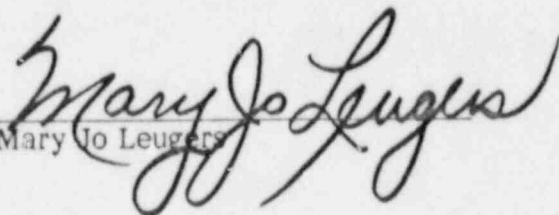
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DATED: April 13, 1988


Mary Jo Leugers