

Before the
UNITED STATES NUCLEAR REGULATORY COMMISSION
Washington, D.C. 20555

In the Matter of:	:	
	:	
ENERGY NUCLEAR OPERATIONS,	:	DOCKET No. 50-247
INC.	:	50-286
(Indian Point Nuclear Generating Unit,	:	
Units No. 2 and 3)	:	Licenses DPR-5, DPR-26
	:	and DPR-64
	:	
-----	:	October 16, 2003

RICHARD BLUMENTHAL, ATTORNEY GENERAL
OF THE STATE OF CONNECTICUT,
Petitioner

**SECOND SUPPLEMENT TO SECTION 2.206 REQUEST FOR REVIEW OF
INDIAN POINT ENERGY CENTER UNITS 2 AND 3**

On April 24, 2003, the Petitioner, Richard Blumenthal, Attorney General of Connecticut, filed a petition pursuant to 10 CFR §§ 2.206 and 2.202 (the "Petition"), urging the United States Nuclear Regulatory Commission ("NRC") to take immediate action with regard to certain security and other emergency preparedness issues at the Indian Point Energy Center, a multi-reactor nuclear power station located in Buchanan, New York. On June 3, 2003, the Attorney General submitted a supplement to the Petition including certain additional factual material relevant to the preparedness review. The Attorney General now respectfully files a second supplement to the Petition in order to provide the Commission with valuable additional

information to assist it in evaluating the radiological emergency preparedness plan ("REPP") at Indian Point.

As noted in the original Petition, the State of Connecticut has several specific interests with regard to emergency planning at Indian Point, including the impact on the already overburdened transportation infrastructure in southwestern Connecticut of the evacuation of large numbers of people from New York. Additionally, Connecticut has a stake in emergency response issues at Indian Point because it appears virtually certain that, in the event of an attack or accident at the facility, large numbers of Connecticut residents in cities and towns near the New York border would voluntarily relocate. The Petition also points out that a major element of the REPP is a system of two, separate notices; the first to a small group of initial evacuees including schoolchildren, and a second general evacuation notice for the rest of the population including parents. Such a system, of course, is clearly unworkable both because the initial "secret" notice will in all likelihood become public very quickly and, especially because it flatly contradicts human nature as it expects parents to evacuate without their children.

Certain new information has become available which directly addresses these issues. Specifically, attachment A hereto is a study done at the Disaster Research Center at the University of Delaware and entitled "Hurricane Threat and Evacuation Intentions: An Analysis of Risk Perception, Preparedness, Social Influence, and Resources." This study provides a number of valuable insights about behavior responses to large-scale disasters. While the entire study is important, page 18 of the report is particularly helpful: "Historically, studies have shown that family variables have been very important components of evacuation (Houts et al.,

1984; Drabeck & Stephenson, 1971). *This was because families tended to evacuate as a unit.* (Perry, 1979).” (Emphasis added.) Thus, contrary to the premise underlying the REPP, the families of New York and Connecticut citizens living in and around the Indian Point plant *are not going to leave* until they have collected together as families. Knowing that parents will not leave until they have been reunited with their children, the REPP’s contrary directive will simply be ignored, and the REPP would be worse than having no evacuation plan at all.¹

Moreover, the REPP clearly fails to consider the statistically significant “family variables” in its evacuation plans. For example, the University of Delaware study highlights the importance of what is described as the “warning confirmation process,” whereby individuals evaluate evacuation warnings. (*Id.*, p. 5.) The study identifies a series of demographic and economic factors of critical importance in predicting evacuation compliance “[b]ecause evacuation decisions are influenced by societal norms, different population subgroups, with different norms, may have different rates of evacuation.” (*Id.*, p. 5) Important predictive factors include, for example, age (Quarantelli, 1985) and gender (Riad et al., 1997).” (*Id.*) In addition, the study points to “health, income, and social support” as other relevant factors. Some

¹Not only does it defy common sense that the REPP expects parents to flee a nuclear disaster without their children but, as Attachment B to this supplement demonstrates, even the Federal Emergency Management Agency (“FEMA”) appears to agree. This document, a “Fact Sheet” published by FEMA points out that an accident at a nuclear power station could lead to a plume of radioactivity resulting in an evacuation order. (Fact Sheet, p. 1) In response to this possibility, FEMA urges the public to “Develop an emergency communication plan.” (Fact Sheet, p.2) FEMA adds: “*In case family members are separated from one another during a disaster (a real possibility during the day when adults are at work and children are at school), have a plan for getting back together.*” (*Id.* Emphasis added.) Thus, FEMA recognizes that families will spontaneously act to get “back together,” and urges members of the public to develop a plan to do so. The REPP, however, carefully plans to keep parents and children separate, by notifying and evacuating each group separately.

additional social and family criteria of importance included prior evacuation experience and the presence of children, their age, etc. (*Id.*, pp. 18-19.)

There is no indication in the REPP that any of these factors have been identified, let alone considered. An evacuation plan that lacks the minimum data necessary accurately to predict evacuation characteristics is, by definition, incomplete and quite possibly does more harm than good. Without the data to evaluate who and how many people will evacuate, it is impossible to effectively plan for the mass movement of evacuees onto the already jammed southwestern Connecticut roads.

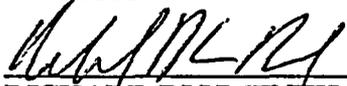
Further, recognition of the fact that the REPP is fundamentally flawed will undermine public confidence, potentially to disastrous effect. "In emergencies which call for a response by the public, the degree of reliability which is accorded to the source of information and instruction is known to be a major factor in determining the quality and speed of the public's response. This is especially true in emergencies in which individuals cannot perceive the danger through their own senses. For example, impending industrial, or even radiation, accidents can be foreseen by the competent authorities, but to the layman's eye everything in the vicinity of the plants appears absolutely normal. The credibility of the source of the public warnings about emergencies must be protected. . . ." (*Disaster Response*, University of Wisconsin Disaster Management Center, Lesson 4: Initial Emergency Operations, pp. 2-3, attached hereto as Attachment C.)

This study flatly states that authorities must "[e]stablish what factors . . . bear on a household making a decision to evacuate" in order to establish a proper plan. (*Id.*, p. 6) Not

only has this not been done in the Indian Point REPP, but more ominously, the Wisconsin report unequivocally states as the first point under the heading "Major Lessons from Evacuation Studies" that "Evacuation plans must be based on family evacuation, not individual evacuation." (*Id.*, p. 7.)

The Indian Point REPP lacks even the barest minimum of social and economic data necessary to provide proper predictive behavior analysis to support an evacuation plan. More importantly, the existing plan, with its two part notification system predicated upon separate notification and non-family evacuation is fatally and fundamentally flawed. The consequences are obvious -- public confidence in this plan will be nil, the public will not follow the evacuation scenarios as planned, and the concomitant confusion, chaos, and panic may well overwhelm authorities in New York and Connecticut. It is imperative, therefore, that the Indian Point REPP meet all legal requirements to protect the public, should an unthinkable radiation release ever occur. Until this is done, the NRC should suspend operations at the Indian Point plant in order to minimize the risk to the public.

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Hurricane Threat and Evacuation Intentions: An Analysis of
Risk Perception, Preparedness, Social Influence, and Resources

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Running Head: Hurricane Threat and Evacuation Intentions

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Abstract

The goal of this study was to test a model in which the decision to evacuate is a function of four processes (risk perception, preparedness, social influence, and economic resources). Participants were interviewed by telephone both while they were under a hurricane warning and after the threat had disappeared (pre-post sample). Because all respondents had been participants in an earlier panel study, pre-threat data were also available. The pre-post sample of 95 panelists was older than the non-respondent sample of 54 panelists who could not be reached by phone during the warning period but was otherwise comparable. The results indicated that higher risk perception and the belief that one is influenced by others are the strongest predictors of intentions to evacuate. Furthermore, risk perception was shown to mediate the influences of many background variables (e.g., experiences, demographics) on evacuation intentions. Post-event comparisons between the pre-post group and a reactivity control group of 66 panelists suggested that the warning period interview did not increase anxiety but may have influenced reactive preparedness.

Hurricane Threat and Evacuation Intentions: An Analysis of Risk Perception,
Preparedness, Social Influence, and Resources

From the viewpoint of the individuals involved in the process, evacuation is a gamble. Either they do not evacuate and risk possible injury or they evacuate and risk worrying about their homes and possibly wasting their time if a hurricane does not hit. Whereas many individuals err on the side of caution, other individuals take the gamble. Evacuation is largely a function of people defining themselves as being in danger and believing that leaving the area in question is beneficial (Fitzpatrick & Mileti, 1991). Successful evacuation requires involvement from both the community (issuing evacuation orders, providing marked exit routes) and the individual (decision making). Although community involvement is important in evacuation, external social influence can only go so far because ultimately the individual is responsible for the decision. Knowing who is at higher risk for not evacuating, and why, could indicate ways of influencing these individuals to make an affirmative evacuation decision and may even suggest early intervention strategies that provide access to the resources necessary to evacuate successfully. The goal of this study was to test a model in which the decision to evacuate is a function of four processes: risk perception, preparedness, social influence, and resources.

Risk Perceptions and Protection Motivation

In an analysis using a combined sample of 777 subjects from Hurricanes Hugo and Andrew, Riad, Norris, and Ruback (1998) examined the reasons people gave for not evacuating. Although both of these storms were Category 4 hurricanes, 33% of those who did not evacuate had believed that the hurricane was not a serious threat, and 25% had been confident in their safety. How bad must conditions be perceived to be before evacuation occurs? Evacuation researchers have examined different aspects of assessing risk, such as perceived severity of the threat, the individual's perceived susceptibility to that threat (Perry et al., 1981; Houts et al. 1984), and family characteristics (Houts et al. 1984, Drabek and Stephenson, 1971).

Many theories focus on individual preventive behavior by using a cost-benefit, decision making perspective (Weinstein, 1988). The health belief model (Becker, 1974; Janz & Becker, 1984), Fishbein and

Ajzen's theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), subjective expected utility theory (Beach, Campbell, & Townes, 1979; Edwards, 1954; Sutton, 1982) and Roger's protection motivation theory (Rogers, 1975) all share this cost-benefit view (Weinstein, 1988). Perceptions of costs and benefits are important for understanding evacuation. While evacuation decreases certain risks, such as personal injury, it sometimes is perceived as increasing other risks, such as burglary (Riad et al., 1998).

Preparedness

Preparedness in the form of general knowledge and information should facilitate evacuation by enabling more appropriate response behaviors (Faupel et al., 1992). However, whereas some researchers have found high levels of preparedness (Hodler, 1982; Perry & Lindell, 1986) among evacuees, others have not (Bourque et al, 1973; Worth & McLuckie, 1977). What exactly constitutes preparedness has also been debated. At the United Nations conference in Yokohama, the word preparedness was defined in drastically different ways, ranging from action-oriented steps to education (Quarantelli, 1994). A citizen's ability to evacuate on short notice may depend upon two different types of preparedness -- proactive behaviors that have taken place previously in response to a hypothetical threat and reactive behaviors that take place when the threat is immediate (Faupel et al., 1992; Norris, 1997). Although many types of disasters occur too suddenly for reactive behaviors, satellite technology now provides most hurricane victims with a substantial warning period.

Prior disaster experience has been found to be a powerful predictor of preparedness (e.g., Demerath, 1957; Fritz 1961; Hutton, 1976; Moore et al., 1963; Norris, Smith, & Kaniasty, 1998; Perry et al., 1981). The more recent (Perry, 1979), direct (Tierney, 1993), and severe the experience was (Weinstein, 1988) the greater its influence on preparedness. However, Riad et al. (1998) found that prior evacuation behavior significantly predicted future evacuation behavior, whereas prior disaster experience did not. This led the authors to believe there is an "evacuation repertoire" because people who have evacuated before know what to do and how to act. This repertoire is very individualized. Prior evacuation experience may give people a sense of control or a feeling of self-efficacy. Residents may feel prepared for the storm (e.g., boarded up

windows, car filled with gas) but may not feel they have the capability to deal with the evacuation process if they have not done it before.

Social Influence and Norms

Emergency conditions change behavior and norms (Fritz, 1957; Perry, 1979). When a warning is received, people engage in what evacuation researchers have historically called the warning confirmation process. Individuals call others to get their interpretation of the event (Mileti, 1991; Drabek and Boggs, 1968) and observe each other's behavior (Cutter and Barnes, 1982; Carter, Clark and Leik, 1979). Other researchers like Christensen and Ruch (1980) are divided over the influence of social networks in prompting evacuation. Results from their two experiments using taped simulated hurricane bulletins showed that neither actions of an observable friend nor those of a spouse had any effect on the individual's response.

Because evacuation decisions are influenced by societal norms, different population subgroups, with different norms, may have different rates of evacuation (Moore, 1963). Research has backed this notion with race (Perry, 1979; Riad, et al., 1997), age, (Quarantelli, 1985) and gender (Riad et al., 1997).

Access to Resources

Resources are those stable assets, such as health, income, and social support, that can be used to cope with a variety of circumstances. Inadequate economic resources may inhibit evacuation because poor people do not have the means to evacuate (i.e., have no transportation or money). In Riad et al.'s (1997) study, 10% of those who did not evacuate attributed their behavior to inadequate social or economic resources.

Individuals who are not well physically may also have trouble evacuating.

One important resource is social embeddedness which provides access to both tangible resources (e.g., a ride or a place to stay) and emotional support (Kaniasty & Norris, 1995). Family constitute an important resource because individuals are most likely to evacuate to the homes of relatives (Drabek & Boggs, 1968). Riad et al. (1997) found that individuals with strong social support were more likely to evacuate following Hurricanes Hugo and Andrew.

Present Study

In summary, the variables hypothesized to influence individual decision making are risk perception, preparedness, social influence and resources. These variables were examined as predictors of intentions to evacuate among individuals threatened by Hurricane Bertha in 1996. On Wednesday, July 10, 1996, Hurricane Bertha, a category 2 storm was threatening the Eastern Coast. The storm was 300 miles in diameter and its path was unclear. In Georgia, official mandatory evacuation orders were not yet issued but officials recommended that residents of the coastal islands evacuate as a precaution. In South Carolina, a mandatory evacuation order was issued in the evening for South Carolina's barrier islands. Because a northerly turn had been anticipated, a hurricane watch was never issued for Savannah and Charleston. A hurricane warning was issued when it appeared that Bertha would continue on a north-westerly path. A hurricane warning is issued when a hurricane is expected to hit within 24 hours. The hurricane did eventually turn towards the north and made landfall in Wilmington, NC. At the time, Bertha was a category 2 hurricane (105 mph).

On Tuesday July 9, 1996 at 11:30 pm it was decided that this hurricane presented a unique opportunity for study because two of the cities being threatened were the same cities involved in a longitudinal panel study that had been initiated following Hurricane Hugo. Longitudinal data are important for many reasons, including the establishment of reliability of measurement and documentation of changes over time. For this particular study, having a solid data base to work from helped immensely with the time pressures by allowing specific questions regarding evacuation to comprise the bulk of the questionnaire.

This situation also presented a methodological opportunity. Two major weaknesses of evacuation studies are that they are based on self report and employ a retrospective design. When data are collected after a hurricane strikes, time and the fact that the evacuation warnings were true may change residents' memories of why they did not evacuate. Though these weaknesses are pervasive in disaster research, this study overcame them by studying a community before as well as after evacuation warnings were proclaimed. By calling people during the warning period, we were able to ask them about their preparatory behaviors when the

details were still fresh in their minds. One possible issue with prospective designs is that calling before the event may increase awareness of the event and cause individuals to behave differently. Therefore we also incorporated a control group into the design to check for demand characteristics.

Method

Sampling Procedures and Design

Original Panel. A sample of 1,000 adults was drawn, 250 each from four cities that differed in their experience with Hurricane Hugo in 1989. Two of the original cities -- Charlotte, NC and Greenville, SC -- were not included in the present study of Hurricane Bertha. The two included cities -- Charleston, SC and Savannah, GA -- had both been threatened by Hurricane Hugo before the storm actually hit Charleston. Local interviewers used maps marking the boundaries of the areas to solicit interviews. Only one interview per household was allowed. For comparison purposes, a quota (purposive) sampling strategy was used. This strategy provided approximately equal numbers of Blacks and Whites, men and women, and younger (18-39), middle-aged (40-59) and older (60+) persons. The first interviews were conducted in the respondents' homes in the Fall of 1990, the second wave was six months later and the third wave was six months after that. The fourth wave of data was collected in the Fall of 1995. It was from this fourth wave of interviews conducted in Charleston (n = 146) and Savannah (n = 169) that the sample for this study was drawn (see Figure 1).

The Pre-Event Sample. From the fourth wave of interviews, conducted in the Fall of 1995, a manual contained the names, addresses, phone numbers and ID number of those respondents living in Savannah, GA, and Charleston, S.C. The flip of a coin randomly determined the individuals to be called during the hurricane warning. A team of 5 graduate students and 4 undergraduate students were organized to be the interview team. All of the interviewers but one had experience in conducting telephone interviews. Data collection started at 3:00 PM and lasted until 9:30 PM. A total of 165 phone numbers were called, and 95 interviews were conducted for a response rate of 58%.

Post-Event Samples. The post-event samples consist of three groups (see Figure 1). The first group consisted of all the individuals who were called during the pre-event phase of the study (n = 95). Out of this

group a total of 91 individuals were re-interviewed for a response rate of 96%. This group will be referred to as the pre-post group. The sample was 60.4% female and 50.5% black.

The second group called the reactivity control group consists of 95 individuals (n = 41 for Charleston and n = 54 in Savannah). A total of 66 individuals were interviewed (n = 32 for Charleston and n = 34 in Savannah) for a total response rate of 69%. This group had been set aside and was not called in the pre-event phase of the research. A control group is necessary because our phone call about evacuation could possibly be interpreted as a demand characteristic (increasing awareness of the hurricane and therefore causing evacuation). The sample was 68.2% female and 48.5% black.

The third group, the non-respondent group, was made up of 70 individuals (n = 37 in Charleston and n = 33 in Savannah) who were called on the night of the pre-event interviews but were not reached for the interview. Out of this group a total of 54 individuals were reached for a total response rate of 77%. Comparing their responses during the post-event interview to those of the other two groups will allow an estimate of sampling bias to be made. The sample was 61.1% female and 40.7% black.

The same interviewers responsible for the pre-event interviews attempted to call the same respondents back for the post-event interview. There are three large categories of measures, background, pre-event and post-event.

Background Measures

Many important demographic variables were located in the longitudinal data set. Related to evacuation is whether the individual owned or rented his/her home. Also available were measures of race, sex, age, tenure, occupation and education.

Risk Perception. A composite score of psychological distress at Wave 4 ($\alpha = .79$) was measured by taking the mean to 5 items (e.g., how often were your emotions numb, did you quit caring about people, were jumpy or easily startled, unusually forgetful, have trouble sleeping; Thompson, Norris & Hanacek, 1993). The response format ranged from 1 = never to 5 = very often.

Preparedness. At Wave 4, a set of 20 hazard preparedness questions influenced by the Mulilis - Lippa earthquake preparedness scale (Mulilis et al., 1990) were included by Norris (1997). In a factor analysis, items clustered into Basic Supplies (e.g., radio, batteries, flashlight), Advanced Planning (e.g., household plan for severe storm, professional advice), Hazard Alertness (e.g., attentiveness to weather information), and Perceived Usefulness of Hazard Preparedness (e.g., how useful to have a plan of action). For this analysis a composite score was made by counting affirmative responses to a general hazard preparedness and awareness scale ($\alpha = .72$).

Social Influence. A scale of social embeddedness ($\alpha = .70$) was created by taking the mean of 7 items (number of people you say hello to in a day, how many friends and relatives do you enjoy spending time with and how many times did you get together with them, how many neighbors do you know well enough to visit, how many organizations do you participate in). Resources. The composite score of financial well-being was measured by taking the mean of 4 items ($\alpha = .76$; e.g., problems having clothing, food, meeting monthly bills and money issues were a burden; Norris & Uhl , 1993). The composite score of physical well-being combines 4 items ($\alpha = .84$; e.g., how often did your health prevent you from doing things you wanted to do, have trouble getting around, feel tired and feel physical burden; Norris & Uhl , 1993). The response format for these measures ranged from 1 = never to 5 = very often.

Pre-Event Measures

Evacuation. Subjects were asked, "If a warning is issued, are you going to evacuate?" They responded on a dichotomous scale (yes or no). From the literature and previous work, a list of all of the reasons people had given for not evacuating was compiled. Respondents were read each reason and then asked if it was true or false about them (see Table 1).

Risk Perception. The measure of risk perception was created by taking the mean of affirmative responses to 10 items tapping whether these perceptions would encourage evacuation (current severity/category of the hurricane, national hurricane center increasing the category of the hurricane, an official evacuation order being issued, a governmental mandatory evacuation order being issued, actually

feeling the sustained winds on your face, hearing the noise the winds make, family encourages leaving, believe storm is coming, believe storm will be bad, feel house unsafe; $\alpha = .72$). Respondents answered each question yes or no.

A composite score representing anxiety ($\alpha = .89$) was created by taking the mean of responses to whether the respondents felt nervous, fearful, anxious and stressed. The response format ranged from 1 = not at all to 4 = a great deal. The age and gender of everyone currently living in their household was listed.

Preparedness. To assess the level of reactive preparedness a number of items related to hurricane preparedness were asked. Respondents were told that people do different things in case of emergencies and that the questions referred to right now, today. The respondents answered yes or no. A reactive preparedness measure was created by counting the affirmative responses to whether individuals had done a number of items related to hurricane preparedness (presence of a tarp, chainsaw, protection plan, secured outdoor furniture, moved valuables to a safer place, knew location of shelter, had extra cash, had an evacuation route, had an alternative evacuation route; $\alpha = .72$).

Social Influence. Two types of social influence were measured. The first was reality based, in that it measured the types of social influence actually received or provided. The second type of social influence was hypothetical in that it asked whether types of social influence would affect an evacuation decision if received.

The measure of actual social influence ($\alpha = .76$) was created by taking the mean of the responses tapping this construct (number of neighbors spoken with, number of neighbors preparing their homes, number of neighbors preparing to evacuate, number of people spoken to about an evacuation route, how many friends and family members have called you to urge evacuation, how many friends and family members have offered you a ride or a place to stay, have you made plans for relatives, have you offered anyone a ride or a place to stay). Except for offering a ride or a place to stay, whose response options were yes or no, the questions were answered on a 5-point scale: 1 = none, 2 = one or two, 3 = three to five, 4 = six to nine, or 5 = ten or more.

Openness to social influence ($\alpha = .61$) was assessed by asking whether the following experiences would encourage them to evacuate: the chance to affiliate with others, seeing neighbors leave, having a friend ask you to evacuate. Respondents answered simply yes or no. The more speculative hypothetical questions were asked before the reality based social influence questions.

Resources. To assess the amount of self-efficacy, four questions ($\alpha = .77$) were adopted from Bandura and rewritten to be specific for the evacuation process (when I make the evacuation plan I am sure it will work, if I run into a problem while evacuating I am sure I can solve it, I think evacuation is too complicated to do and when I start to evacuate I believe I will be able to reach a safe spot). The response options were simply true or false. Applicable questions were reverse-scored.

Post-Event Measures

Risk Perception. Post-event anxiety ($\alpha = .72$) was assessed with the same 4 questions used in the pre-event questionnaire (feel nervous, fearful, anxious, stressed). In addition, respondents were asked, "In the past week how often have you thought about Hurricane Hugo?" and "In the past week how often have you thought about other seriously stressful events that have happened to you?" Both questions were answered on a 4-point scale from 1 = not at all to 4 = a great deal.

Preparedness. To assess any preparatory actions that may have happened after we telephoned respondents, the following questions were asked, "Did you gas up your car, or had you already gassed it up or you did not gas it up?" The answers were scored on a 3 point nominal scale did it, had already done it, and did not do it. The same format was used to assess attainment of water, food, batteries and cash.

Social Influence. To assess amount of social comparison and need for affiliation, respondents were asked if they spent the warning period with anyone other than members of their household. If they answered "yes" then they were asked whether this was for: "Emotional support?", "To compare yourself with others?", "For practical support?", "For informational support?", "Because you were afraid?", and "Because they were afraid?" Respondents answered yes or no.

Results

Description of the Pre-Event Sample

There were 38 males (40%) and 57 females (60%) in the sample. Regarding race, 48% of the sample were Black ($n = 46$) and 52% were White ($n = 49$). The sample's mean age in years was 62 ($SD = 15.5$, range = 27 to 88), and the average years of education were 12.6 ($SD = 3.5$, range = 5 to 24). The majority of the sample (43.2%) were retired, followed by 33.7% of the sample working full-time. The average amount of time spent in the house during the day was 18 hours. The majority (45%) of the sample ($n = 43$) were married, although 14% had never married ($n = 13$), 11% were divorced ($n = 10$) and 30% were widowed ($n = 29$).

The number of people in the household ranged from 1 to 6 ($M = 2.5$). The number of males in the household ranged from 0 to 3 ($M = 1.1$) and the number of females ranged from 0 to 4 ($M = 1.4$). The number of children in the household ranged from 0 to 5 ($M = 0.6$). The range for male children was 0 to 3 ($M = .35$) and the range for female children was 0 to 3 ($M = .28$).

Descriptive Analyses of Evacuation Beliefs and Experiences

Table 1 presents a list of beliefs about evacuation, compiled from earlier work regarding why individuals do not evacuate (Riad et al., 1997). As indicated by the percentages, the majority of this sample believed that they had enough time to leave, that they were in control, and that they had experience with hurricanes. Against the grain of popular disaster lore, only 5 individuals felt they had to stay and care for their pets.

To test whether individuals with different demographic characteristics had different beliefs and experiences regarding the evacuation process a series of chi-square analyses were conducted. Women were more likely to believe the storm was going to be bad, $\chi^2(1, N = 95) = 3.67, p = .05$. Men were more likely to say that they felt their house was safe, $\chi^2(1, N = 95) = 6.88, p < .01$. Men were also more likely to say that they felt in control $\chi^2(1, N = 95) = 4.95, p < .05$. Higher education was related to feeling God is in control, $\chi^2(1, N = 95) = 9.27, p < .05$ as was being Black, $\chi^2(1, N = 95) = 13.70, p < .001$. Whites had more

recent evacuation experience, $\chi^2(1,94) = 15.00, p < .001$. Individuals who had intentions of evacuating felt less safe in their homes, $\chi^2(1, N = 95) = 10.81, p < .001$, and owned cars, $\chi^2(1, N = 95) = 4.17, p < .05$.

Individuals who had evacuation intentions had family who wanted to leave, $\chi^2(1, N = 82) = 14.72, p < .01$. They also felt that the hurricane would be coming, $\chi^2(1, N = 95) = 5.10, p < .05$, and that it would be bad, $\chi^2(1, N = 95) = 8.39, p < .01$. Individuals who lived in Savannah were more concerned about looting, $\chi^2(1, N = 95) = 3.71, p = .05$, whereas individuals in Charleston said they had more hurricane experience $\chi^2(1, N = 95) = 8.30, p < .01$.

Those who spent the warning period with others ($n = 66$) did so for a variety of reasons. Rank ordered, emotional support was first, followed by: practical support, informational support, because they were afraid, in order to compare self with others and, finally, because the individual was afraid. Blacks were more likely to have spent the warning period with others for emotional support, $\chi^2(1, N = 66) = 4.91, p < .05$.

Multivariate Relations Between Background Variables and the Proximal Measures

Multiple regression was used to determine whether background variables predicted risk perception, reactive preparedness, actual social influence, openness to social influence, efficacy, and anxiety. These measures are those thought to be more proximally related to the evacuation decision and were often substantially related to one another. Risk perception and hypothetical social influence were highly intercorrelated ($r = .64$). Risk perception was also highly correlated with anxiety ($r = .39$). Reactive preparedness was correlated with actual social influence ($r = .53$) and efficacy ($r = .32$). Openness to social influence was moderately correlated with anxiety ($r = .23$). The background variables were selected on the basis of the literature and bivariate relations. They were entered into the equation simultaneously. Table 2 presents the standardized regression coefficients as well as the amount of variance accounted for by the set of background variables in each of the composite variables.

For risk perception, hurricane experience had a marginal relationship. Prior evacuation experience was positively related to risk perception. Women, Blacks, and individuals living in Savannah perceived more

risk. Individuals who reported psychological distress at Wave 4 perceived more risk. Anxiety was only predicted by past psychological distress.

Reactive preparedness was predicted by prior evacuation experience and greater preparedness at Wave 4. Younger and Black individuals conducted fewer of the preparatory behaviors. There was a marginal, inverse relation between education and reactive preparedness.

Higher actual social influence was associated with greater preparedness at Wave 4, higher embeddedness in the community, and having more women in the house. Openness to social influence was associated with more evacuation experience and past psychological distress. Respondents who lived in Savannah were also more open to social influence.

Higher efficacy was associated with prior evacuation experience, financial and physical well-being, embeddedness in the community, and more children. However, the fewer women in the household, the more efficacy was reported.

Predictors of Evacuation Intention

Almost half of the sample said they had intentions of evacuating (46%). To determine what demographics were related to intentions to evacuate a series of chi-square analyses were conducted. Chi-square analyses revealed that individuals who had prior hurricane experience were less likely to have evacuation intentions, $\chi^2(1, N = 95) = 9.44, p < .01$. Those who owned their homes were less likely to have intentions to evacuate, $\chi^2(1, N = 95) = 8.17, p < .01$. Women were more likely to have evacuation intentions, $\chi^2(1, N = 95) = 3.73, p < .05$. Individuals who lived in Savannah were more likely to have evacuation intentions, $\chi^2(1, N = 95) = 7.60, p < .01$. Blacks were more likely to have evacuation intentions than Whites, $\chi^2(1, N = 95) = 5.50, p < .05$.

For the continuous variables predicting evacuation a MANOVA was conducted. Dependent variables were the proximal influences (efficacy, reactive preparedness, risk perception, actual social influence, openness to social influence, anxiety), the background variables (e.g., financial well-being, physical well-being, Wave 4 preparedness, Wave 4 distress, home ownership, tenure, age, sex, and race) and

household composition variables (e.g., number of females and males, children and adults). The independent (grouping) variable was evacuation intentions (yes, no). The multivariate F was significant, $F(21, 72) = 4.22, p < .001$. Individuals who intended to evacuate were more anxious, had less education, were less embedded in the community, reported psychological distress in the past, perceived more risk, and were more open to social influence than those not intending to evacuate. Reactive preparedness, actual social influence and efficacy were not related to evacuation intentions.

To investigate the importance of whether these relations might differ by city, another MANOVA was conducted on the split sample. The results are presented in Table 3. Individuals who intended to evacuate from Savannah had more anxiety, perceived more risk, were more open to receiving social influence, had more females in the house, were less attached to their home, had lower education levels, and were less embedded in the community than those who did not intend to evacuate. Individuals who intended to evacuate from Charleston also were more anxious, perceived more risk, were more open to social influence, had prior psychological distress, were less educated, and were less embedded in the community than individuals who did not intend to evacuate.

A hierarchical logistic regression model was derived by entering variables that had significant bivariate effects into the equation predicting evacuation intentions. Hierarchical logistic regression was used because of multicollinearity between two of the important variables, risk perception and openness to social influence. Risk perception was entered into the equation first, $\chi^2(1, N = 94) = 40.79, p < .000$. Alone this variable correctly classified 28.5% of the sample over chance. Then embeddedness was entered into the equation, $\chi^2(1, N = 94) = 6.73, p < .001$. This addition improved the model fit by correctly classifying another 1.1% of the sample. Third, openness to social influence was entered, $\chi^2(1, N = 94) = 5.52, p < .05$. The addition of this variable further increased the overall fit of the model by correctly classifying another 3.2% of the sample. Finally, all of the other variables such as anxiety, prior hurricane experience, home ownership, education, race, sex, and city were entered last (see Table 4). None of these variables added to the overall fit of the model, $\chi^2(7, N = 87) = 8.34, n.s.$ Overall the total model correctly classified 32.8% of the

sample over chance. Individuals who more perceived risk and were less embedded in the community had evacuation intentions. Openness to social influence was marginally correlated with evacuation intention.

Risk Perception as a Mediator

To test the idea that risk perception mediated the relationship between other variables and evacuation intentions, further analyses were conducted (See Figure 2). According to Baron and Kenny (1986) three conditions must be met to establish mediation. First the independent variable (in this case a set of variables; hurricane experience, evacuation experience, city, past psychological distress, race and sex) must be shown to affect the mediator (risk perception). To test the first condition, a regression equation predicting risk perception was conducted using sex, race, evacuation experience, past psychological distress, city, and hurricane experience as independent variables. This equation was significant, $F(6,88) = 8.24, p < .001$.

The second requirement of mediation is that the mediator (risk perception) must be shown to affect the outcome variable (evacuation intention). This second step was also confirmed because risk perception predicted intentions to evacuate, $\chi^2(1, N = 95) = 42.33, p < .001$. The third requirement is that the effects of the set of independent variables on the outcome variable should (evacuation intention) decrease when the effects of the mediator are taken into account. This was accomplished in two parts. First, the same group of independent variables needed to significantly predict evacuation intention and it did, $\chi^2(1, N = 95) = 31.17, p < .001$. The second goal was to see whether the group of background variables predicted evacuation intentions to evacuate when risk perception was controlled for in the analysis. It did not, $\chi^2(1, N = 87) = 7.78, n.s.$ This meant that risk perception was a psychological mediator of evacuation intentions for those with experience, those living in Savannah, those having past psychological distress, Blacks and women.

Methodological Comparisons

In order to test for the presence of response bias and demand characteristics, validity checks were conducted. To identify these biases, three groups were interviewed one week after the hurricane. The pre-post group was the sample who was interviewed both before and after the hurricane (see Figure 1 for a review). The reactivity control group was the sample that was randomly set aside at the beginning of the study, and no

attempt to call them was made. The non-respondent group consisted of those with whom interviews were attempted but who could not be reached. All validity checks involved examining whether there were differences between these groups on basic demographic characteristics and all post-event measures. Only the significant ones will be mentioned here.

The first comparison involved the reactivity control group and the pre-post group. This comparison tells us whether the individuals we called were significantly different from the individuals we did not call and if our phone call could have influenced evacuation, anxiety levels, or preparedness. The reactivity group scored higher on anxiety ($M = 1.38$) than the pre-post group ($M = 1.20$), $t(155) = -2.32, p < .05$. The second comparison involved the reactivity control group and the non-respondent comparison group. This comparison tells us whether the individuals we attempted to contact (e.g. but were not at home) were significantly different from the individuals we did not call. There were no significant differences between these two groups. A third comparison tested differences between the pre-post group and the non-respondent group. This was done in order to determine if there was a response bias, meaning that the individuals we contacted were different in some way than the individuals who were not at home that night. The non-respondent group was marginally more anxious ($M = 1.34$) than the pre-post group ($M = 1.20$), $t(143) = -1.90, p < .07$. The pre-post group was older ($M = 61.9$) than the non-respondent group ($M = 52.5$), $t(143) = 3.45, p < .001$. A chi-square analysis revealed that the pre-post group had been less likely to spend the warning period with other people, $\chi^2(1, N = 143) = 9.52, p < .01$. From this we know that our phone call did not influence affiliation. The pre-post group was, however, more likely to buy batteries than the non-respondent group, $\chi^2(1, N = 143) = 9.19, p < .01$. It appears from the consistent anxiety findings that our phone call did not increase anxiety.

Discussion

In this final section, results of the study are summarized, the limitations and strengths of the study are described, and the implications for future investigations are discussed. This study was undertaken to identify the differences between respondents who intended to evacuate and those who did not under

ambiguous threatening circumstances. The variables of particular interest were risk perception, preparedness, social influence, and resources.

Clearly, perceiving risk was very important in deciding whether to evacuate or not. Other storm characteristics such as believing it was going to be bad and that it was coming also had an effect on evacuation intentions. These findings are consistent with the models of evacuation decision-making that have placed great emphasis on risk perception.

Risk perception was a psychological mediator for important background variables (e.g., race, sex, past psychological distress, hurricane experience, evacuation experience, and city). Although independently these variables predicted evacuation intention, they do not once risk perception was controlled for. Being Black, female, having past distress, being experienced, and living in Savannah affected how much risk these individuals felt and this link was what predicted evacuation intention.

There are other variables that may affect the adults' perception of risk. Historically, studies have shown that family variables have been very important components of evacuation (Houts et al, 1984; Drabeck & Stephenson, 1971). This was because families tended to evacuate as a unit (Perry, 1979). Consistent with past research, individuals who had intentions to evacuate had family who wanted to leave.

Another household variable that could affect perceptions of risk was having children in the house. Past research has found that households with young children were more likely to evacuate (e.g., Houts et al, 1984). In this study, the influence of children in the household was assessed in two ways. First, those who had children in the household (35.8%) were compared to those who did not have children in the household (64.2%). Secondly, the evacuation intentions of individuals who had young children (e.g., under six and 12) were examined. Neither the number of total children in the household nor the number of young children in the household were related to evacuation intentions.

Although having children was not related to evacuation intention, having male children was related to perceiving more risk. The more male children in the household, the more risk was perceived. Zajonc's (1976) research with birth order showed that there was a longer lag time between babies being born when the first

child was a male. The hypothesized reason for this was that parents preferred male children, therefore waited longer after having a male child than a female child. Cross-cultural research also shows that male children are preferred in India (Nath & Land, 1994) and in China (Arnold & Zhaxiang, 1986). If this male child preference is true, then respondents may have been more concerned with protecting male children.

This study took into account that individuals may sometimes experience conflicting motivations in that although they perceive risk, it may be for their territory rather than for themselves. This notion of territoriality was important on the bivariate level with owners being less likely to leave, and being more concerned about looting. There was also a city difference with individuals who lived in Savannah being more attached to and proud of their homes. These individuals were less likely to have evacuation intentions.

The second variable hypothesized to be related to evacuation intentions was preparedness. Younger, White, and married individuals were more prepared. This may be a resource issue in that younger individuals have more energy to prepare, and married couples have more help. Blacks were less well off financially than Whites. However, financial well-being itself was not related to preparedness.

Individuals who were prepared at Wave 4 (1995) were prepared at Wave 5 (before Bertha). The Wave 4 measure was concerned with general hazard preparedness. The Wave 5 measure was concerned with reactive preparedness. This research is consistent with the finding that higher levels of general preparedness should enable more appropriate response behaviors (Faupel et al., 1992). This finding is very important because it pulls the field one step beyond where it was given the context of the study (e.g., actual threat of natural disaster).

Prior evacuation experience was once again more important than hurricane experience. Those who had prior evacuation experience (52.6%) perceived more risk, were more prepared, had higher levels of efficacy, and were more likely to say that others would influence their decision to evacuate. Hurricane experience was only marginally related to risk perception. Those who had evacuation experience were more likely to have evacuation intentions. However, those who had hurricane experience were less likely to have evacuation intentions.

It has been suggested that individuals who have prior evacuation experience have an evacuation repertoire because they know what to do and how to act (Riad et al., 1997). This study takes the repertoire finding further because it includes 2 additional steps, efficacy and risk perception. Now it can be said that individuals who have evacuated before know what to do, how to act, feel as though they can accomplish the action, and perceive enough risk to intend to evacuate to begin with.

The other important variable that predicted evacuation intentions in the logistic regression model was social embeddedness. Individuals who had evacuation intentions appeared to be less embedded in the community. As mentioned before, some individuals may be more attached to place. It is possible that individuals who are more embedded in the community find it more difficult to leave.

There were two types of social influence measured, actual and hypothetical. Actual social influence is a combination of social comparison processes (e.g., see neighbors preparing homes, see neighbors preparing to evacuate) and specific disaster related support (e.g., received phone calls, talked to individuals about evacuation routes). Hypothetical social influence measured an openness to being influenced by others to make an evacuation decision.

Younger individuals received more actual social influence (e.g., spoke with more people, saw more individuals engaging in preparatory behaviors). The more females in the household the more actual social influence. Vaux (1988) has argued that feminine sex-role characteristics (e.g., expressing warmth and compassion; see Bem, 1974) facilitates the providing and receiving of support and therefore enhances the development and maintenance of supportive relations. These types of relations may become more apparent under stressful situations like a hurricane threat. There is some indication that women prepare their families and communities for disasters more than men (Fothergill, 1996).

Openness to social influence was related to having evacuation experience and having past psychological distress. These individuals may have made a positive decision to evacuate if only they had been influenced. Blacks were more open to social influence. In other words, Blacks said that they would be influenced to evacuate if they were called, if they saw their neighbors leave, and if a friend asked them to

leave. There were, however, no ethnic differences regarding actual social influence. This may be representative of cultural differences between White and Black families. Staples (1979) stated that the Black kinship network is more extensive and cohesive than kinship bonds among the Whites and a larger proportion of Black families take relatives into their household. From this, it logically follows that Blacks would be more open to others suggesting that they evacuate; however, they may not have had the resources to provide actual support.

Gender differences appear to be quite consistent in the literature with women being more likely to evacuate (Riad et al., 1997) and have evacuation intentions. As men and women view the world differently, it follows that they will also perceive risks differently (Cutter, 1992). Women are more likely to perceive a disaster event or threat as serious or risky (Cutter, 1992; Howe, 1990; Leik et al., 1982; Flynn et al., 1994, Fothergill, 1996). Gender was also one of the variables mediated by risk perception. Women perceived more risk and felt less safe in their homes than the men. Women are more likely to receive risk communication, due to their social networks, and to respond with protective actions, such as evacuation (Fothergill, 1996).

Altogether resources were not important predictors of evacuation intentions. This is consistent with past research as well (Riad et al., 1997). It appears as though individuals will find a way to leave if they perceive enough risk. Socioeconomic status, as indicated by a financial well-being scale, was not a significant predictor of evacuation intention. Physical stress that could hinder evacuation was not related to intentions either. Efficacy was unrelated to evacuation intentions as well. Social support questions specific to evacuation were not distinguishable in factor analyses from the other social influence items.

Before closing, a few strengths and weaknesses of the study should be noted. The major weaknesses of the study are that it was based on self report and that a wide range of age groups were not represented. It is important to remember that this was the fifth wave of interviews with these individuals. The original sample in 1990 was selected so that a third of the individuals were over 60.

A possible issue also is that evacuation intention was measured, not evacuation per se. In the theory of reasoned action (Fishbein & Ajzen, 1977) and the addition to it of the theory of planned behavior (Ajzen,

1989), the individual's intention to perform the behavior is a central factor. Intentions are assumed to capture the motivational factors that impact on a behavior; they are indications of how hard people are willing to try and of how much effort they are planning to exert in order to perform the behavior. The theory of planned behavior postulates three conceptually independent determinants of intentions. The first is the attitude toward the behavior (positive or negative). The second is a social factor that is the perceived social pressure to perform or not perform the behavior. The third and final antecedent of intention is the degree of perceived control which is influenced by such factors as prior experience and other resources.

Intention, in turn, is viewed as one immediate antecedent of actual behavior (Ajzen & Fishbein, 1980). In this case the driving motivation is risk perception. This study showed that risk perception is a psychological mediator of intentions to evacuate controlling for social norm pressures and resources.

The main strength of this study was the prospective design using a large longitudinal data base. One of the advantages of using a longitudinal sample was that the prior psychological distress measure was truly prior and, therefore some causality can be inferred. Most studies of evacuation use a retrospective design and we do not believe that evacuation intentions under true threat conditions have ever been studied.

One problem with this approach was that asking evacuation questions before the event may cause heightened awareness of the four processes discussed so far. The inclusion of the non-respondent and reactivity control groups addressed this issue. It is important to note for both ethical and measurement issues that our phone call did not increase anxiety.

Another concern is that Bertha did not hit. However, Turner, Nigg, and Paz (1986) have stated that a disaster need not occur for there to be social consequences. Their research showed increased levels of preparedness for and awareness of an earthquake threat in California. Another possible criticism was that studying evacuation intention was not the same as studying evacuation. It may be that the lack of significant resource variables predicting evacuation intentions may be proof of this missing link in that resources may become important for turning the intention into an action. On the other hand, as already mentioned, the theory of planned behavior states that intentions are the best predictors of behavior.

Another possible criticism is that exactly how the individuals were warned about the impending disaster was not assessed. It may be that how individuals were warned was not central to whether these individuals perceived risk. This is especially the case with hurricanes when satellite images are readily available. As has already been mentioned, the sample was aware of the threat. However, warning may be more important with flash floods, tornados and other types of more immediate disasters.

Regarding generalizability there were differences between the cities of Savannah and Charleston. Individuals in Savannah were more concerned about looting and were more open to social influence. The political problems in Savannah may have led to strong city differences. Another reason there was a city difference could be that individuals in Charleston had prior experience with Hugo. This may explain why individuals in Charleston who intended to evacuate had experienced past psychological distress. A final reason for why Savannah perceived more risk than Charleston was that they were closer to the hurricane during data collection.

In summary, this study adds to the scientific body of literature in numerous ways. First the design of the study was such that many issues regarding evacuation in the literature could be assessed under threat conditions. Having comparison groups adds to the validity of the findings. Secondly, showing that risk perception is a psychological mediator could lead to specific intervention ideas. Knowing who takes these events less seriously gives emergency managers a way to target that population for possible help with decision making or preparedness. Third, regarding social influence, in some cases, a single phone call from a friend could encourage evacuation. Fourth, there was a relationship between general preparedness and reactive preparedness. Increasing general preparedness of the community would lead to better preparedness under threat conditions.

In conclusion, risk perception, social influence and preparedness are important indicators of intentions to evacuate. Resources were not important in predicting evacuation intentions. Usually reasons including resources are examined after an event has occurred. Individuals who really should have evacuated

are asked why they did not. Using low resources (e.g., no car, no place to go) as excuses may reduce the cognitive dissonance felt by the individuals in some of these cases.

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Table 1

Beliefs and Experiences Related to Evacuation Decision Making

Beliefs and Experiences	n	%
You have enough time to leave .	93	97.9
Believe your survival is under your control.	84	88.4
Experience with hurricanes.	79	83.2
Believe whether you survive is God's will.	79	83.2
Believe your house is structurally safe.	78	82.1
You have a place to go.	74	77.9
Believe the hurricane is a serious threat.	72	75.8
You have a car.	66	69.5
Your family is together in one place.	61	64.2
Believe the hurricane will be bad.	61	64.2
Believe the hurricane is coming.	53	55.8
Experience with evacuation.	50	52.6
Have to protect your home from the storm.	43	45.3
Have to protect your home from looters.	42	44.2
Your family wants to leave.	30	30.6
You want to leave.	27	28.4
You have to stay to care for your pet.	5	5.3
You are too sick to leave.	3	3.2

Table 2
 Standardized Regression Coefficients for Composite Measures.

	Risk Perception	Reactive Preparedness	Actual Social Influence	Openness to Social Influence	Efficacy	Anxiety
Hurricane Experience	-.20	---	---	---	---	---
Evacuation Experience	.29**	.30***	---	.30**	.35***	---
Wave 4 Preparedness	---	.37***	.30**	---	---	---
Financial Well-being	---	---	---	---	.23*	---
Physical Well-being	---	---	---	---	.28**	---
Embeddedness	---	---	.22*	---	.18	---
Past psychological distress	.37***	---	---	.28**	---	.39**
Age	---.30**	---	---	---	---	---
Sex	.20*	---	---	---	---	---
Race	.22*	-.29**	---	.39***	---	---
Education	---	-.20	---	---	---	---
# of Females	---	---	.35**	---	-.33**	---
# of Children	---	---	---	---	.26	---
City	-.27**	---	---	-.31**	---	---
Multiple R	.65	.70	.59	.57	.61	.46
Adjusted R ²	.33	.40	.23	.21	.26	.07

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3

Means for Individuals Who Intended to Evacuate and Those Who Did Not, with Corresponding Values of F, Separated by City

	<u>Savannah</u>		<u>F</u>	<u>Charleston</u>		<u>F</u>
	Intended to Evacuate	Did not Intend to evacuate		Intended to Evacuate	Did not Intend to Evacuate	
Anxiety 2.37	1.75	5.12*	2.30	1.92	2.28	
Attachment to Home	3.98	4.62	6.80**	4.03	4.11	.07
Education	10.57	12.00	2.92 ^a	12.31	14.60	4.75*
Risk Perception	.77	.48	27.08***	.68	.43	17.83***
Openness to Social Influence	.81	.49	12.61***	.83	.43	15.44***
Past psychological distress	1.28	.85	3.12 ^a	1.59	1.06	4.27*
Embeddedness	17.50	20.00	5.19*	18.62	20.42	2.29
Number of Females 1.54	1.06	4.72*	1.31	1.57	1.18	

^a $p < .10$ * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4
Predicting Evacuation Intention: Hierarchical Logistic Regression Results

Predictors of Evacuation	Regression Results	
	B	SE B
Risk perception	4.14*	1.85
Embeddedness	-.21*	.09
Hypothetical social Influence	2.03 ^a	1.16
Prior hurricane experience	-1.39	1.08
Owner	.68	.79
City (Charleston)	-.48	.73
Black	.30	.38
Male sex	.42	.67
Anxiety	.32	.46
Education	-.09	.12
Prior distress	.01	.45

^a $p < .08$ * $p < .05$ ** $p < .01$ *** $p < .001$

FACT SHEET



Federal Emergency Management Agency

NUCLEAR POWER PLANT EMERGENCY

Although construction and operation of nuclear power plants are closely monitored and regulated by the Nuclear Regulatory Commission, accidents, though unlikely, are possible. The most immediate danger from an accident at a nuclear power plant is exposure to high levels of radiation.

Know these facts about a nuclear power plant emergency.

- A nuclear power plant accident would not cause the same widespread destruction as a nuclear weapon.
- Although radioactive materials could be released in a cloud or *plume*, no fallout is produced to endanger people.
- There may be a radiation hazard in the surrounding areas, depending on the type of accident, amount of radiation released, and weather factors.
- Radiation would be monitored by authorities to determine potential danger and warn the public.
- Local citizens would be evacuated or instructed on how to avoid radiation hazards.

Attend public information meetings.

Local emergency managers and plant officials can provide information about radioactivity; safety precautions; and local, state, industry, and federal accident emergency plans.

Ask about the hazards radiation may pose to your family. Young children, pregnant women, and the elderly may be affected more than others.

Ask where nuclear power plants, radioactive storage sites, and radioactive waste dumps are located.

Learn your community's warning systems.

Learn emergency plans for schools, day care centers, nursing homes — anywhere family members might be.

Have disaster supplies on hand.

- Flashlight and extra batteries
- Portable, battery-operated radio and extra batteries
- First aid kit and manual
- Emergency food and water
- Nonelectric can opener
- Essential medicines
- Cash and credit cards
- Sturdy shoes

Obtain information about official evacuation routes from local officials.

Terms for Describing Nuclear Power Plant Emergencies

Know the following terms and what they mean:

Notification of unusual event means a problem has occurred at the plant, but no radiation leak is expected. No action by you is necessary.

Alert means that small amounts of radiation could leak inside the plant, but it will not affect the community. No action by you is necessary.

Site area emergency describes a more serious problem. Small amounts of radiation could leak from the plant. Area sirens may sound. Listen to your radio or television for information.

General emergency refers to a serious problem. Radiation could leak outside the plant and off the plant site. Area sirens will sound. Listen to your radio or television for instructions. Be prepared to evacuate or find shelter in your home.

Be prepared to evacuate or find shelter in your home.

Develop an emergency communication plan.

In case family members are separated from one another during a disaster (a real possibility during the day when adults are at work and children are at school), have a plan for getting back together.

Ask an out-of-state relative or friend to serve as the "family contact." After a disaster, it's often easier to call long distance. Make sure everyone knows the name, address, and phone number of the contact person.

Emergency Response Plans

Federal, state, and local officials work together to develop emergency response plans for nuclear power plants and surrounding communities. These plans are tested through emergency exercises that can include small-scale evacuation drills for public institutions such as schools and nursing homes.

Listen to a battery-operated radio or television for official information. Not all nuclear power plant incidents result in the release of radiation.

If advised to remain at home:

- Bring pets inside.
- Close and lock windows and doors.
- Turn off air conditioning, vents, fans, and furnace.
- Close fireplace dampers.
- Go to the basement or other underground area.
- Stay inside until authorities say it is safe.
- If you must go out, cover mouth and nose.

When coming in from outdoors:

- Shower and change clothing and shoes.
- Put items worn outdoors in a plastic bag and seal it.

If advised to evacuate:

- Listen to a radio or television for information on evacuation routes, temporary shelters, and procedures.
- Minimize contamination in house.
- Close and lock windows and doors.
- Turn off air conditioning, vents, fans and furnace.
- Close fireplace dampers.
- Take disaster supplies.

Remember your neighbors who may require special assistance — infants, elderly people, and people with disabilities.

Three Ways to Minimize Radiation Exposure

There are three ways to minimize radiation exposure to your body:

Distance — The more distance between you and the source of the radiation, the less radiation you will receive. In a serious nuclear accident, local officials will likely call for an evacuation, thereby increasing the distance between you and the radiation.

Shielding — Like distance, the more heavy, dense materials between you and the source of the radiation, the better. This is why local officials could advise you to remain indoors if a radiological accident occurs. In some cases, the walls in your home would be sufficient shielding to protect you.

Time — Most radioactivity loses its strength fairly quickly. Limiting the time spent near the source of radiation reduces the amount of radiation you will receive. Following a radiological accident, local authorities will monitor any release of radiation and determine when the threat has passed.

After the Event

When the immediate danger has passed, avoid using foods from your garden or milk from cows or goats until they can be inspected by local emergency officials. Remember that contamination can affect areas many miles from the accident site.



**University of Wisconsin
Disaster Management Center**

Disaster Response

Lesson 4: Initial Emergency Operations

About UW-DMC
Diploma
Courses
Projects
Publications

Introduction

This lesson discusses the actions that must be taken during the period from the emergency warning through the immediate response to the emergency. Characteristics of warning systems are identified. The role of public information in an emergency is described. The design of an evacuation plan is developed and techniques for its implementation presented. Search-and-rescue requirements are summarized. Some basic information about damage and needs assessment is outlined with recommendations for implementation suggested.

[English Courses](#)

[PAHO Scholars](#)

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[Seminars, Workshops, and Conferences](#)

[User Survey](#)

[Customized Training](#)

Learning Objectives

- Describe two characteristics of a good warning system.
- Recognize three problems of evacuation planning and potential solutions to them.
- Identify three of the "Five F's" of search and rescue.
- Distinguish between disaster assessment policies to adopt and those to avoid.

[About](#)

[Lesson 1](#)

[Lesson](#)

Learning Activities

Read this lesson. Review Appendix B.

2

Evaluation

Lesson 3

Complete the self-assessment test, compare your answers to the answer KEY.

Lesson 4

Lesson 5- Part One

Lesson 4

Warning and Evacuation

Lesson 5- Part Two

Public Warnings and Information¹

Lesson 6

Although timely and accurate warnings coupled with an effective and efficient state of disaster preparedness make it possible to reduce the severity of the consequences of an event, no warning will be of any value unless it is acted upon. It is assumed that the emergency manager will take the necessary steps to disseminate the warning to the public, as well as setting into action other arrangements suitable to the nature of the individual case.

Lesson 7

From the point of view of the public, the warning will be most effective if it is:

Lesson 8

Lesson 9

Appendix A

- issued by a person or organization in whom the public places confidence
- as specific as practicable in its information concerning the magnitude of the event, the place at which it is expected, and the time when it will occur
- susceptible to independent confirmation.

Appendix B

Appendix C

Appendix D

Appendix E

Appendix E

Key

Pretest

Evaluation

In emergencies which call for a response by the public, the degree of reliability which is accorded to the source of information and instruction is known to be a major factor in determining the quality and speed of the public's response. This is especially true in emergencies in which individuals cannot perceive the danger through their own senses. For example, impending industrial, or even radiation, accidents can be foreseen by the competent authorities, but to the layman's eye everything in the vicinity of the plants appears

Graphics

absolutely normal. The credibility of the source of public warnings about emergencies must be protected if mutual understanding and confidence are to be achieved: not only through positive action but also through avoidance of inappropriate actions, such as the issuance of inaccurate information, or tardy dissemination of accurate information.

Warnings should:

- be specific, i.e. they should give specific local information about the threat which listeners can conveniently remember. Sirens, or the sound of church bells, for example, are non-specific and are easily imagined to be something else, or not very important, unless an adequate information and education campaign has already been effectively conducted;²
- be urgent (they should get people moving and not allow time for rationalizing the warning away);
- spell out the consequences of ignoring the warning (probably in explicit detail) so that people cannot casually dismiss them;
- be absolutely clear about the probability of occurrence, since people tend to pay little attention to something labeled "a probability." One warning is usually not enough; they should be continuous, because people also need to be kept up-to-date about what is happening and to be given instructions appropriate to the development of the situation.

Different sectors of the endangered population may have to be given different messages. For example island or coastal territories subject to storms will have to take special precautions for the benefit of inshore and coastal boat traffic. Special consideration will be needed by the disabled, who may not be able to see or hear warnings, or act upon them if they do.³

Planners must guard against the community's tendency not to want to believe that conditions will change for the worse. Some people may go further, and actively seek justification for ignoring warnings. When the "warning" cannot be truly specific, as in the case of a prediction of an earthquake, the issue of credibility becomes of even greater importance, particularly when there is no agreement between scientists about the accuracy of the prediction.

Community Warning Broadcast (Australia)

The following preplanned messages (Figures [4.1](#), [4.2](#), [4.3](#)) are to be broadcast by radio/TV when a specific cyclone threatens. The frequency and timing of the broadcasts are decided at the time. Suggested texts are given which may require changes depending on specific circumstances.

Evacuation⁴

How to Develop a Workable Evacuation Plan

Introduction

Only in the last few years has the ability to warn populations of impending disasters become a reality. In the case of cyclone storms, advanced meteorology has provided the ability to track and forecast severe storms. Various monitoring devices have been developed which closely estimate the flood potential of a particular storm.

The ability to track and warn, however, must be complemented with the capability of effecting a timely evacuation of potentially threatened areas. By and large, this problem has been met in the industrialized countries. In those underdeveloped countries where communication links to remote settlements are still sporadic, evacuation is more difficult. Two problems exist. The first is the ability to adequately disseminate a warning of an impending disaster. The second is the problem of producing an evacuation once the warning has been received.

Problems in Evacuation

Five major problems, identified from past experience, must be overcome in order to effect a successful evacuation. These are:

1. the psychological hesitancy of the potential victims to leave their homes and lands
2. evacuees' fear of theft and confiscation if they leave their homes
3. perception on the part of the potential victims that destinations for evacuation are unsafe
4. the lack of adequate transport systems to move large numbers of people out of threatened areas
5. organization of the evacuation in such a way as to reduce confusion and to prohibit "log jams" during the evacuation process.

Overcoming the Problems

The major methods currently seen as means of overcoming the problems listed above are:

- the development of a timely and accurate warning system
- identification of escape routes and dissemination of information to the potential victims as to where escape routes are
- establishment of a policy wherein everyone within a threatened area is required to evacuate when an evacuation order is given
- establishment of a policy wherein all traffic moves out of the area with no traffic or vehicles moving into the area to effect rescue (a one-way system)
- establishment, wherein possible, of a policy which requires evacuees to walk out of the endangered area.

Other approaches which have been suggested for helping overcome the problems include: the establishment of adequate support facilities in the

peripheral areas and the development of a series of incentives to encourage compliance with the evacuation order. These incentives are described in the following section.

Information Needs in Order to Establish an Evacuation Plan

- Establish the preconditions for evacuation.
- Establish the preconditions for successful warning.
- Establish the best point within the existing community structures (such as social support agencies) to have an impact.
- Establish the differences between urban and rural households and their information and support needs.
- Identify the types of organizations that should be most effective at distributing warning information.
- Establish the types of organizations that are viewed by the potential victims as the most credible for issuing a warning.
- Establish the point in the information distribution system at which further warning efforts will have little effect (the point of diminishing return).
- Establish the point at which the majority of people begin to take action and evacuate (in relation to the warning).
- Determine whether it is necessary for potential victims to receive more than one warning (from different sources).
- Establish what factors or constraints bear on a household making a decision to evacuate.
- Establish alternative evacuation plans necessitated by different types of disasters.
- Establish the target number necessary to reach in order to begin an evacuation movement (target numbers should include separate target numbers for organizations and for numbers of families contacted).
- Determine if there are significant differences between information needs for land owners and tenants.
- Determine if practice or drill will play a

successful part in achieving a successful evacuation.

- Determine what counter-instructions must be announced to the warning system if a warning is issued and a disaster does not occur.
- Determine the level of public comprehension and public education that is necessary to effect a successful evacuation.
- Determine how the perception of vulnerability will affect a family's response to a warning.
- Develop generic family profiles that include the following information:
 - to what extent the family is separated at different times during the day
 - the relative travel time from home to school and work
 - where people say they would go if they were separated from other members of their family.

Major Lessons from Evacuation Studies

1. Evacuation plans must be based on family evacuation, not individual evacuation.
2. In warning systems, the more the contact between organizations during non-danger periods, the higher the likelihood the necessary warning can be communicated.
3. It has been found that warning data is best transmitted within the community through personal contact.

Evacuation Compliance

In an article on evacuation compliance, Perry, et al.⁵ suggest several additional incentives to increase the probability that threatened citizens will comply with a warning to evacuate. The concern here is with evacuations which are instituted prior to disaster impact, and involve a short-term absence of individuals from the threatened area. From this perspective, incentives to evacuate must be devised in advance—they represent the results of careful planning and not simply a response to some immediate threat to

the community.

In approaching the problem of isolating evacuation incentives, we have chosen four issues from the warning response literature. The following merit careful consideration: temporary shelter, transportation, the role of the family, and security and property protection. Each of these issue areas will be examined in turn, reviewing the empirical basis for concern, and enumerating possible incentives that could be employed to encourage participation from potential evacuees.

Temporary Shelter

The nature of temporary shelter facilities for evacuees has been a source of considerable controversy among disaster researchers. It has been frequently reported that evacuees tend not to use public or planned shelters. However, even if many evacuees rely on other means of shelter (such as the homes of friends and relatives), there still remain at least some people who depend upon public shelters. Three general conclusions about evacuees' sheltering behavior are stated by Perry, et. al.:

1. When relatives are within a reasonable distance of the disaster site and some forewarning is possible, evacuees clearly prefer the homes of relatives as shelter. As the amount of forewarning decreases, people tend to seek shelter in the homes of friends. When forewarning is short and community preparedness is low, people tend to seek any known protection (such as high ground in floods) to gain enough time in which to evaluate the situation themselves.
2. The use of public shelter increases when community preparedness is high, when the entire community must be evacuated, and when the evacuees anticipate that the necessary period of absence will be long. Generally, though, public shelters seem to attract, even under the conditions described

above, approximately one-fourth of the evacuees at a given site.

3. In communities where flooding is recurrent and a public consciousness is well developed, use of public shelter tends to be low, and evacuees primarily seek shelter in the homes of friends or relatives.

These points argue for the development and use of reasonably flexible shelter plans for evacuees, particularly in small communities which are part of or close to large metropolitan areas. It may be both cost effective and efficient to use temporary "shelter checkpoints" where evacuees could report to gain additional information about the evacuation effort and then either depart to stay with friends or relatives or be assigned to stay in a public facility. Such a plan would minimize the need for elaborate and extensive shelter facilities, permit evacuees their choice of arrangements, and allow for more careful accounting of those who do evacuate. Shelter checkpoints would aid in the operation of "family message centers" where concerned relatives or friends from outside the disaster area could quickly find data on evacuees. Note that a shelter checkpoint should be located in a "safe" area which could probably also be a public shelter. It should not be confused with "roadside checkpoints" which tend to snarl traffic and generally impede the flow of evacuees from the threatened area.

Another alternative to traditional public sheltering might involve distribution of information to residents of frequently threatened areas. The information would describe, in advance, safe areas and access routes to them for potential evacuees. Residents could then be instructed to make contact with friends or relatives in the safe area and arrange in advance for shelter in that home in the event of disaster impact. In this way as soon as an evacuation warning is issued, evacuees can depart for their host home.

An additional option involves the continued

broadcasting of relevant information about the hazard and about evacuation procedures and destinations. The broadcast medium could be either radio or television (assuming the local availability of both) but it is important that the station be officially designated as the community's source for disaster information and that the public be aware of this designation. Establishing credibility of the warning source can be nearly as important as the information disseminated.

Transportation

When a warning message calls for evacuation, local officials are asking the public to undertake a specific adaptive action whose timing is critically important and where effective adaptation by the community depends upon a coordinated exodus. Under such circumstances the question of how best to handle the exit of citizens arises.

Numerous studies have indicated that evacuations can be more effectively accomplished if the people involved have a plan—a route of egress and safe destination. This also helps to minimize traffic coordination difficulties as well as the problem of families not evacuating or evacuating to an even more dangerous location. Thus an incentive to evacuate could center upon the establishment of safe destinations and plausible routes. Information about these could be distributed to citizens in advance as part of general community emergency preparation. Such a plan need not be elaborate and could be made available to the public in the form of a labeled map.

One alternative strategy minimizes the contingency supplies citizens must store until an evacuation is necessary. The strategy involves making detailed route and destination information available at the time of warning. In small communities, evacuation warnings could be issued on a face-to-face basis by designated emergency officials. These officials could explain the warning and hand residents a single sheet of paper with

map and other appropriate instructions. This procedure would accelerate and simplify the evacuation process since details (to which the individual could refer later) would be supplied in written form and only minimum verbal explanations would be needed. The amount of lead time and the number of personnel available for delivering warnings serve as limiting factors with this strategy.

Role of the Family

Families tend to evacuate as units; and the separation of family members often involves anxiety and attempts by evacuees to reunite families, sometimes by returning to previously evacuated areas. However, keeping families united is not necessarily as important as simply having information available regarding the whereabouts of family members. Therefore evacuation would be facilitated if some means were available through which families could communicate if separated. The establishment of "family message centers," where evacuees could obtain information on the whereabouts and condition of family members, could be included in evacuation shelter planning and may be seen as an incentive for compliance with an evacuation warning. Such a family message center-which would of course only maintain minimal records-could be structured around a shelter check-in system like those described in the previous section. It is possible that the message centers could be centralized and accessed by telephone: different shelters could call with name lists as available and people who wished to use the service but not the public shelters could report directly to the central location.

Security and Property Protection

While research has shown that looting is not a common occurrence in evacuated areas, it is widely assumed by disaster researchers that if evacuees feel that their property will be safe from

potential looters, they will be more likely to comply with an evacuation program. Therefore, as part of an incentive program, local communities could communicate the general nature of whatever official security measures will be undertaken to the public. Such measures need not be elaborate; the purpose of communicating them is to inform potential evacuees that some measures are being taken.

It may be worthwhile to incorporate community members into the protection process. This would involve assigning a few selected individuals security duties within their own neighborhoods. These people would coordinate with local police departments and act much like auxiliary police personnel. Such a program would appear to be particularly useful since it would free some police personnel for other work, reduce slightly the number of residents who would have to be evacuated simultaneously, and provide the "peace of mind" necessary. This would also help to convince the evacuees that they are a part of their own community protection plan-which enhances citizen participation in community preparedness plans.

Summary

This review of incentives to evacuate is meaningful largely in the context of planning for and managing the consequences of the impact of riverine floods. Many of these ideas should also apply to cyclone evacuations. Of course, incentives do not constitute an emergency plan. At best, they should be seen as suggestions for structuring some elements of a plan. Furthermore, the enumeration of incentives presented here is meant to be suggestive rather than exhaustive. A primary objective of this section has been to underscore the importance of advance planning in coping with hazards.

The incentives described here are drawn from empirical research on the public's performance

under flood disaster conditions. It reflects the view that it is important to build emergency planning around people's known reaction patterns. Too often emergency plans which are devised by administrators turn out to be based upon misconceptions of how people react and, therefore, create more difficulties than they solve. One must be cautioned, however, that although the data indicates that people say they would support the idea of various evacuation incentives examined here, the real test of evacuation incentives lies in their implementation and in evaluating pilot programs. In the final analysis, it is wise to develop emergency plans which guide and channel citizen actions into complementary and productive protection behavior patterns.

Public Information in the Postdisaster Phase⁶

A disaster manager would be well advised to appoint, or to have seconded to the staff, an experienced public information/press relations officer who can act as chief spokesperson during the relief operation. This person's duties will be directed to two different types of audience:

* members of the public who have to be addressed as a group, either generally or as subgroups (e.g., all teachers; all who live in a certain area; all business owners) * media representatives.

This officer must be fully briefed not only on the progress of the operation itself but also on the implications of the events associated with it. If a state of emergency has been declared officially, then not only the fact but also its main effects must be described. The disaster may have disrupted certain facilities which people had earlier been advised to use: new instructions will be needed. If casualties have been heavy, people must be told to whom and where enquiries should be addressed.

The media representatives can of course be used to convey messages to the public, but they will also tend to be more demanding in their search for information which they can use to prepare their descriptive reports. Accuracy and frankness in the spokesperson's response to these queries will help to instill confidence in the emergency organization and at the same time help to counteract the rumors which usually abound at such times.

Requests for information which are received from individual members of the general public may be handled by the chief spokesperson's staff-who must naturally have been given a full briefing also-or referred to services more competent to deal with the minutiae of personal affairs. If services like the Red Cross Tracing Service, Citizens' Advice Bureau, legal aid centers, and local government offices are still operational, they will be of great assistance. For example, the question of casualties brings to the fore one point of information which always attracts attention: the number of dead. From the point of view of the disaster manager, the size of the death toll is almost irrelevant, for the chief concern is for the survivors. The numbers of dead are a social problem but create a minimal danger to public health. The spokesperson for the disaster manager must be able to say what arrangements are being made for recovery, identification, and disposal of the dead, and especially to reassure and advise those who may require proof of death for legal or other purposes. This last is a matter which will require particular attention in countries which depend on foreign tourists. If it is possible to do so, a casualty information bureau, linked to but separate from the emergency operations center, should be set up with its own communications which enquirers can use without interfering with emergency operations.

In order to avoid the usually disruptive presence of media representatives in an emergency operations center, it is desirable that an

information center should be set up. This may be adjacent to the operations center itself, if the latter is located in a capital or other large city, with reasonable communications out to newsrooms, etc., or at some distance away—provided that there are also good communications between the operations and information centers.

Disaster managers must, then, be aware of what action they will need to take in the area of public information after a disaster. If the manager is to establish and maintain mutual understanding between his/her organization and the public, the public must receive accurate and authoritative information either from a single spokesperson or, at the very least (if different sources have to be tapped), from spokespersons whose several announcements are not only accurate and authoritative but also consistent and compatible.

Search and Rescue

This section, as with the preceding, refers to rapid-onset disasters and has little application to slow-onset disasters. The following section summarizes key information required to implement a search-and-rescue operation.

Search-and-Rescue Requirements in Disaster Situations

Search and rescue, often known by the acronym SAR, is the process of identifying the location of disaster victims that may be trapped or isolated and bringing them to safety and medical attention.

In the aftermath of cyclones and floods, SAR usually includes locating stranded flood victims, who may be threatened by rising water, and either bringing them to safety or providing them with food and first aid until they can be evacuated or returned to their homes.

In the aftermath of earthquakes, SAR normally focuses on locating people who are trapped and injured in collapsed buildings.

In recent years, searchers have been greatly aided by new technologies. These advances range from dogs that have been specially trained to find victims trapped beneath collapsed buildings to sophisticated radars and listening devices that can penetrate rubble to locate those who are trapped. (One device is so sensitive that it can detect heartbeats of victims who are partially buried.)

Rescuers have also received new tools for their work. Pneumatic tubes that can be inserted under the rubble, then inflated to lift debris so that rescuers can tunnel through to the victims, speed rescue of those trapped in large buildings. Heavy-lift, mobile cranes can be used to move heavy partitions and other materials that have collapsed. And for flood victims, helicopter rescue techniques are now highly advanced.

The SAR Process

Experience has shown that most search-and-rescue operations are conducted by survivors immediately after the threat is passed, and there is little that disaster management authorities can do to aid this process except in the preparedness phase when first aid and some rescue techniques can be demonstrated. Neighbors, working together, can usually locate and rescue survivors pinned in the rubble of low-rise structures such as houses and small shops. Pre-positioning of lightweight, hand-operated rescue equipment such as block-and-tackle, crow-bars, sledgehammers, etc., with neighborhood groups like the local Red Cross/Red Crescent chapters, police and fire brigades, can greatly aid the immediate rescue process.

After the victims that can be located quickly have been rescued, SAR turns to the more complicated and delicate task of locating survivors trapped in isolated locations or in more complex (and usually heavier) buildings. This type of rescue requires trained professional supervision (although the workers may be volunteers), the use of heavy

equipment, and often the use of special detection equipment for locating people trapped under the debris. At this stage of the emergency, systematic search-and-rescue efforts are carried out, led by specially trained and equipped groups operating in close coordination with medical personnel. Organizations that typically have responsibility for SAR include fire brigades, civil defense SAR teams, the police and the military. In many countries, especially in Latin America, volunteer rescue brigades (often highly trained and well equipped) play a major role. In addition, government ministries with access to heavy equipment, especially Public Works, are often assigned major SAR responsibilities.

The SAR Sequence

The sequence of action that takes place in all search-and-rescue operations is called the "Five Fs." They can be summarized as: FIND them, FIX their location, FREE them, FEED them, FIRST AID.

"Find them" refers to the obvious first step of locating the survivors. This requires a systematic search process, making sure that, before searchers leave an area or a building, every possible location has been thoroughly checked and re-checked to ensure that there is no one left who needs assistance. It is especially important to search buildings where small children, especially infants, may have been because they often will not respond to calls. Buildings where the elderly reside should also be checked thoroughly because they often weaken more quickly than others and may not be able to signal or call out to searchers.

"Fix their location" refers to the practice of marking or recording the exact location of survivors. In the search process, there are usually victims that require more urgent attention than others, and some people may have to be temporarily left where they are until others have been reached or until the necessary equipment arrives to complete their rescue. In these cases, it is important that searchers clearly identify the

locations of those who are awaiting rescue so that they will not be forgotten. Where people are trapped in buildings or under debris, someone should always be assigned to stay with them; people left alone after initial contact has been made often worry that they have been or will be forgotten, and may panic. In the case of isolated flood victims, searchers should make detailed notes on the survivors' locations and mark the spots on maps. If the search is being conducted by aircraft, photos showing the location should be taken to aid the rescuers.

"Free them" refers to the most important step-freeing the survivors as soon as possible. In the case of victims trapped in structures, care must be taken not to injure them during the rescue process. If they are suspected of having sustained back injuries, trained first aid workers should be brought in to lift them from their position.

"Feed them": if people have been, or are going to be, trapped for a long period of time, they may need to be fed promptly. Fear, cool weather, rain and other factors can cause people to lose body heat, and lack of food and water will weaken even those with minor injuries. Once survivors have been located, they should be given food according to the following principles:

- provide as much fluids as the victim is willing to drink
- furnish electrolytes in a form (such as soups or oral rehydration solution-ORS) as close to a normal diet as possible
- provide foods that are high in caloric content, such as carbohydrates
- avoid giving alcohol as it will increase the rate loss of body heat
- as much as possible, provide hot foods to help maintain body heat;

(There are a few exceptions. If a survivor has been injured in the abdomen, neck or head, or if injuries are likely to require major surgery that

would necessitate general anesthesia, food should only be given on the advice of medical personnel.)

- When feeding a trapped victim, the time nourishment is given should be recorded and given to medical authorities once the person is free.

"First aid" is the immediate medical attention that is given to survivors throughout the rescue process and especially after they have been freed or rescued.

SAR Planning

Experience has shown that the most effective SAR actions are those that have been carried out on the basis of plans drawn up as part of an overall preparedness plan before the disaster strikes. Both pre- and postdisaster SAR plans follow certain basic patterns.

Search activities are divided into two phases, the identification phase and the search phase. During identification, SAR coordinators evaluate preliminary reports and identify areas or zones where the largest concentrations of people need help, then subdivide the search area into small areas that can be rapidly, but thoroughly, checked by search teams. (This is often done by dividing a map of the area into a grid of small squares. This is called a "search grid.")

During the search phase, search teams methodically move through the disaster area, checking each sub-area in sequence to identify the locations of survivors. If the survivors can be rescued quickly, search teams perform this task on the spot. If more sophisticated equipment is required, the needs are communicated back to the SAR coordinator. All buildings or areas must be double-checked during the search phase. As soon as each square has been double-checked and all survivors rescued, the grid is "closed" and searchers move on to the next.

Rescue operations should be decentralized as much as possible. Local authorities should be given responsibility (and should be trained as part of overall disaster preparedness activities) to coordinate rescue efforts in their communities. Larger municipalities normally have sufficient equipment to initiate more complex rescues and must be relied upon as the first to respond.

Rescue operations after large-scale disasters must usually rely on volunteers for a large part of the rescue team. Bearing this in mind, it is important to utilize the professional and trained rescue workers as team leaders to the greatest extent possible. Specialized rescue teams, such as those that use rescue dogs to locate buried victims, should be controlled by the central SAR coordinator.

Principles of SAR Planning

The following principles should be observed in planning a SAR operation:

1. Search activities must be systematic and methodical. 2. Searches should be redundant, i.e., double-check!!
2. Responsibility for searches should be decentralized but coordinated.
3. Responsibility for search-and-rescue coordination should be placed in departments of government that have access to heavy equipment, rescue apparatus, and their own internal communications (radio).
4. Responsibility for control of specialized rescue teams should be assigned to the central SAR coordinator in each municipality.
5. As a general rule, police departments should not be assigned the role of coordinating SAR since they will be needed for civil protection duties.
6. When a potential disaster can be forecast (e.g., flooding, cyclones) departments with equipment that may be needed for SAR should be instructed to position their equipment in or near suspected vulnerable

areas if protected from damage.

7. Local groups, such as Red Cross/Red Crescent, can play a vital role in SAR. Rapid identification of the groups and a thorough briefing on sectors to search, identification of techniques, etc., is mandatory before they are sent to the field. (Knowing their capabilities before a disaster will greatly enhance SAR planning and response.)
8. Planners should remember that there is no substitute for good footwork. While the newest technologies are extremely helpful, the vast majority of survivors are still found by rescuers responding to cries for help.

Content of Search Teams

There is no standard or model search team, but experience has shown that it is helpful to include certain people if they are available. Each team should include a person trained in first aid as the top priority. Next, a person should be assigned to keep a log of the areas and buildings searched. Several members of the team should be assigned responsibility for remaining with victims that are traced in debris until more help arrives, and several persons should be assigned to act as messengers.

Summary

Even with the best planning, search and rescue is never perfect and is often very much an ad hoc process. The most important factor is for the search pattern to be methodical and systematic. The more planning, training and preparation that can be done before the disaster, the easier and less problematic SAR will be after the disaster.

See also Appendix B, "Emergency Rescue Training," a manual on search and rescue.

Disaster Assessment

Introduction: The Assessment of Survivors' Needs⁷

Principle

The accurate assessment of survivors' needs is in the short term more important than a detailed assessment of damage to houses and property. Partial or inaccurate assessments of the human needs by assisting groups have been a frequent cause of past failure of relief efforts.

Common Failures of Assessment

One of the first responses to natural disaster is to estimate the extent of the damage. Assumptions are then made about the kind and scale of the survivors' needs. Specific failures in assessment occur in three categories:

Lack of familiarity of assessors with the local situation. A lack of knowledge of physical and economic conditions prior to the disaster often makes it difficult, if not impossible, to distinguish between disaster-related needs and pre-existing problems. Consequently, postdisaster requirements may be overstated, attributing residual deficiencies to the disaster. Lack of familiarity with the local situation can also result in overlooking local resources, which may be extensive: social "coping mechanisms" which can assist in providing emergency shelter; material goods, including existing supplies of building products and tools stocked-in the normal course of events-within any large community; local skills and manpower which can be used for both emergency shelter and reconstruction; local agencies or institutions (e.g. cooperatives) capable of managing emergency response and reconstruction programs.

Lack of understanding of appropriate techniques for damage and needs assessment. Conventional methods of data collection do not work in the chaotic conditions of the immediate postdisaster phase, and assessment techniques to measure survivors' needs have to draw the subtle, but vital, distinction between "needs" and "wants." However, information-gathering technology may

not be appropriate to the technical level of the country being surveyed (data requiring computer analysis, for instance, is useless if a computer is not readily available either in time or locally).

Weak management of the assessment.

Inappropriate assessments can be characterized by:

- the overestimation of needs by local or national officials in order to receive maximum assistance
- a higher priority placed on damage information than on estimates of basic human needs
- a lack of active participation by the surviving community (or even the surviving local administration) in the assessment of needs
- confusion as to who has the responsibility for making the assessment
- problems of communicating the assessments of assisting groups
- lack of definition of the objectives of the assessment (for example, is the assessment of needs aimed at regenerating the self-help process in housing reconstruction, or is it aimed at providing emergency shelters before all other considerations?).

Defining Who Should Make the Assessment

The Problem of Authority and Information Needs

It is characteristic of all major disasters that too many regard it as their role to assess survivors' needs. There may be confusion within government departments about where this responsibility lies. Health, housing and emergency planning officials have all often regarded it as their particular task. In addition, groups such as the military frequently make their own assessments, as do voluntary organizations, representatives of international agencies, etc. They often do so either to suit their own views and operational policies, or as verification of official assessments which they may be inclined to distrust, or which may not be

sufficiently detailed for their purposes.

Given this situation, if the government is to maintain full control it will be necessary for assisting groups to accept ultimate governmental authority in the assessment of needs, as in all other relief matters. On the other hand, the government must recognize the value of assisting groups' advice on assessment, since many of these groups will probably have more experience of disaster impact than the government itself. Further, the government must be prepared to accept-where the assessment of needs and damage is a task beyond its resources-to enter into a close working relationship with all assisting groups, and, from the information so collected, to act as the information clearinghouse.

Policy Guidelines

Policies to Avoid

1. Encouraging a proliferation of independent assessments, without coordination or agreement on the sharing of information.
2. Requesting the assessment of needs from those without predisaster knowledge of the locality.
3. Awaiting the results of damage surveys and subsequent vulnerability analyses before starting any reconstruction activities. Although damage surveys reveal the need for detailed vulnerability and risk analyses of various building types and sites, the evidence indicates that if such studies do not already exist, it is not advisable to wait for their completion before starting the reconstruction process-both should proceed in parallel, for delays dissipate commitment and resources.⁸
4. Isolating damage or structural surveys from the assessment of social, cultural, and economic needs.
5. Assuming that the assessment of needs and damage surveys can be undertaken after a disaster without first establishing a methodology for it.

6. Over-reliance on sophisticated technology, such as remote sensing or high altitude photographs, for damage surveys.

Policies to Adopt

1. The governmental body in charge of relief must allocate all roles as a matter of priority to those individuals or organizations best equipped to make the assessment. It is advisable for the assessment of needs to be undertaken by a multi-disciplinary governmental/interagency team, covering public works, housing, sanitation, community development, relief, etc. The composition of the team will vary according to the type of disaster and local conditions. Although there may be extensive damage to housing, damage to the infrastructure and other sectors of the economy may be of equal, or greater, concern to the survivors.
2. Some members of the team should be familiar with the normal pattern of life in the affected area, so as not to confuse immediate emergency needs with the norm for the area. This is not an easy task in marginal or squatter settlements, where, for the most part, people subsist in a state of chronic shortages and need.
3. The assessment must be verifiable. Many assisting groups will be well experienced in disaster management, and will be quick to detect overestimations. Once assisting groups recognize the accuracy of the assessment, they will be less likely to insist on their own independent assessments. It is essential to capitalize on relief assistance for the medium to longer terms. There is an urgent need to transcend exclusive preoccupation with immediate relief needs, and to give more thought to reconstruction needs at the outset.

The First Step in Disaster Assessment⁹

The first step in disaster assessment is the

situation assessment (also known as initial reconnaissance). When an immediate estimate of the impact of a disaster is made, a situation assessment is normally carried out immediately to determine:

- the extent and nature of the disaster's principal effects
- locations of critical need and number of people affected
- directions for search and rescue
- the operating status of lifelines and critical facilities.

The importance of an accurate disaster assessment cannot be overstated. A swift, accurate and credible assessment will enable program planners to proceed expeditiously with program plans. An assessment that is incomplete or inaccurate does not address major needs; it can provide misleading data and may lead to inappropriate relief efforts and costly delays.

Dissemination and Sharing of Assessment Information¹⁰

The dissemination of assessment information to all interested parties must be assured. A possible means of information sharing might be the creation of a council of assisting groups working in the disaster area. The council could be structured with one agency responsible for liaison and acting as the information clearinghouse. Whatever the means, it is essential that the information reaches the head of each force and is placed in the hands of staff capable of effectively interpreting it.

This is followed by a new assessment that classifies victims' needs as immediate, which usually concern health, life support, and safety, and long-term, which refer to housing and economic needs.¹¹

Damage Surveys¹²

Survey Methods

The process of collecting the necessary information obviously cannot be a systematic family by family survey. Therefore some type of survey is essential to obtain usable data. However, natural disasters often reduce access to the stricken area by cutting lines of communication (rail, roads, bridges). The most useful survey method may include low-level reconnaissance flights. A trained observer can determine the geographic extent of the disaster area, the relative degree of damage at each location, the patterns of damage, and perhaps the patterns of the survivors' emergency response. The aerial survey can also be used to identify areas that are accessible by land for limited though more accurate ground assessments, and to identify those areas on which to concentrate relief efforts.

But it should be noted that although such a survey can help calculate information such as the number of buildings damaged, it cannot, of course, provide information on damage invisible from the air (e.g. cracked adobe walls, weakened foundations, roofs nearing collapse, broken gas lines, etc.). For this reason, the data assembled must be assessed in conjunction with that collected by sample field surveys. Interviews with reliable eye witnesses may also provide additional information of value.

Field Surveys

The field survey must be regarded as the most useful method of information collection, as opposed to aerial survey or sample interviews. Field surveys may be limited by the following factors:

- Depending on local conditions and survey objectives, the cost can be high in money, time, and expertise.
- The affected areas may be difficult to reach.
- Cultural heterogeneity in the area to be studied may make it difficult to obtain useful data from sampling.

- Interviews may distort the information, depending on the interviewer/interviewee relationship.
- Field surveys require considerable local knowledge to distinguish damage from poor building techniques.
- Cultural differences between the affected population and foreign or national experts may produce differences of understanding and therefore difficulties in designing appropriate reconstruction programs.

Nevertheless, field surveys have some important advantages:

- They permit consultation with and observation of victims.
- They generally cost less than more sophisticated assessment methods, such as remote sensing.
- They use less sophisticated, and therefore more accessible, technologies and equipment than in aerial observation and remote sensing.
- They yield high volumes of information. In sudden disasters, data collection includes estimates of the number of injured people, types of injury, number of deaths, availability of health facilities, medical and paramedical resources, locally available medical supplies, damage to water supply and waste-disposal systems, risk of communicable diseases, damage to lifeline systems and to physical structures. Field surveys are also particularly valuable for inventorying useful resources, such as building materials for temporary and permanent shelter, reusable debris, labor, building contractors, etc.
- They make it possible to generalize from relatively small samples, if adequate techniques are used.
- They permit the participation of local personnel who, after a short period of training, can conduct interviews and assist in other field survey tasks. Skilled personnel are

needed, however, to plan, supervise, and analyze the collected data.

Examples of field surveys of housing sectors are illustrated in Figures [4.4](#) and [4.5](#).

Assessment Information¹³

Disaster assessment information that is gathered must be geared to the specific needs of the relief organization.

Identification of Users

Disaster assessment should be designed to collect information for specific users. In planning an assessment, the users can be identified (usually by sector or region) and they can help specify their information requirements. For example, health and medical organizations need certain types of information, whereas housing agencies have very different information needs. Each agency has specific information needs and general information is usually of little value.

The table on the following page contains examples of the types of assessment information needed by different disaster response organizations.

Specifics of Situation Assessment¹⁴

Role of Survivors in the Assessment of Needs

As has been stated, survivors must have a full and effective role in determining their emergency needs, especially shelter. This principle must be applied to the process of damage and needs assessment. In the event of a slowly developing disaster, such as drought, there is usually ample time to involve the affected population. In the immediate aftermath of a sudden disaster, when there is considerable damage and chaos, the immediate involvement of survivors in assessment may be inappropriate, at least until the initial rescue and relief operations have been organized.

Beyond the emergency period, however, survivors should begin to take an active role in the assessment of needs. The interview of key individuals within the community is often considered the appropriate course of action. For this to be successful, the individuals interviewed must be well informed about the extent of damage and needs, but also willing and capable of providing information and fully representative of their community. Obviously, the more familiar the authorities and assisting groups are with the community, the more secure they will be in obtaining reliable information.

(For a complete discussion of disaster assessment objectives, techniques, uses, and options, see the University of Wisconsin- Madison Disaster Management Center textbook, Disaster Assessment.)

Table 4.1

References

1. This section is from UNDRO, Disaster Prevention and Mitigation, A Compendium of Current Knowledge, Volume II, Preparedness Aspects, New York, 1984, pp. 36-42.
2. The emphasis is on "effectively." In 1981 a flood warning exercise in London was preceded by an extensive and expensive publicity campaign. A post-exercise survey showed that 50 percent of those interviewed did not hear the warning; 30 percent of those who did, did not realize its meaning; and 60 percent did not know what to do.
3. This subject is treated more fully in Disasters and the Disabled, published by UNDRO, Geneva, 1982.
4. INTERTECT, "Evacuation, How to Develop a Workable Evacuation Plan," Dallas, Texas, 1979.
5. Condensed from Ronald W. Perry, Marjorie R. Greene and Michael K. Lindell, "Enhancing Evacuation Warning Compliance, Suggestions for

Emergency Planning," Disasters, Vol. 4, No. 4, pp. 433-449, Pergamon Press Lt., Great Britain, 1980.

6. UNDR0, Disaster Prevention and Mitigation, pp. 42-43.

7. UNDR0, Shelter After Disaster, Guidelines for Assistance, Geneva, published by United Nations, New York, New York, 1982, pp. 16-17. This article is based on assessing shelter needs. It has been modified to apply to general assessment needs.

8. Following the 1963 earthquake in Skopje, Yugoslavia, the authorities undertook detailed damage surveys in parallel with vulnerability analyses. Both activities continued while reconstruction began on less hazardous sites. In contrast, following the 1970 Peruvian earthquake, the microzoning studies of Huaraz delayed the start of some reconstruction for three to four years.

9. University of Wisconsin-Madison Disaster Management Center textbook, Disaster Assessment.

10. UNDR0, Shelter After Disaster, Guidelines for Assistance, p. 19.

11. University of Wisconsin-Madison Disaster Management Center textbook, Disaster Assessment.

12. UNDR0, Shelter After Disaster, Guidelines for Assistance, p. 18.

13. University of Wisconsin-Madison Disaster Management Center textbook, Disaster Assessment.

14. Ibid.

Self-Assessment Test: Lesson 4

Multiple Choice

Circle the correct answer(s)

1. From the point of view of the public, a disaster warning will be most effective if it is
 - a. not too detailed about magnitude of the event and where it will occur
 - b. declared only when most people are likely to be

at home and listening to the radio

- c. issued only a few times; too much repetition will mean people will stop listening
- d. issued by a person or organization in whom public confidence is placed
- e. issued as soon as the possibility of a disaster arises, giving rough probability about its occurrence

2. It may be necessary to set up an Information Center apart from the Emergency Operations Center because

- a. the presence of media representatives in the Emergency Operations Center can be quite a hindrance
- b. the public should not be aware of some of the disaster information
- c. there usually isn't room for reporters in an Emergency Operations Center
- d. disaster managers need time to prepare reports to the public
- e. members of the foreign media will not speak the local language

3. One policy of effective evacuation planning is to have a plan where all evacuees can out of the area.

- a. be bussed
- b. be trucked
- c. be taxied
- d. be air lifted
- e. walk

4. Evacuation plans must be based on evacuation, not evacuation.

- a. individual, family
- b. family, individual
- c. community, regional
- d. neighborhood, family

5. Evacuations can be more effectively accomplished if the people involved

- a. have a plan for an egress route and safe destination
- b. have ample time to decide whether or not to

evacuate

- c. are forced by the military to comply with evacuation orders
- d. are told beforehand they will be paid for all losses due to the disaster

6. In search and rescue the term "fix their locations" refers to

- a. repairing the building where the survivor is found
- b. recording the exact location of the survivors
- c. identifying possible locations for trapped victims
- d. freeing the victim from the rubble

7. One characteristic of a poorly produced damage and needs assessment is

- a. the underestimation of needs by local or national officials
- b. too much participation in the assessment by the surviving community
- c. a single agency taking over responsibility for the survey
- d. a higher priority being placed on damage surveys than surveys of basic human needs

8. A policy to adopt for an assessment of survivors' needs is

- a. to encourage a proliferation of independent assessments
- b. to await the results of damage surveys and vulnerability analyses before starting any reconstruction activities
- c. to isolate structural surveys from assessment of social and economic needs
- d. to rely on state-of-the-art technology
- e. to use a team with members who are acquainted with the affected area

9. Compared to other assessment techniques field surveys have an important advantage because they

- a. make it possible to generalize from relatively small samples
- b. cost less than any of the other techniques
- c. are the quickest form of surveys

- d. are unaffected by cultural differences between survivors and surveyors
- e. require the least expertise to administer and analyze

Place a (+) in front of the following principles of search and rescue that should be encouraged and a (-) in front of those that should not.

10. Searches should be redundant (repetitious).

11. Responsibility for searches should be centralized.

12. Responsibility for search and rescue coordinations should usually be placed in social welfare departments of government.

13. Rescue equipment should be placed within vulnerable communities before the disaster.

True or False

Indicate T or F:

14. One study has shown that persons of high and low socioeconomic status differed in their perceptions of preferred warning sources.

15. Local survivors perform the minimum of all immediate postdisaster rescue work.

16. The accurate assessment of survivors' needs is in the short term more important than a detailed assessment of damage to houses and property.

17. Beyond the emergency period, survivors should not be bothered with an active role in the assessment of needs.

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**Hurricane Threat and Evacuation Intentions: An Analysis of
Risk Perception, Preparedness, Social Influence, and Resources**

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Running Head: Hurricane Threat and Evacuation Intentions

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Abstract

The goal of this study was to test a model in which the decision to evacuate is a function of four processes (risk perception, preparedness, social influence, and economic resources). Participants were interviewed by telephone both while they were under a hurricane warning and after the threat had disappeared (pre-post sample). Because all respondents had been participants in an earlier panel study, pre-threat data were also available. The pre-post sample of 95 panelists was older than the non-respondent sample of 54 panelists who could not be reached by phone during the warning period but was otherwise comparable. The results indicated that higher risk perception and the belief that one is influenced by others are the strongest predictors of intentions to evacuate. Furthermore, risk perception was shown to mediate the influences of many background variables (e.g., experiences, demographics) on evacuation intentions. Post-event comparisons between the pre-post group and a reactivity control group of 66 panelists suggested that the warning period interview did not increase anxiety but may have influenced reactive preparedness.

Hurricane Threat and Evacuation Intentions: An Analysis of Risk Perception,
Preparedness, Social Influence, and Resources

From the viewpoint of the individuals involved in the process, evacuation is a gamble. Either they do not evacuate and risk possible injury or they evacuate and risk worrying about their homes and possibly wasting their time if a hurricane does not hit. Whereas many individuals err on the side of caution, other individuals take the gamble. Evacuation is largely a function of people defining themselves as being in danger and believing that leaving the area in question is beneficial (Fitzpatrick & Mileti, 1991). Successful evacuation requires involvement from both the community (issuing evacuation orders, providing marked exit routes) and the individual (decision making). Although community involvement is important in evacuation, external social influence can only go so far because ultimately the individual is responsible for the decision. Knowing who is at higher risk for not evacuating, and why, could indicate ways of influencing these individuals to make an affirmative evacuation decision and may even suggest early intervention strategies that provide access to the resources necessary to evacuate successfully. The goal of this study was to test a model in which the decision to evacuate is a function of four processes: risk perception, preparedness, social influence, and resources.

Risk Perceptions and Protection Motivation

In an analysis using a combined sample of 777 subjects from Hurricanes Hugo and Andrew, Riad, Norris, and Ruback (1998) examined the reasons people gave for not evacuating. Although both of these storms were Category 4 hurricanes, 33% of those who did not evacuate had believed that the hurricane was not a serious threat, and 25% had been confident in their safety. How bad must conditions be perceived to be before evacuation occurs? Evacuation researchers have examined different aspects of assessing risk, such as perceived severity of the threat, the individual's perceived susceptibility to that threat (Perry et al., 1981; Houts et al. 1984), and family characteristics (Houts et al. 1984, Drabek and Stephenson, 1971).

Many theories focus on individual preventive behavior by using a cost-benefit, decision making perspective (Weinstein, 1988). The health belief model (Becker, 1974; Janz & Becker, 1984), Fishbein and

Ajzen's theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), subjective expected utility theory (Beach, Campbell, & Townes, 1979; Edwards, 1954; Sutton, 1982) and Roger's protection motivation theory (Rogers, 1975) all share this cost-benefit view (Weinstein, 1988). Perceptions of costs and benefits are important for understanding evacuation. While evacuation decreases certain risks, such as personal injury, it sometimes is perceived as increasing other risks, such as burglary (Riad et al., 1998).

Preparedness

Preparedness in the form of general knowledge and information should facilitate evacuation by enabling more appropriate response behaviors (Faupel et al., 1992). However, whereas some researchers have found high levels of preparedness (Hodler, 1982; Perry & Lindell, 1986) among evacuees, others have not (Bourque et al, 1973; Worth & McLuckie, 1977). What exactly constitutes preparedness has also been debated. At the United Nations conference in Yokohama, the word preparedness was defined in drastically different ways, ranging from action-oriented steps to education (Quarantelli, 1994). A citizen's ability to evacuate on short notice may depend upon two different types of preparedness – proactive behaviors that have taken place previously in response to a hypothetical threat and reactive behaviors that take place when the threat is immediate (Faupel et al., 1992; Norris, 1997). Although many types of disasters occur too suddenly for reactive behaviors, satellite technology now provides most hurricane victims with a substantial warning period.

Prior disaster experience has been found to be a powerful predictor of preparedness (e.g., Demerath, 1957; Fritz 1961; Hutton, 1976; Moore et al., 1963; Norris, Smith, & Kaniasty, 1998; Perry et al., 1981). The more recent (Perry, 1979), direct (Tierney, 1993), and severe the experience was (Weinstein, 1988) the greater its influence on preparedness. However, Riad et al. (1998) found that prior evacuation behavior significantly predicted future evacuation behavior, whereas prior disaster experience did not. This led the authors to believe there is an "evacuation repertoire" because people who have evacuated before know what to do and how to act. This repertoire is very individualized. Prior evacuation experience may give people a sense of control or a feeling of self-efficacy. Residents may feel prepared for the storm (e.g., boarded up

windows, car filled with gas) but may not feel they have the capability to deal with the evacuation process if they have not done it before.

Social Influence and Norms

Emergency conditions change behavior and norms (Fritz, 1957; Perry, 1979). When a warning is received, people engage in what evacuation researchers have historically called the warning confirmation process. Individuals call others to get their interpretation of the event (Mileti, 1991; Drabek and Boggs, 1968) and observe each other's behavior (Cutter and Barnes, 1982; Carter, Clark and Leik, 1979). Other researchers like Christensen and Ruch (1980) are divided over the influence of social networks in prompting evacuation. Results from their two experiments using taped simulated hurricane bulletins showed that neither actions of an observable friend nor those of a spouse had any effect on the individual's response.

Because evacuation decisions are influenced by societal norms, different population subgroups, with different norms, may have different rates of evacuation (Moore, 1963). Research has backed this notion with race (Perry, 1979; Riad, et al., 1997), age, (Quarantelli, 1985) and gender (Riad et al., 1997).

Access to Resources

Resources are those stable assets, such as health, income, and social support, that can be used to cope with a variety of circumstances. Inadequate economic resources may inhibit evacuation because poor people do not have the means to evacuate (i.e., have no transportation or money). In Riad et al.'s (1997) study, 10% of those who did not evacuate attributed their behavior to inadequate social or economic resources.

Individuals who are not well physically may also have trouble evacuating.

One important resource is social embeddedness which provides access to both tangible resources (e.g., a ride or a place to stay) and emotional support (Kaniasty & Norris, 1995). Family constitute an important resource because individuals are most likely to evacuate to the homes of relatives (Drabek & Boggs, 1968). Riad et al. (1997) found that individuals with strong social support were more likely to evacuate following Hurricanes Hugo and Andrew.

Present Study

In summary, the variables hypothesized to influence individual decision making are risk perception, preparedness, social influence and resources. These variables were examined as predictors of intentions to evacuate among individuals threatened by Hurricane Bertha in 1996. On Wednesday, July 10, 1996, Hurricane Bertha, a category 2 storm was threatening the Eastern Coast. The storm was 300 miles in diameter and its path was unclear. In Georgia, official mandatory evacuation orders were not yet issued but officials recommended that residents of the coastal islands evacuate as a precaution. In South Carolina, a mandatory evacuation order was issued in the evening for South Carolina's barrier islands. Because a northerly turn had been anticipated, a hurricane watch was never issued for Savannah and Charleston. A hurricane warning was issued when it appeared that Bertha would continue on a north-westerly path. A hurricane warning is issued when a hurricane is expected to hit within 24 hours. The hurricane did eventually turn towards the north and made landfall in Wilmington, NC. At the time, Bertha was a category 2 hurricane (105 mph).

On Tuesday July 9, 1996 at 11:30 pm it was decided that this hurricane presented a unique opportunity for study because two of the cities being threatened were the same cities involved in a longitudinal panel study that had been initiated following Hurricane Hugo. Longitudinal data are important for many reasons, including the establishment of reliability of measurement and documentation of changes over time. For this particular study, having a solid data base to work from helped immensely with the time pressures by allowing specific questions regarding evacuation to comprise the bulk of the questionnaire.

This situation also presented a methodological opportunity. Two major weaknesses of evacuation studies are that they are based on self report and employ a retrospective design. When data are collected after a hurricane strikes, time and the fact that the evacuation warnings were true may change residents' memories of why they did not evacuate. Though these weaknesses are pervasive in disaster research, this study overcame them by studying a community before as well as after evacuation warnings were proclaimed. By calling people during the warning period, we were able to ask them about their preparatory behaviors when the

details were still fresh in their minds. One possible issue with prospective designs is that calling before the event may increase awareness of the event and cause individuals to behave differently. Therefore we also incorporated a control group into the design to check for demand characteristics.

Method

Sampling Procedures and Design

Original Panel. A sample of 1,000 adults was drawn, 250 each from four cities that differed in their experience with Hurricane Hugo in 1989. Two of the original cities -- Charlotte, NC and Greenville, SC -- were not included in the present study of Hurricane Bertha. The two included cities -- Charleston, SC and Savannah, GA -- had both been threatened by Hurricane Hugo before the storm actually hit Charleston. Local interviewers used maps marking the boundaries of the areas to solicit interviews. Only one interview per household was allowed. For comparison purposes, a quota (purposive) sampling strategy was used. This strategy provided approximately equal numbers of Blacks and Whites, men and women, and younger (18-39), middle-aged (40-59) and older (60+) persons. The first interviews were conducted in the respondents' homes in the Fall of 1990, the second wave was six months later and the third wave was six months after that. The fourth wave of data was collected in the Fall of 1995. It was from this fourth wave of interviews conducted in Charleston ($n = 146$) and Savannah ($n = 169$) that the sample for this study was drawn (see Figure 1).

The Pre-Event Sample. From the fourth wave of interviews, conducted in the Fall of 1995, a manual contained the names, addresses, phone numbers and ID number of those respondents living in Savannah, GA, and Charleston, S.C. The flip of a coin randomly determined the individuals to be called during the hurricane warning. A team of 5 graduate students and 4 undergraduate students were organized to be the interview team. All of the interviewers but one had experience in conducting telephone interviews. Data collection started at 3:00 PM and lasted until 9:30 PM. A total of 165 phone numbers were called, and 95 interviews were conducted for a response rate of 58%.

Post-Event Samples. The post-event samples consist of three groups (see Figure 1). The first group consisted of all the individuals who were called during the pre-event phase of the study ($n = 95$). Out of this

group a total of 91 individuals were re-interviewed for a response rate of 96%. This group will be referred to as the pre-post group. The sample was 60.4% female and 50.5% black.

The second group called the reactivity control group consists of 95 individuals (n = 41 for Charleston and n = 54 in Savannah). A total of 66 individuals were interviewed (n = 32 for Charleston and n = 34 in Savannah) for a total response rate of 69%. This group had been set aside and was not called in the pre-event phase of the research. A control group is necessary because our phone call about evacuation could possibly be interpreted as a demand characteristic (increasing awareness of the hurricane and therefore causing evacuation). The sample was 68.2% female and 48.5% black.

The third group, the non-respondent group, was made up of 70 individuals (n = 37 in Charleston and n = 33 in Savannah) who were called on the night of the pre-event interviews but were not reached for the interview. Out of this group a total of 54 individuals were reached for a total response rate of 77%. Comparing their responses during the post-event interview to those of the other two groups will allow an estimate of sampling bias to be made. The sample was 61.1% female and 40.7% black.

The same interviewers responsible for the pre-event interviews attempted to call the same respondents back for the post-event interview. There are three large categories of measures, background, pre-event and post-event.

Background Measures

Many important demographic variables were located in the longitudinal data set. Related to evacuation is whether the individual owned or rented his/her home. Also available were measures of race, sex, age, tenure, occupation and education.

Risk Perception. A composite score of psychological distress at Wave 4 ($\alpha = .79$) was measured by taking the mean to 5 items (e.g., how often were your emotions numb, did you quit caring about people, were jumpy or easily startled, unusually forgetful, have trouble sleeping; Thompson, Norris & Hanacek, 1993). The response format ranged from 1 = never to 5 = very often.

Preparedness. At Wave 4, a set of 20 hazard preparedness questions influenced by the Mulilis - Lippa earthquake preparedness scale (Mulilis et al., 1990) were included by Norris (1997). In a factor analysis, items clustered into Basic Supplies (e.g., radio, batteries, flashlight), Advanced Planning (e.g., household plan for severe storm, professional advice), Hazard Alertness (e.g., attentiveness to weather information), and Perceived Usefulness of Hazard Preparedness (e.g., how useful to have a plan of action). For this analysis a composite score was made by counting affirmative responses to a general hazard preparedness and awareness scale ($\alpha = .72$).

Social Influence. A scale of social embeddedness ($\alpha = .70$) was created by taking the mean of 7 items (number of people you say hello to in a day, how many friends and relatives do you enjoy spending time with and how many times did you get together with them, how many neighbors do you know well enough to visit, how many organizations do you participate in). Resources. The composite score of financial well-being was measured by taking the mean of 4 items ($\alpha = .76$; e.g., problems having clothing, food, meeting monthly bills and money issues were a burden; Norris & Uhl, 1993). The composite score of physical well-being combines 4 items ($\alpha = .84$; e.g., how often did your health prevent you from doing things you wanted to do, have trouble getting around, feel tired and feel physical burden; Norris & Uhl, 1993). The response format for these measures ranged from 1 = never to 5 = very often.

Pre-Event Measures

Evacuation. Subjects were asked, "If a warning is issued, are you going to evacuate?" They responded on a dichotomous scale (yes or no). From the literature and previous work, a list of all of the reasons people had given for not evacuating was compiled. Respondents were read each reason and then asked if it was true or false about them (see Table 1).

Risk Perception. The measure of risk perception was created by taking the mean of affirmative responses to 10 items tapping whether these perceptions would encourage evacuation (current severity/category of the hurricane, national hurricane center increasing the category of the hurricane, an official evacuation order being issued, a governmental mandatory evacuation order being issued, actually

feeling the sustained winds on your face, hearing the noise the winds make, family encourages leaving, believe storm is coming, believe storm will be bad, feel house unsafe; $\alpha = .72$). Respondents answered each question yes or no.

A composite score representing anxiety ($\alpha = .89$) was created by taking the mean of responses to whether the respondents felt nervous, fearful, anxious and stressed. The response format ranged from 1 = not at all to 4 = a great deal. The age and gender of everyone currently living in their household was listed.

Preparedness. To assess the level of reactive preparedness a number of items related to hurricane preparedness were asked. Respondents were told that people do different things in case of emergencies and that the questions referred to right now, today. The respondents answered yes or no. A reactive preparedness measure was created by counting the affirmative responses to whether individuals had done a number of items related to hurricane preparedness (presence of a tarp, chainsaw, protection plan, secured outdoor furniture, moved valuables to a safer place, knew location of shelter, had extra cash, had an evacuation route, had an alternative evacuation route; $\alpha = .72$).

Social Influence. Two types of social influence were measured. The first was reality based, in that it measured the types of social influence actually received or provided. The second type of social influence was hypothetical in that it asked whether types of social influence would affect an evacuation decision if received.

The measure of actual social influence ($\alpha = .76$) was created by taking the mean of the responses tapping this construct (number of neighbors spoken with, number of neighbors preparing their homes, number of neighbors preparing to evacuate, number of people spoken to about an evacuation route, how many friends and family members have called you to urge evacuation, how many friends and family members have offered you a ride or a place to stay, have you made plans for relatives, have you offered anyone a ride or a place to stay). Except for offering a ride or a place to stay, whose response options were yes or no, the questions were answered on a 5-point scale: 1 = none, 2 = one or two, 3 = three to five, 4 = six to nine, or 5 = ten or more.

Openness to social influence ($\alpha = .61$) was assessed by asking whether the following experiences would encourage them to evacuate: the chance to affiliate with others, seeing neighbors leave, having a friend ask you to evacuate. Respondents answered simply yes or no. The more speculative hypothetical questions were asked before the reality based social influence questions.

Resources. To assess the amount of self-efficacy, four questions ($\alpha = .77$) were adopted from Bandura and rewritten to be specific for the evacuation process (when I make the evacuation plan I am sure it will work, if I run into a problem while evacuating I am sure I can solve it, I think evacuation is too complicated to do and when I start to evacuate I believe I will be able to reach a safe spot). The response options were simply true or false. Applicable questions were reverse-scored.

Post-Event Measures

Risk Perception. Post-event anxiety ($\alpha = .72$) was assessed with the same 4 questions used in the pre-event questionnaire (feel nervous, fearful, anxious, stressed). In addition, respondents were asked, "In the past week how often have you thought about Hurricane Hugo?" and "In the past week how often have you thought about other seriously stressful events that have happened to you?" Both questions were answered on a 4-point scale from 1 = not at all to 4 = a great deal.

Preparedness. To assess any preparatory actions that may have happened after we telephoned respondents, the following questions were asked, "Did you gas up your car, or had you already gassed it up or you did not gas it up?" The answers were scored on a 3 point nominal scale did it, had already done it, and did not do it. The same format was used to assess attainment of water, food, batteries and cash.

Social Influence. To assess amount of social comparison and need for affiliation, respondents were asked if they spent the warning period with anyone other than members of their household. If they answered "yes" then they were asked whether this was for: "Emotional support?", "To compare yourself with others?", "For practical support?", "For informational support?", "Because you were afraid?", and "Because they were afraid?" Respondents answered yes or no.

Results

Description of the Pre-Event Sample

There were 38 males (40%) and 57 females (60%) in the sample. Regarding race, 48% of the sample were Black ($n = 46$) and 52% were White ($n = 49$). The sample's mean age in years was 62 ($SD = 15.5$, range = 27 to 88), and the average years of education were 12.6 ($SD = 3.5$, range = 5 to 24). The majority of the sample (43.2%) were retired, followed by 33.7% of the sample working full-time. The average amount of time spent in the house during the day was 18 hours. The majority (45%) of the sample ($n = 43$) were married, although 14% had never married ($n = 13$), 11% were divorced ($n = 10$) and 30% were widowed ($n = 29$).

The number of people in the household ranged from 1 to 6 ($M = 2.5$). The number of males in the household ranged from 0 to 3 ($M = 1.1$) and the number of females ranged from 0 to 4 ($M = 1.4$). The number of children in the household ranged from 0 to 5 ($M = 0.6$). The range for male children was 0 to 3 ($M = .35$) and the range for female children was 0 to 3 ($M = .28$).

Descriptive Analyses of Evacuation Beliefs and Experiences

Table 1 presents a list of beliefs about evacuation, compiled from earlier work regarding why individuals do not evacuate (Riad et al., 1997). As indicated by the percentages, the majority of this sample believed that they had enough time to leave, that they were in control, and that they had experience with hurricanes. Against the grain of popular disaster lore, only 5 individuals felt they had to stay and care for their pets.

To test whether individuals with different demographic characteristics had different beliefs and experiences regarding the evacuation process a series of chi-square analyses were conducted. Women were more likely to believe the storm was going to be bad, $\chi^2(1, N = 95) = 3.67, p = .05$. Men were more likely to say that they felt their house was safe, $\chi^2(1, N = 95) = 6.88, p < .01$. Men were also more likely to say that they felt in control $\chi^2(1, N = 95) = 4.95, p < .05$. Higher education was related to feeling God is in control, $\chi^2(1, N = 95) = 9.27, p < .05$ as was being Black, $\chi^2(1, N = 95) < 13.70, p < .001$. Whites had more

recent evacuation experience, $\chi^2(1,94) = 15.00, p < .001$. Individuals who had intentions of evacuating felt less safe in their homes, $\chi^2(1, N = 95) = 10.81, p < .001$, and owned cars, $\chi^2(1, N = 95) = 4.17, p < .05$.

Individuals who had evacuation intentions had family who wanted to leave, $\chi^2(1, N = 82) = 14.72, p < .01$. They also felt that the hurricane would be coming, $\chi^2(1, N = 95) = 5.10, p < .05$, and that it would be bad, $\chi^2(1, N = 95) = 8.39, p < .01$. Individuals who lived in Savannah were more concerned about looting, $\chi^2(1, N = 95) = 3.71, p = .05$, whereas individuals in Charleston said they had more hurricane experience $\chi^2(1, N = 95) = 8.30, p < .01$.

Those who spent the warning period with others ($n = 66$) did so for a variety of reasons. Rank ordered, emotional support was first, followed by: practical support, informational support, because they were afraid, in order to compare self with others and, finally, because the individual was afraid. Blacks were more likely to have spent the warning period with others for emotional support, $\chi^2(1, N = 66) = 4.91, p < .05$.

Multivariate Relations Between Background Variables and the Proximal Measures

Multiple regression was used to determine whether background variables predicted risk perception, reactive preparedness, actual social influence, openness to social influence, efficacy, and anxiety. These measures are those thought to be more proximally related to the evacuation decision and were often substantially related to one another. Risk perception and hypothetical social influence were highly intercorrelated ($r = .64$). Risk perception was also highly correlated with anxiety ($r = .39$). Reactive preparedness was correlated with actual social influence ($r = .53$) and efficacy ($r = .32$). Openness to social influence was moderately correlated with anxiety ($r = .23$). The background variables were selected on the basis of the literature and bivariate relations. They were entered into the equation simultaneously. Table 2 presents the standardized regression coefficients as well as the amount of variance accounted for by the set of background variables in each of the composite variables.

For risk perception, hurricane experience had a marginal relationship. Prior evacuation experience was positively related to risk perception. Women, Blacks, and individuals living in Savannah perceived more

risk. Individuals who reported psychological distress at Wave 4 perceived more risk. Anxiety was only predicted by past psychological distress.

Reactive preparedness was predicted by prior evacuation experience and greater preparedness at Wave 4. Younger and Black individuals conducted fewer of the preparatory behaviors. There was a marginal, inverse relation between education and reactive preparedness.

Higher actual social influence was associated with greater preparedness at Wave 4, higher embeddedness in the community, and having more women in the house. Openness to social influence was associated with more evacuation experience and past psychological distress. Respondents who lived in Savannah were also more open to social influence.

Higher efficacy was associated with prior evacuation experience, financial and physical well-being, embeddedness in the community, and more children. However, the fewer women in the household, the more efficacy was reported.

Predictors of Evacuation Intention

Almost half of the sample said they had intentions of evacuating (46%). To determine what demographics were related to intentions to evacuate a series of chi-square analyses were conducted. Chi-square analyses revealed that individuals who had prior hurricane experience were less likely to have evacuation intentions, $\chi^2(1, N = 95) = 9.44, p < .01$. Those who owned their homes were less likely to have intentions to evacuate, $\chi^2(1, N = 95) = 8.17, p < .01$. Women were more likely to have evacuation intentions, $\chi^2(1, N = 95) = 3.73, p < .05$. Individuals who lived in Savannah were more likely to have evacuation intentions, $\chi^2(1, N = 95) = 7.60, p < .01$. Blacks were more likely to have evacuation intentions than Whites, $\chi^2(1, N = 95) = 5.50, p < .05$.

For the continuous variables predicting evacuation a MANOVA was conducted. Dependent variables were the proximal influences (efficacy, reactive preparedness, risk perception, actual social influence, openness to social influence, anxiety), the background variables (e.g., financial well-being, physical well-being, Wave 4 preparedness, Wave 4 distress, home ownership, tenure, age, sex, and race) and

household composition variables (e.g., number of females and males, children and adults). The independent (grouping) variable was evacuation intentions (yes, no). The multivariate F was significant, $F(21, 72) = 4.22, p < .001$. Individuals who intended to evacuate were more anxious, had less education, were less embedded in the community, reported psychological distress in the past, perceived more risk, and were more open to social influence than those not intending to evacuate. Reactive preparedness, actual social influence and efficacy were not related to evacuation intentions.

To investigate the importance of whether these relations might differ by city, another MANOVA was conducted on the split sample. The results are presented in Table 3. Individuals who intended to evacuate from Savannah had more anxiety, perceived more risk, were more open to receiving social influence, had more females in the house, were less attached to their home, had lower education levels, and were less embedded in the community than those who did not intend to evacuate. Individuals who intended to evacuate from Charleston also were more anxious, perceived more risk, were more open to social influence, had prior psychological distress, were less educated, and were less embedded in the community than individuals who did not intend to evacuate.

A hierarchical logistic regression model was derived by entering variables that had significant bivariate effects into the equation predicting evacuation intentions. Hierarchical logistic regression was used because of multicollinearity between two of the important variables, risk perception and openness to social influence. Risk perception was entered into the equation first, $\chi^2(1, N = 94) = 40.79, p < .000$. Alone this variable correctly classified 28.5% of the sample over chance. Then embeddedness was entered into the equation, $\chi^2(1, N = 94) = 6.73, p < .001$. This addition improved the model fit by correctly classifying another 1.1% of the sample. Third, openness to social influence was entered, $\chi^2(1, N = 94) = 5.52, p < .05$. The addition of this variable further increased the overall fit of the model by correctly classifying another 3.2% of the sample. Finally, all of the other variables such as anxiety, prior hurricane experience, home ownership, education, race, sex, and city were entered last (see Table 4). None of these variables added to the overall fit of the model, $\chi^2(7, N = 87) = 8.34, n.s.$ Overall the total model correctly classified 32.8% of the

sample over chance. Individuals who more perceived risk and were less embedded in the community had evacuation intentions. Openness to social influence was marginally correlated with evacuation intention.

Risk Perception as a Mediator

To test the idea that risk perception mediated the relationship between other variables and evacuation intentions, further analyses were conducted (See Figure 2). According to Baron and Kenny (1986) three conditions must be met to establish mediation. First the independent variable (in this case a set of variables; hurricane experience, evacuation experience, city, past psychological distress, race and sex) must be shown to affect the mediator (risk perception). To test the first condition, a regression equation predicting risk perception was conducted using sex, race, evacuation experience, past psychological distress, city, and hurricane experience as independent variables. This equation was significant, $F(6,88) = 8.24, p < .001$.

The second requirement of mediation is that the mediator (risk perception) must be shown to affect the outcome variable (evacuation intention). This second step was also confirmed because risk perception predicted intentions to evacuate, $\chi^2(1, N = 95) = 42.33, p < .001$. The third requirement is that the effects of the set of independent variables on the outcome variable should (evacuation intention) decrease when the effects of the mediator are taken into account. This was accomplished in two parts. First, the same group of independent variables needed to significantly predict evacuation intention and it did, $\chi^2(1, N = 95) = 31.17, p < .001$. The second goal was to see whether the group of background variables predicted evacuation intentions to evacuate when risk perception was controlled for in the analysis. It did not, $\chi^2(1, N = 87) = 7.78, n.s.$ This meant that risk perception was a psychological mediator of evacuation intentions for those with experience, those living in Savannah, those having past psychological distress, Blacks and women.

Methodological Comparisons

In order to test for the presence of response bias and demand characteristics, validity checks were conducted. To identify these biases, three groups were interviewed one week after the hurricane. The pre-post group was the sample who was interviewed both before and after the hurricane (see Figure 1 for a review). The reactivity control group was the sample that was randomly set aside at the beginning of the study, and no

attempt to call them was made. The non-respondent group consisted of those with whom interviews were attempted but who could not be reached. All validity checks involved examining whether there were differences between these groups on basic demographic characteristics and all post-event measures. Only the significant ones will be mentioned here.

The first comparison involved the reactivity control group and the pre-post group. This comparison tells us whether the individuals we called were significantly different from the individuals we did not call and if our phone call could have influenced evacuation, anxiety levels, or preparedness. The reactivity group scored higher on anxiety ($M = 1.38$) than the pre-post group ($M = 1.20$), $t(155) = -2.32, p < .05$. The second comparison involved the reactivity control group and the non-respondent comparison group. This comparison tells us whether the individuals we attempted to contact (e.g. but were not at home) were significantly different from the individuals we did not call. There were no significant differences between these two groups. A third comparison tested differences between the pre-post group and the non-respondent group. This was done in order to determine if there was a response bias, meaning that the individuals we contacted were different in some way than the individuals who were not at home that night. The non-respondent group was marginally more anxious ($M = 1.34$) than the pre-post group ($M = 1.20$), $t(143) = -1.90, p < .07$. The pre-post group was older ($M = 61.9$) than the non-respondent group ($M = 52.5$), $t(143) = 3.45, p < .001$. A chi-square analysis revealed that the pre-post group had been less likely to spend the warning period with other people, $\chi^2(1, N = 143) = 9.52, p < .01$. From this we know that our phone call did not influence affiliation. The pre-post group was, however, more likely to buy batteries than the non-respondent group, $\chi^2(1, N = 143) = 9.19, p < .01$. It appears from the consistent anxiety findings that our phone call did not increase anxiety.

Discussion

In this final section, results of the study are summarized, the limitations and strengths of the study are described, and the implications for future investigations are discussed. This study was undertaken to identify the differences between respondents who intended to evacuate and those who did not under

ambiguous threatening circumstances. The variables of particular interest were risk perception, preparedness, social influence, and resources.

Clearly, perceiving risk was very important in deciding whether to evacuate or not. Other storm characteristics such as believing it was going to be bad and that it was coming also had an effect on evacuation intentions. These findings are consistent with the models of evacuation decision-making that have placed great emphasis on risk perception.

Risk perception was a psychological mediator for important background variables (e.g., race, sex, past psychological distress, hurricane experience, evacuation experience, and city). Although independently these variables predicted evacuation intention, they do not once risk perception was controlled for. Being Black, female, having past distress, being experienced, and living in Savannah affected how much risk these individuals felt and this link was what predicted evacuation intention.

There are other variables that may affect the adults' perception of risk. Historically, studies have shown that family variables have been very important components of evacuation (Houts et al, 1984; Drabeck & Stephenson, 1971). This was because families tended to evacuate as a unit (Perry, 1979). Consistent with past research, individuals who had intentions to evacuate had family who wanted to leave.

Another household variable that could affect perceptions of risk was having children in the house. Past research has found that households with young children were more likely to evacuate (e.g., Houts et al, 1984). In this study, the influence of children in the household was assessed in two ways. First, those who had children in the household (35.8%) were compared to those who did not have children in the household (64.2%). Secondly, the evacuation intentions of individuals who had young children (e.g., under six and 12) were examined. Neither the number of total children in the household nor the number of young children in the household were related to evacuation intentions.

Although having children was not related to evacuation intention, having male children was related to perceiving more risk. The more male children in the household, the more risk was perceived. Zajonc's (1976) research with birth order showed that there was a longer lag time between babies being born when the first

child was a male. The hypothesized reason for this was that parents preferred male children, therefore waited longer after having a male child than a female child. Cross-cultural research also shows that male children are preferred in India (Nath & Land, 1994) and in China (Arnold & Zhaxiang, 1986). If this male child preference is true, then respondents may have been more concerned with protecting male children.

This study took into account that individuals may sometimes experience conflicting motivations in that although they perceive risk, it may be for their territory rather than for themselves. This notion of territoriality was important on the bivariate level with owners being less likely to leave, and being more concerned about looting. There was also a city difference with individuals who lived in Savannah being more attached to and proud of their homes. These individuals were less likely to have evacuation intentions.

The second variable hypothesized to be related to evacuation intentions was preparedness. Younger, White, and married individuals were more prepared. This may be a resource issue in that younger individuals have more energy to prepare, and married couples have more help. Blacks were less well off financially than Whites. However, financial well-being itself was not related to preparedness.

Individuals who were prepared at Wave 4 (1995) were prepared at Wave 5 (before Bertha). The Wave 4 measure was concerned with general hazard preparedness. The Wave 5 measure was concerned with reactive preparedness. This research is consistent with the finding that higher levels of general preparedness should enable more appropriate response behaviors (Faupel et al., 1992). This finding is very important because it pulls the field one step beyond where it was given the context of the study (e.g., actual threat of natural disaster).

Prior evacuation experience was once again more important than hurricane experience. Those who had prior evacuation experience (52.6%) perceived more risk, were more prepared, had higher levels of efficacy, and were more likely to say that others would influence their decision to evacuate. Hurricane experience was only marginally related to risk perception. Those who had evacuation experience were more likely to have evacuation intentions. However, those who had hurricane experience were less likely to have evacuation intentions.

It has been suggested that individuals who have prior evacuation experience have an evacuation repertoire because they know what to do and how to act (Riad et al., 1997). This study takes the repertoire finding further because it includes 2 additional steps, efficacy and risk perception. Now it can be said that individuals who have evacuated before know what to do, how to act, feel as though they can accomplish the action, and perceive enough risk to intend to evacuate to begin with.

The other important variable that predicted evacuation intentions in the logistic regression model was social embeddedness. Individuals who had evacuation intentions appeared to be less embedded in the community. As mentioned before, some individuals may be more attached to place. It is possible that individuals who are more embedded in the community find it more difficult to leave.

There were two types of social influence measured, actual and hypothetical. Actual social influence is a combination of social comparison processes (e.g., see neighbors preparing homes, see neighbors preparing to evacuate) and specific disaster related support (e.g., received phone calls, talked to individuals about evacuation routes). Hypothetical social influence measured an openness to being influenced by others to make an evacuation decision.

Younger individuals received more actual social influence (e.g., spoke with more people, saw more individuals engaging in preparatory behaviors). The more females in the household the more actual social influence. Vaux (1988) has argued that feminine sex-role characteristics (e.g., expressing warmth and compassion; see Bem, 1974) facilitates the providing and receiving of support and therefore enhances the development and maintenance of supportive relations. These types of relations may become more apparent under stressful situations like a hurricane threat. There is some indication that women prepare their families and communities for disasters more than men (Fothergill, 1996).

Openness to social influence was related to having evacuation experience and having past psychological distress. These individuals may have made a positive decision to evacuate if only they had been influenced. Blacks were more open to social influence. In other words, Blacks said that they would be influenced to evacuate if they were called, if they saw their neighbors leave, and if a friend asked them to

leave. There were, however, no ethnic differences regarding actual social influence. This may be representative of cultural differences between White and Black families. Staples (1979) stated that the Black kinship network is more extensive and cohesive than kinship bonds among the Whites and a larger proportion of Black families take relatives into their household. From this, it logically follows that Blacks would be more open to others suggesting that they evacuate; however, they may not have had the resources to provide actual support.

Gender differences appear to be quite consistent in the literature with women being more likely to evacuate (Riad et al., 1997) and have evacuation intentions. As men and women view the world differently, it follows that they will also perceive risks differently (Cutter, 1992). Women are more likely to perceive a disaster event or threat as serious or risky (Cutter, 1992; Howe, 1990; Leik et al., 1982; Flynn et al., 1994, Fothergill, 1996). Gender was also one of the variables mediated by risk perception. Women perceived more risk and felt less safe in their homes than the men. Women are more likely to receive risk communication, due to their social networks, and to respond with protective actions, such as evacuation (Fothergill, 1996).

Altogether resources were not important predictors of evacuation intentions. This is consistent with past research as well (Riad et al., 1997). It appears as though individuals will find a way to leave if they perceive enough risk. Socioeconomic status, as indicated by a financial well-being scale, was not a significant predictor of evacuation intention. Physical stress that could hinder evacuation was not related to intentions either. Efficacy was unrelated to evacuation intentions as well. Social support questions specific to evacuation were not distinguishable in factor analyses from the other social influence items.

Before closing, a few strengths and weaknesses of the study should be noted. The major weaknesses of the study are that it was based on self report and that a wide range of age groups were not represented. It is important to remember that this was the fifth wave of interviews with these individuals. The original sample in 1990 was selected so that a third of the individuals were over 60.

A possible issue also is that evacuation intention was measured, not evacuation per se. In the theory of reasoned action (Fishbein & Ajzen, 1977) and the addition to it of the theory of planned behavior (Ajzen,

1989), the individual's intention to perform the behavior is a central factor. Intentions are assumed to capture the motivational factors that impact on a behavior; they are indications of how hard people are willing to try and of how much effort they are planning to exert in order to perform the behavior. The theory of planned behavior postulates three conceptually independent determinants of intentions. The first is the attitude toward the behavior (positive or negative). The second is a social factor that is the perceived social pressure to perform or not perform the behavior. The third and final antecedent of intention is the degree of perceived control which is influenced by such factors as prior experience and other resources.

Intention, in turn, is viewed as one immediate antecedent of actual behavior (Ajzen & Fishbein, 1980). In this case the driving motivation is risk perception. This study showed that risk perception is a psychological mediator of intentions to evacuate controlling for social norm pressures and resources.

The main strength of this study was the prospective design using a large longitudinal data base. One of the advantages of using a longitudinal sample was that the prior psychological distress measure was truly prior and, therefore some causality can be inferred. Most studies of evacuation use a retrospective design and we do not believe that evacuation intentions under true threat conditions have ever been studied.

One problem with this approach was that asking evacuation questions before the event may cause heightened awareness of the four processes discussed so far. The inclusion of the non-respondent and reactivity control groups addressed this issue. It is important to note for both ethical and measurement issues that our phone call did not increase anxiety.

Another concern is that Bertha did not hit. However, Turner, Nigg, and Paz (1986) have stated that a disaster need not occur for there to be social consequences. Their research showed increased levels of preparedness for and awareness of an earthquake threat in California. Another possible criticism was that studying evacuation intention was not the same as studying evacuation. It may be that the lack of significant resource variables predicting evacuation intentions may be proof of this missing link in that resources may become important for turning the intention into an action. On the other hand, as already mentioned, the theory of planned behavior states that intentions are the best predictors of behavior.

Another possible criticism is that exactly how the individuals were warned about the impending disaster was not assessed. It may be that how individuals were warned was not central to whether these individuals perceived risk. This is especially the case with hurricanes when satellite images are readily available. As has already been mentioned, the sample was aware of the threat. However, warning may be more important with flash floods, tornados and other types of more immediate disasters.

Regarding generalizability there were differences between the cities of Savannah and Charleston. Individuals in Savannah were more concerned about looting and were more open to social influence. The political problems in Savannah may have led to strong city differences. Another reason there was a city difference could be that individuals in Charleston had prior experience with Hugo. This may explain why individuals in Charleston who intended to evacuate had experienced past psychological distress. A final reason for why Savannah perceived more risk than Charleston was that they were closer to the hurricane during data collection.

In summary, this study adds to the scientific body of literature in numerous ways. First the design of the study was such that many issues regarding evacuation in the literature could be assessed under threat conditions. Having comparison groups adds to the validity of the findings. Secondly, showing that risk perception is a psychological mediator could lead to specific intervention ideas. Knowing who takes these events less seriously gives emergency managers a way to target that population for possible help with decision making or preparedness. Third, regarding social influence, in some cases, a single phone call from a friend could encourage evacuation. Fourth, there was a relationship between general preparedness and reactive preparedness. Increasing general preparedness of the community would lead to better preparedness under threat conditions.

In conclusion, risk perception, social influence and preparedness are important indicators of intentions to evacuate. Resources were not important in predicting evacuation intentions. Usually reasons including resources are examined after an event has occurred. Individuals who really should have evacuated

are asked why they did not. Using low resources (e.g., no car, no place to go) as excuses may reduce the cognitive dissonance felt by the individuals in some of these cases.

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Table 1

Beliefs and Experiences Related to Evacuation Decision Making

Beliefs and Experiences	n	%
You have enough time to leave .	93	97.9
Believe your survival is under your control.	84	88.4
Experience with hurricanes.	79	83.2
Believe whether you survive is God's will.	79	83.2
Believe your house is structurally safe.	78	82.1
You have a place to go.	74	77.9
Believe the hurricane is a serious threat.	72	75.8
You have a car.	66	69.5
Your family is together in one place.	61	64.2
Believe the hurricane will be bad.	61	64.2
Believe the hurricane is coming.	53	55.8
Experience with evacuation.	50	52.6
Have to protect your home from the storm.	43	45.3
Have to protect your home from looters.	42	44.2
Your family wants to leave.	30	30.6
You want to leave.	27	28.4
You have to stay to care for your pet.	5	5.3
You are too sick to leave.	3	3.2

Table 2
Standardized Regression Coefficients for Composite Measures.

	Risk Perception	Reactive Preparedness	Actual Social Influence	Openness to Social Influence	Efficacy	Anxiety
Hurricane Experience	-.20	---	---	---	---	---
Evacuation Experience	.29**	.30***	---	.30**	.35***	---
Wave 4 Preparedness	---	.37***	.30**	---	---	---
Financial Well-being	---	---	---	---	.23*	---
Physical Well-being	---	---	---	---	.28**	---
Embeddedness	---	---	.22*	---	.18	---
Past psychological distress	.37***	---	---	.28**	---	.39**
Age	----.30**	---	---	---	---	---
Sex	.20*	---	---	---	---	---
Race	.22*	-.29**	---	.39***	---	---
Education	---	-.20	---	---	---	---
# of Females	---	---	.35**	---	-.33**	---
# of Children	---	---	---	---	.26	---
City	-.27**	---	---	-.31**	---	---
Multiple R	.65	.70	.59	.57	.61	.46
Adjusted R ²	.33	.40	.23	.21	.26	.07

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3

Means for Individuals Who Intended to Evacuate and Those Who Did Not, with Corresponding Values of F, Separated by City

	<u>Savannah</u>		<u>F</u>	<u>Charleston</u>		<u>F</u>
	Intended to Evacuate	Did not Intend to evacuate		Intended to Evacuate	Did not Intend to Evacuate	
Anxiety 2.37	1.75	5.12*	2.30	1.92	2.28	
Attachment to Home	3.98	4.62	6.80**	4.03	4.11	.07
Education	10.57	12.00	2.92 [†]	12.31	14.60	4.75*
Risk Perception	.77	.48	27.08***	.68	.43	17.83***
Openness to Social Influence	.81	.49	12.61***	.83	.43	15.44***
Past psychological distress	1.28	.85	3.12 [†]	1.59	1.06	4.27*
Embeddedness	17.50	20.00	5.19*	18.62	20.42	2.29
Number of Females 1.54	1.06	4.72*	1.31	1.57	1.18	

[†]p < .10 *p < .05. **p < .01. ***p < .001.

Table 4
 Predicting Evacuation Intention: Hierarchical Logistic Regression Results

Predictors of Evacuation	Regression Results	
	B	SE B
Risk perception	4.14*	1.85
Embeddedness	-.21*	.09
Hypothetical social Influence	2.03 ^a	1.16
Prior hurricane experience	-1.39	1.08
Owner	.68	.79
City (Charleston)	-.48	.73
Black	.30	.38
Male sex	.42	.67
Anxiety	.32	.46
Education	-.09	.12
Prior distress	.01	.45

^a $p < .08$ * $p < .05$ ** $p < .01$ *** $p < .001$