

03-4313

IN THE
United States Court of Appeals
FOR THE SECOND CIRCUIT

RIVERKEEPER, INC.,
Petitioner,

v.

**SAMUEL J. COLLINS, DIRECTOR, OFFICE OF NUCLEAR REACTOR
REGULATION, DR. WILLIAM TRAVERS, EXECUTIVE DIRECTOR FOR
OPERATIONS OF THE NUCLEAR REGULATORY COMMISSION, THE UNITED
STATES OF AMERICA, ENTERGY NUCLEAR INDIAN POINT 2, LLC,
ENTERGY NUCLEAR INDIAN POINT 3, LLC, AND ENTERGY NUCLEAR
OPERATIONS, INC.,**
Respondents.

**PETITION FOR REVIEW OF A DECISION OF THE
UNITED STATES NUCLEAR REGULATORY COMMISSION**

**BRIEF OF AMICUS CURIAE RICHARD BLUMENTHAL
ATTORNEY GENERAL OF CONNECTICUT
IN SUPPORT OF THE BRIEF OF PETITIONER, RIVERKEEPER, INC.
WITH APPENDIX**

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STATEMENT OF THE ISSUES

- I. Whether the Nuclear Regulatory Commission properly denied the petition of Riverkeeper, Inc. challenging the Indian Point Energy Center radiological emergency preparedness plan for failing to properly consider the threat of terrorism, inadequate transportation infrastructure, and shadow evacuation.

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INTEREST OF THE AMICUS CURIAE

Amicus curiae, Richard Blumenthal, Attorney General of Connecticut, (“Attorney General”), resides in Greenwich, Connecticut and files this brief in his capacity as the chief legal officer representing the legal interests of the State of Connecticut and its residents.

The underlying appeal involves a challenge by Riverkeeper, Inc. (“Riverkeeper”) to the adequacy of the existing security arrangements at the Indian Point Energy Center (“Indian Point”). Riverkeeper asserts that the Nuclear Regulatory Commission (“NRC”) has failed to ensure that the facility can successfully protect public health and safety from a potential terrorist attack.

The Attorney General supports the Riverkeeper petition regarding the terrorism issue in all respects. The interests of the State of Connecticut are particularly acute in this matter because the emergency planning zone that would be involved in responding to either a terrorist attack, or a conventional nuclear incident, at Indian Point involves both a 10-mile radius emergency planning zone (“EPZ”) and a separate 50-mile radius ingestion pathway EPZ. The 50-mile radius EPZ includes substantial portions of the State of Connecticut, including its largest city, Bridgeport, and its most populous county, Fairfield.

The emergency evacuation plan for Indian Point, which governs a response to either a terror attack or an accident at the facility, involves relocating potentially

in excess of 10 million people, many of whom are Connecticut residents or New York residents who will be evacuated into Connecticut, while simultaneously protecting these people from the deadly effects of escaped radiation. What is absent from the emergency planning at Indian Point, however, is not only adequate preparation for a terrorist attack, but also any discussion of the current severe transportation constraints of Interstates 95 and 84 in Connecticut, even though they are two of the critical proposed escape routes. Both of these major roads are currently inadequate to handle normal daily traffic, let alone emergency evacuation of large numbers of people. "Congestion is endemic throughout the Coastal Corridor [area]. It is acute on the primary highways, Interstate Routes I-95 and 84, and U.S. Route 1 and CT Route 15, and particularly acute on the [Connecticut] westerly portion of Interstate Route 95." *Coastal Corridor Transportation Investment Area Twenty Year Strategic Plan For Transportation Investment Area*, Nov. 7, 2001, p. 6, prepared for the Connecticut Transportation Strategy Board by the Coastal Corridor Transportation Investment Area Board. This report continues: "When they can reach their destinations only by road, people are trapped in the congested conditions found there and can only contribute to that congestion when traveling." *Id.*, p. 7.

As will be discussed in depth below, the emergency plan at Indian Point fails in several critical respects. Of particular concern to Connecticut, the assumptions

in the plan regarding evacuation routes are demonstrably inadequate. Therefore, because the Indian Point REPP affects major portions of the State of Connecticut, Petitioner, individually, and in his capacity as chief legal officer of the state, is affected and aggrieved by the continued operation of Indian Point without the specific security and evacuation measures identified in this appeal.

SUMMARY OF THE ARGUMENT

The NRC is obligated under the Atomic Energy Act, 42 U.S.C. § 2011, *et seq.* (“AEA”), to oversee and regulate the nation’s commercial nuclear power stations to protect human health and safety and the environment. The NRC’s own regulations require it to review the safety and security at nuclear power plants and, further, to insure the adequacy of the radiological emergency preparedness plans (“REPP”) at each nuclear power facility.

The NRC has failed to meet this legal obligation at Indian Point. Indian Point Energy Center is a multi-reactor nuclear power station located in Buchanan, New York, just north of New York City and adjacent to Connecticut. Approximately one-third of the population of Connecticut, and millions of residents of New York, are in the emergency preparedness zone surrounding this

plant. Despite the obvious risks to millions of citizens, the NRC has declined to require correction of numerous failures in the emergency planning at Indian Point.¹

Among other deficiencies are the facts that the plan: 1) fails to recognize and plan for the different and potentially greater impact on evacuation from a terrorist attack versus a nuclear accident; 2) underestimates the number of potential evacuees and; 3) wrongly assumes that the existing road network is capable of handling the expected number of evacuees.

The NRC's failure to reject the REPP as deficient and its failure to require the evaluation of emergency preparedness in the context of potential terrorist attacks violate the agency's own regulations.

ARGUMENT

I. NRC is Obligated to Ensure Adequate Emergency Plans

Pursuant to federal law and regulations, the NRC is obligated to ensure that an adequate radiological emergency preparedness plan ("REPP") is created for each commercial nuclear power station in the nation, primarily in order to provide evacuation routes and other emergency plans in the event of a release of radioactive material from a nuclear generating facility. 42 U.S.C. §§ 2013, 2201, *New England Coalition v. NRC.*, 582 F.2d 87, 90-91 (1978). Specifically, 10 CFR

¹ Many of these failures have been documented in a recently completed independent report commissioned by the Governor of New York and prepared by James L. Witt Associates (the "Witt Report").

§ 50.33 requires, as part of an application to construct a nuclear power station, appropriate response plans regarding the “Emergency Planning Zone,” or EPZ. Further, 10 CFR § 50.47 states that no operation license can be issued without a finding by the NRC that “adequate protective measures can and will be taken in the event of a radiological emergency.” This same section adds “NRC will base its finding on a review of the Federal Emergency Management Agency (FEMA) findings” regarding emergency plans.²

As will be discussed below, there are obvious and material failures in the Indian Point REPP.

II. Compliance History of Indian Point.

As described in a recent publication of the United States General Accounting Office (“GAO”) submitted as testimony before the House Subcommittee on National Security, Emerging Threats and International Relations on March 10, 2003, (“GAO Report”), to this day there are serious concerns regarding “problems

² The NRC has primary jurisdiction over issues of radiological health and safety. *Pacific Gas & Elec. v. State Energy Resources Conservation and Development Commission*, 461 U.S. 190, 103 S.Ct. 1713 (1983). The regulatory basis for radiological emergency preparedness plans is the “planning and preparedness standards and related criteria contained in NUREG-0654/FEMA-REP-1, Rev. 1.” 44 CFR § 3501.13(a) citing 44 CFR § 350.

in emergency preparedness [at Indian Point that] remain after being repeatedly identified as needing attention.” (GAO Report, pp. 14-15.)³

This very sobering report documents how, beginning in 2001, a previous report by the GAO noted that “NRC had identified a number of emergency preparedness weaknesses at Indian Point 2 that had gone largely uncorrected.” (GAO Report, p. 3.) Apparently, the plant’s owners made some moves to adjust matters but, “according to an April, 2001 NRC inspection report, the actions were not fully effective. . . .” (*Id.*)

The GAO’s testimony continued with an exhaustive discussion of the history of emergency response failures at Indian Point and concluded as follows:

In reviewing NRC’s reports on its on-site inspections and evaluations of the plant’s emergency preparedness exercises or drills completed since we issued our 2001 report, we found that the facility’s emergency preparedness program has continued to experience problems or weaknesses. . . . In addition, NRC reported that several actions to correct previously identified weaknesses had not been completed.

(GAO Report, p. 12.)

The independent review by the GAO clearly establishes three things. The first is that Indian Point has a documented history of emergency preparedness

³ This Court may take judicial notice of this public report, prepared by a government agency, which was completed after this appeal was filed but directly addresses the issues before the Court.

failures going back several years. The second is that NRC is aware of these problems. The last is that, in large measure, the problems have not been corrected. Consequently, it is not surprising that the testimony of the GAO concludes that concerns remain, concerns that are particularly important in that the standard by which Indian Point was judged did not include the potential for a terrorist attack.

III. Terrorism and the REPP

The essential premise of the REPP is that any radiological release from the facility would come from an accident in the reactor containment building. This assumption is based on a deliberate policy decision of the NRC that the design basis threat (DBT) for which emergency planning is required does not need to include terrorism.⁴ This assumption, however, must be changed because it is obviously erroneous and fatally compromises the REPP.

After September 11, 2001, no one would claim that terrorism does not pose a threat to commercial nuclear stations. In fact, the Central Intelligence Agency has recently warned that “Usama Bin Ladin’s operatives may try to launch conventional attacks against the nuclear industrial infrastructure of the United States in a bid to cause contamination, disruption, and terror.” (*Terrorist CBRN:*

⁴ The NRC has most recently articulated its position regarding emergency planning and terrorist threats in the Director’s Decision Under 10 CFR 2.206, Dckt Nos. 50-003, 50-247 and 50-286 (Nov. 18, 2002) which states: “The Petitioners are correct that the [design basis threat] did not consider a terrorist attack. . . .”

Materials and Effects, June 3, 2003, [///www.odci.gov/](http://www.odci.gov/), included in the Appendix as Attachment 1.) Because of the population density, international profile, and economic importance of New York City and its surrounding areas, including southwestern Connecticut, Indian Point is a potentially attractive target for a terrorist attack.

This is not an idle concern. In his State of the Union Address, President Bush noted that “we have found diagrams of American nuclear power plants and water facilities, [and] detailed instructions for making chemical weapons.” President George W. Bush, State of the Union Address (January 29, 2002), *New York Times*, Jan. 29, 2003.

Such an attack might target the reactor containment building of a nuclear generating facility, but it might also target potentially more vulnerable targets, such as the spent fuel pools, that have considerably less structural protection. A recent article in the *New York Times* states that “A successful terrorist attack on a spent fuel storage pool at a large nuclear reactor could have consequences ‘significantly worse than Chernobyl,’” citing a recent study by Princeton University. Study Warns Attack on Fuel Could Pose Serious Hazards, *New York Times*, Jan. 29, 2003. An attack on these non-containment building structures may result in a rapid radiation release because of the lack of even minimal radiological safety systems.

In its decision of November 18, 2002 (“Decision”) regarding the Riverkeeper petition, the NRC argued that the design basis threat is “robust and flexible.” Further, NRC pointed out that it has required stepped-up security after 9/11. Decision, p. 1.

In response to the first claim, as a recent published news report states: “Before the 9/11 attacks, plant owners were required to provide personnel capable of repulsing an attack by no more than three armed intruders.” *U.S. News & World Report*, April 28, 2003, p. 47. Perhaps in acknowledgement that such a DBT is hardly robust, NRC did, in fact, order additional strengthening of security at nuclear plants. However, as the same article points out, since these new requirements went into effect, at “a plant in Nebraska, 150 rounds of ammunition passed through an X-ray machine undetected; in Alabama, a guard failed to check vital access doors and then lied about it.” *Id.*

The conclusion is inescapable. The NRC’s design basis threat does not reflect the existing threat of terrorism and, therefore, Indian Point’s emergency plan is fundamentally flawed. Consequently, the NRC erred in declining to order a temporary suspension of the power station’s operating license pending a full review of the REPP.

IV. REPP Transportation Plans Inadequate.

An integral element of any disaster response plan is the requirement for proper evacuation of the affected population. The existing plan is woefully inadequate, is known by the NRC to be inadequate, and based on independent reports, is not presently capable of being corrected.

As an initial matter, the REPP never addresses the fact that the major road systems in southwestern Connecticut are, as previously noted, currently inadequate to handle normal daily traffic. "Congestion is endemic throughout the Coastal Corridor [area]. It is . . . particularly acute on the [Connecticut] westerly portion of Interstate Route 95." *Coastal Corridor Transportation Investment Area Twenty Year Strategic Plan For Transportation Investment Area*, Nov. 7, 2001, p. 6, prepared for the Connecticut Transportation Strategy Board by the Coastal Corridor Transportation Investment Area Board. The report notes: "Poor or outdated engineering contributes to the inefficient movement of vehicles and gives rise to public safety concerns. Many of the Coastal Corridor [area] roadways were built neither to handle the volume of traffic that currently exists nor to accommodate the type of travel common today." *Id.* Nowhere does the REPP address the fact, known to every commuter in Connecticut, that the main arteries that the evacuation plan depends on will be unusable in an emergency.

Further, there are serious concerns about the ability of the emergency plan to implement its existing public notice provisions. As the GAO Report previously cited states:

NRC's Office of the Inspector General also identified emergency preparedness issues, including the state's difficulties getting information about the emergency from [the plant's then owners] and the fact that English is a second language for many who lived within 10 miles of the plant.

GAO Report, p. 8

Further, the Report noted that while NRC informed the company about various problems, "the company did not correct the weaknesses identified. For example, in 1998 and again in 1999, NRC identified problems with activating the pagers used to alert the plant's staff about an emergency, as well as other communication weaknesses. In 1999, NRC concluded that [the company] lacked the ability to detect and correct problems and determine their causes, resulting in weak oversight of the emergency preparedness program." *Id.* Even after this warning, problems in the communication of emergency information continued. Regarding one incident, "NRC found that [the company] did not activate its emergency operations facilities within the required 60 minutes, primarily because of the complex process used to page the emergency response staff." It is self-evident that a communications 'plan' that has demonstrated a track record of delay

and confusion and that has been unable “to detect and correct problems,” is fatally flawed.

NRC Guidance Document NUREG/CR-48311, “State of the Art in Evacuation Time Estimate Studies for Nuclear Power Plants,” sets forth a series of issues that must be addressed in the basic methodology of evacuation time estimates. The document specifically addresses “shadow evacuation,” which it defines as “voluntary evacuation” of those “who decide to evacuate without being advised to evacuate.” NUREG/CR-4831 at 4. These evacuees “can be individuals living within the planning zone but not within the sector(s) where evacuation has been advised, or those living outside, but near, the EPZ who may be responding to an evacuation order directed at people within the EPZ.” Emphasis added. NUREG/CR-4831 at 4.

Shadow evacuation is not a new concept. As was recently noted in a published news report, in Florida in 1999 “at least 1 million more [people] than authorities intended” evacuated in advance of Hurricane Floyd. (Evacuation Plans Pose Problems, *The Hartford Courant*, May 12, 2003, citing a study from the Harvard University’s Kennedy School of Government entitled “Safe But Annoyed” and included in the Appendix as Attachment 2.) “Mammoth traffic jams clogged the freeways. Motorists were stuck on bumper-to-bumper interstates for 10 hours. . . .” *Id.*

The REPP does not address “shadow evacuation.” Accordingly, all calculations of evacuation times, road capacities, and other logistical concerns assume no additional usage or loads by those outside the zone who may decide to evacuate without either instruction or permission from authorities to do so.

This glaring omission in the REPP alone clearly violates the regulatory requirements of 10 CFR § 50.47 and has an immediate impact on the State of Connecticut. Shadow evacuation will swell the movement of evacuees into Connecticut. At the same time, even though people in western Connecticut live more than 10 miles from the plant, there will be many Connecticut citizens who will spontaneously evacuate and add their numbers to the mass of nuclear refugees.

A nuclear incident, unlike a hurricane, does not announce itself days in advance. An attack or accident will probably occur suddenly and the surprise factor, along with the pervasive public fear of radiation, will undoubtedly result in huge numbers of people outside the designated evacuation zones joining the shadow evacuation. The interstate road network in western Connecticut, operating beyond capacity even on normal working days, will fail. As dangerous as this would be in the event of a hurricane, a nuclear release would be worse, because the evacuated populace, caught immobile in the resulting traffic jams, would be completely unprotected from resulting clouds of radiation.

V. Family Separation and Evacuation Times.

Planning Standard J(10)(1) requires that the state and local governments' "plans to implement protective measures for the plume exposure pathway" include "time estimates for evacuation of various sectors and distances based on a dynamic analysis." NUREG 0654/FEMA REP 1, Rev. 1 at 63. The "dynamic analysis" must evaluate known behavioral responses of the population to be evacuated. NUREG 0654/FEMA REP 1, Rev. 1 at 4-1 – 4-16. The requirements for such an analysis require that

Distribution functions for notification of the various categories of the evacuee population shall be developed. The distribution functions for the action stages after notification predict what fraction of the population will complete a particular action within the given span of time. There are separate distributions for auto-owning households, school population, and transit dependent populations. These distribution functions can be constructed in a variety of ways, depending greatly on the kinds of data available for the actual site being studied. The previously developed conditional distributions are combined to develop the time distribution for the various population segments departing their home or other facility from which they are being evacuated.

Emphasis added, NUREG 0654/FEMA REP 1, Rev. 1 at 4-8.

The Indian Point REPP fails to provide this type of analysis. The most glaring example of this deficiency is that the REPP blithely assumes that school children and their families would evacuate separately, and at the same time

presumes that families would leave as one unit and utilize only one family car. In evacuation scenarios that take place during school days, these two situations contradict each other. The REPP time estimates analysis also fails to address the situation where parents may have children in multiple schools, which may have different designated reception centers for each child.

There is a larger behavioral problem, however. The evacuation plan calls for separation of school children from their parents in the event of a radiological release that requires evacuation. This will not happen. It defies explanation that plan preparers believe that parents will calmly leave their children in school or infants with daycare providers and climb into their private cars and drive to a designated disaster relocation area.⁵ What will happen is that people will seek to reunite *prior* to evacuation despite anything that governmental authorities try to do to stop them.

The evacuation scenario upon which the REPP is based is a fallacy. This fallacy must be corrected before any realistic emergency plan can be created.

⁵ The Kennedy School of Government Study, referred to above, includes the following telling quotation: "It was a problem for us with the people that staff the shelters and for people that might maybe do something else. Maybe they're highway workers. They live in manufactured homes and they say "I gotta go." It turns out that you cannot expect families to split up, for one to stay and work while the rest of the family takes off somewhere. KSG Report, p. 12. Emphasis added.

CONCLUSION

The petition filed by Riverkeeper provided the NRC with a golden opportunity to review a clearly deficient design basis threat and establish a careful and comprehensive policy to upgrade the security at the nation's 100+ commercial nuclear power generating stations. The petition further identified numerous failings at a specific facility – Indian Point – and offered direct and concrete ideas that, if accepted, would have provided an immediate and material benefit to the public.

NRC, however, ignored the uncontroverted evidence that its DBT and the existing security arrangements at Indian Point are inadequate. Further, the NRC dismissed the very credible challenge to the over-optimistic evacuation scenario upon which the NRC bases its response plan. The NRC has, therefore, violated both federal law and its own regulations with respect to its oversight role at Indian Point. In the interests of public safety, it is imperative to suspend the plant's license to operate until a full review of all threats, including terrorism, is completed and needed changes to the security and evacuation plans are implemented.

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE

Pursuant to F.R.A.P. 32(a)(7)(C), I hereby certify that the foregoing brief complies with the applicable type-volume limitations of F.R.A.P. 32(a)(7)(B)(i) in that it contains 4,611 words, including headings, footnotes, table of contents, table of authorities, this certificate, the certificate of service, but excluding the corporate disclosure statement. In making this certification, I have relied on the word count function of Microsoft Word, the word-processing system used to prepare this brief.

A handwritten signature in cursive script, reading "Robert D. Snook", written in black ink.

Robert D. Snook
Assistant Attorney General

CERTIFICATE OF SERVICE

Pursuant to Rule 25(d)(2) of the Federal Rules of Appellate Procedure, I hereby certify that on this 23rd day of June, 2003, the original and 9 copies of the foregoing Brief of Amicus Curiae, Richard Blumenthal Attorney General of Connecticut, were filed in accordance with Rule 25(a)(2)(B(ii)) to Roseann B. . MacKechnie, Clerk, Second Circuit Court of Appeals, 40 Foley Square, New York, New York 10007.

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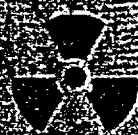
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APPENDIX

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1. Central Intelligence Agency Report, *Terrorist CBRN: Materials and Effects*, June 3, 2003 A-1-A-6
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Terrorist CBRN: Materials and Effects



Background

Spectrum of Terrorist CBRN Threats

Chemical Agents

Biological Agents

Radiological and Nuclear Devices

Online Resources

Acrobat PDF Print Version With Graphics

Acrobat PDF Print Version Without Graphics

Please note: "This pamphlet contains a summary of typical agents and CBRN devices available to al-Qa'ida and other terrorist groups. It is not intended to be a summary of the overall threat from al-Qa'ida's CBRN program."

Background

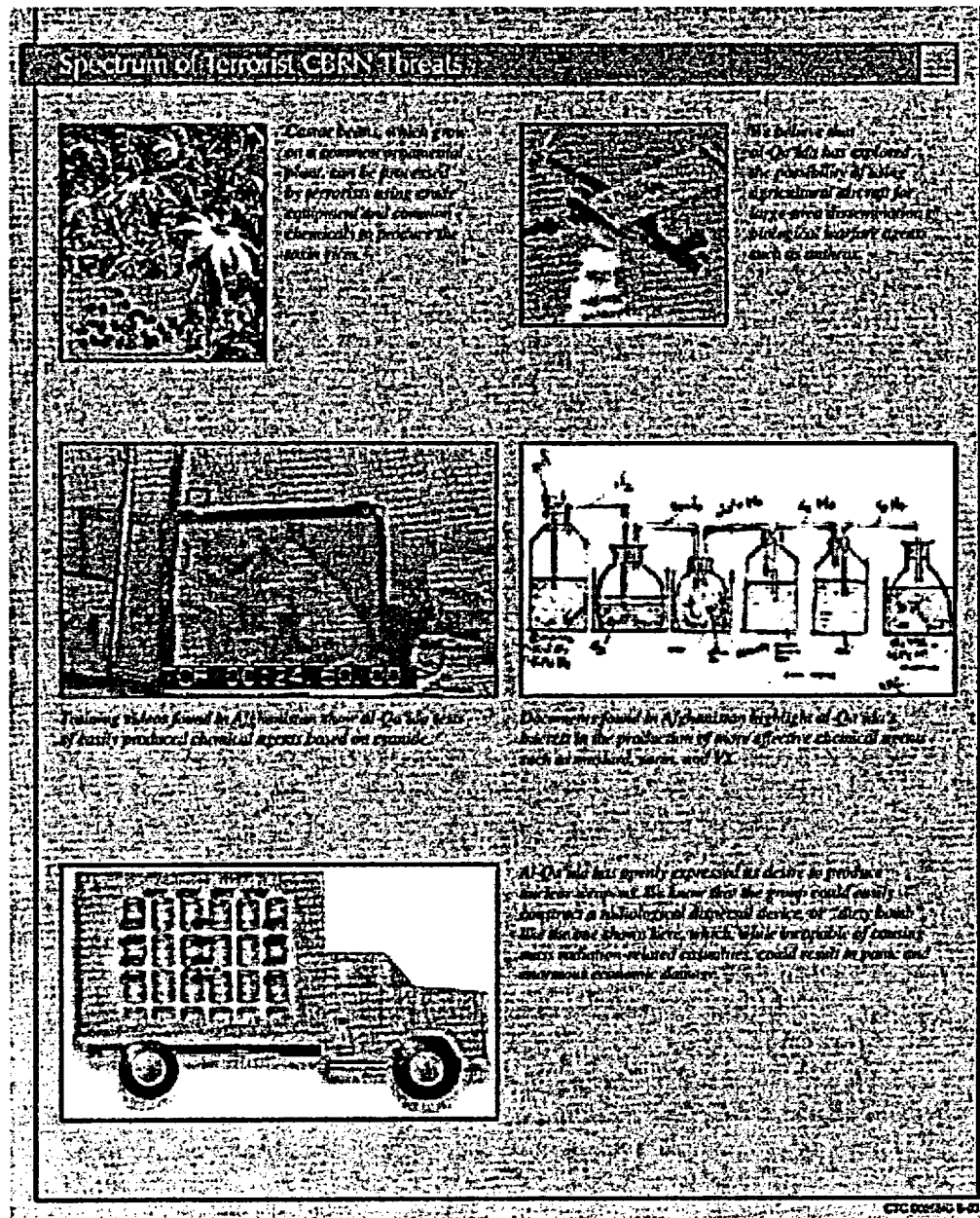
Al-Qa'ida and associated extremist groups have a wide variety of potential agents and delivery means to choose from for chemical, biological, radiological, or nuclear (CBRN) attacks. Al-Qa'ida's end goal is the use of CBRN to cause mass casualties; however, most attacks by the group—and especially by associated extremists—probably will be small scale, incorporating relatively crude delivery means and easily produced or obtained chemicals, toxins, or radiological substances. The success of any al-Qa'ida attack and the number of ensuing casualties would depend on many factors, including the technical expertise of those involved, but most scenarios could cause panic and disruption.

- Several groups of mujahidin associated with al-Qa'ida have attempted to carry out "poison plot" attacks in Europe with easily produced chemicals and toxins best suited to assassination and small-scale scenarios. These agents could cause hundreds of casualties and widespread panic if used in multiple simultaneous attacks.
- Al-Qa'ida is interested in radiological dispersal devices (RDDs) or "dirty bombs." Construction of an RDD is well within its capabilities as radiological materials are relatively easy to acquire from industrial or medical sources. Usama Bin Ladin's operatives may try to launch conventional attacks against the nuclear industrial infrastructure of the United States in a bid to cause contamination, disruption, and terror.
- A document recovered from an al-Qa'ida facility in Afghanistan contained a sketch of a crude nuclear device.
- Spray devices disseminating biological warfare (BW) agents have the highest potential impact. Both 11 September attack leader Mohammad Atta and Zacharias Moussaoui expressed interest in crop dusters, raising our concern that al-Qa'ida has considered using aircraft to disseminate BW agents.
- Analysis of an al-Qa'ida document recovered in Afghanistan in summer 2002 indicates the group has crude procedures for making mustard agent, sarin, and VX.

A-1

This pamphlet contains a summary of typical agents and CBRN devices available to al-Qa'ida and other terrorist groups. It is not intended to be a summary of the overall threat from al-Qa'ida's CBRN program.

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Chemical Agents

Terrorists have considered a wide range of toxic chemicals for attacks. Typical plots focus on poisoning foods or spreading the agent on surfaces to poison via skin contact, but some also include broader dissemination techniques.

Cyanides

Terrorists have considered using a number of toxic cyanide compounds.

Sodium or potassium cyanides are white-to-pale yellow salts that can be easily used to poison food or drinks. Cyanide salts can be disseminated as a contact poison when mixed with chemicals that enhance skin penetration, but may be detected since most people will notice if they touch wet or greasy surfaces contaminated with the mixture.

Hydrogen cyanide (HCN) and cyanogen chloride (ClCN) are colorless-to-pale yellow liquids that will turn into a gas near room temperature. HCN has a characteristic odor of bitter almonds, and ClCN has an acrid choking odor and causes burning pain in the victim's eyes. These signs may provide enough warning to enable evacuation or ventilation of the attack site before the agent reaches a lethal concentration.

- **Both HCN and ClCN need to be released at a high concentration—only practical in an enclosed area—to be effective, therefore, leaving the area or ventilating will significantly reduce the agent's lethality.**

Exposure to cyanide may produce nausea, vomiting, palpitations, confusion, hyperventilation, anxiety, and vertigo that may progress to agitation, stupor, coma, and death. At high doses, cyanides cause immediate collapse. Medical treatments are available, but they need to be used immediately for severely exposed victims.

Mustard Agent

Mustard is a blister agent that poses a contact and vapor hazard. Its color ranges from clear to dark brown depending on purity, and it has a characteristic garliclike odor. Mustard is a viscous liquid at room temperature.

- **Mustard is not commercially available, but its synthesis does not require significant expertise if a step-by-step procedure with diagrams is available.**

Initial skin contact with mustard causes mild skin irritation, which develops into more severe yellow fluid-filled blisters. Inhalation of mustard damages the lungs, causes difficulty breathing, and death by suffocation in severe cases due to water in the lungs. For both skin contact and inhalation, symptoms appear within six to 24 hours. There are only limited medical treatments available for victims of mustard-agent poisoning.

Nerve Agents

Sarin, tabun, and VX are highly toxic military agents that disrupt a victim's nervous system by blocking the transmission of nerve signals.

- **These agents are not commercially available, and their synthesis requires significant chemical expertise.**

Exposure to nerve agents causes pinpoint pupils, salivation, and convulsions that can lead to death. Medical treatments are available, but they need to be used immediately for severely exposed victims.

Toxic Industrial Chemicals

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There are a wide range of toxic industrial chemicals that—while not as toxic as cyanide, mustard, or nerve agents—can be used in much larger quantities to compensate for their lower toxicity.

Chlorine and phosgene are industrial chemicals that are transported in multiton shipments by road and rail. Rupturing the container can easily disseminate these gases. The effects of chlorine and phosgene are similar to those of mustard agent.

Organophosphate pesticides such as parathion are in the same chemical class as nerve agents. Although these pesticides are much less toxic, their effects and medical treatments are the same as for military-grade nerve agents.

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Biological Agents

Anthrax

Bacillus anthracis, the bacterium that causes anthrax, is capable of causing mass casualties. Symptoms usually appear within one to six days after exposure and include fever, malaise, fatigue, and shortness of breath. The disease is usually fatal unless antibiotic treatment is started within hours of inhaling anthrax spores; however, it is not contagious. Few people are vaccinated against anthrax.

- Anthrax can be disseminated in an aerosol or used to contaminate food and water.
- Cutaneous anthrax can be caused by skin contact with *B. anthracis*. This form of the disease, which is easily treated with antibiotics, is rarely fatal.

Botulinum toxin

Botulinum toxin is produced by the bacterium *Clostridium botulinum*, which occurs naturally in the soil. Crude but viable methods to produce small quantities of this lethal toxin have been found in terrorist training manuals.

- Symptoms usually occur 24 to 36 hours after exposure, but onset of illness may take several days if the toxin is present in low doses. They include vomiting, abdominal pain, muscular weakness, and visual disturbance.
- Botulinum toxin would be effective in small-scale poisonings or aerosol attacks in enclosed spaces, such as movie theaters. The toxin molecule is likely too large to penetrate intact skin.

Ricin

Ricin is a plant toxin that is 30 times more potent than the nerve agent VX by weight and is readily obtainable by extraction from common castor beans. There is no treatment for ricin poisoning after it has entered the bloodstream. Victims start to show symptoms within hours to days after exposure, depending on the dosage and route of administration.

- Terrorists have looked at delivering ricin in foods and as a contact poison, although we have no scientific data to indicate that ricin can penetrate intact skin.

- Ricin will remain stable in foods as long as they are not heated, and it will have few indicators because it does not have a strong taste and is off-white in color.

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Radiological and Nuclear Devices

Radiological Dispersal Devices (RDD)

An RDD is a conventional bomb not a yield-producing nuclear device. RDDs are designed to disperse radioactive material to cause destruction, contamination, and injury from the radiation produced by the material. An RDD can be almost any size, defined only by the amount of radioactive material and explosives.

- A passive RDD is a system in which unshielded radioactive material is dispersed or placed manually at the target.
- An explosive RDD—often called a "dirty bomb"—is any system that uses the explosive force of detonation to disperse radioactive material. A simple explosive RDD consisting of a lead-shielded container—commonly called a "pig"—and a kilogram of explosive attached could easily fit into a backpack.
- An atmospheric RDD is any system in which radioactive material is converted into a form that is easily transported by air currents.

Use of an RDD by terrorists could result in health, environmental, and economic effects as well as political and social effects. It will cause fear, injury, and possibly lead to levels of contamination requiring costly and time-consuming cleanup efforts.

A variety of radioactive materials are commonly available and could be used in an RDD, including Cesium-137, Strontium-90, and Cobalt-60. Hospitals, universities, factories, construction companies, and laboratories are possible sources for these radioactive materials.

Improvised Nuclear Device (IND)

An IND is intended to cause a yield-producing nuclear explosion. An IND could consist of diverted nuclear weapon components, a modified nuclear weapon, or indigenous-designed device.

- INDs can be categorized into two types: implosion and gun assembled. Unlike RDDs that can be made with almost any radioactive material, INDs require fissile material—highly enriched uranium or plutonium—to produce nuclear yield.

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Online Resources

More detailed information on the medical aspects of chemical, biological, and nuclear weapons threats can be found at the following Internet sites:

The Medical NBC Information server:
www.nbc-med.org and <http://www.nbc-med.org>

Medical Research and Material Command:
mrmc-www.army.mil

Medical Research Institute of Chemical Defense: chemdef.apgea.army.mil

Medical Research Institute of Infectious Diseases: www.usamriid.army.mil

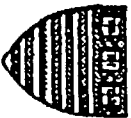
National Institute for Occupational Safety and Health:
www.cdc.gov/niosh/topics/chemical-safety/default.html

US Department of Homeland Security: www.ready.gov

Central Intelligence Agency:
CBR Incident Handbook http://www.cia.gov/cia/reports/cbr_handbook/cbrbook.html

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Kennedy School of Government
Case Program

CI6-02-1652.0

**Safe But Annoyed:
The Hurricane Floyd Evacuation in Florida**

On Monday, September 13, 1999, a hurricane as large as any in the state's history approached the Florida peninsula. As Hurricane Floyd threatened to make landfall, officials at the state's Division of Emergency Management believed they had devised a practical, if extensive, plan for a large-scale evacuation of those areas at risk of severe damage from the storm. Because the hurricane seemed likely to effect different parts of the state at different times and, it was thought, in different ways, the massive evacuation was envisioned to occur in stages. Limited evacuation from the southeastern part of the state would be followed by more extensive evacuation in the central and northern parts of Florida's East Coast. This staged evacuation, along with early warning, would, it was thought, allow enough time to achieve the emergency planners' crucial goal: to ensure efficient "clearance, or the complete movement of all those in harm's way from their homes, off the highways and into sheltered locations, before the storm hit." Protection could take the form of public shelters, hotels, motels, or the homes of friends and relatives outside the "impacted" area.

Four days later, the evacuation and return of 2.5 million Floridians had been completed. It was part of a four-state (Florida, Georgia, North and South Carolina) evacuation that was, in terms of the number of people involved, the largest in US history. There had been no storm-related casualties in Florida. Hurricane Floyd had, as it turned out, virtually bypassed the state completely, its 140-mile per hour winds skirting the peninsula, just off the coastline. (The storm—particularly, storm-related rain—did cause flooding in other states, particularly North Carolina.) Yet far from being hailed as a prudent step that had turned out for the best, the Hurricane Floyd evacuation provoked sharp public outcry. Instead of a smooth "clearance", mammoth traffic jams had left motorists stuck, in many instances, on bumper-to-bumper interstate highways for 10 hours

This case was written by Howard Blumoff, Executive Director, Taubman Center for State and Local Government, for use at the Executive Session on Domestic Preparedness, John F. Kennedy School of Government, Harvard University. Funding was provided by the United States Department of Transportation. (0302)

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or more, in order to complete drives to safety they expected would last two to three hours. As ABC News would put it, many evacuees were "safe but annoyed." Many expressed or implied doubt that the evacuation was really necessary, or that it was handled well. "After five hurricanes in three years," complained one representative radio talk show caller, "you think they'd have a clue about getting people out of danger." Such pique stemmed from the fact that in general, clearance times had proven to be far higher than officials anticipated. For their part, however, officials were less concerned about public annoyance than the possibility that traffic jams could have proven deadly; they were cognizant of the fact that, had the storm tracked inland, thousands of Florida residents might have been exposed to its impact with nothing more than the flimsy protection of their cars, as they crawled along the interstates.

Even before the evacuation was over, some local elected officials had begun to respond to public outcry by calling for more efficient evacuation procedures—in particular, the "reverse-laning" of interstate highways such that lanes on both sides of the road could be used by evacuating traffic. At the same time, emergency management officials were well aware of the fact that, although they had issued orders expected to lead 1.5 million people to evacuate their home, at least a million more had done so. Officials were left to figure out what had caused an evacuation far more extensive than the one they had anticipated and how they should respond to calls for change.

Emergency Management in Florida

In part because of the regular threat of hurricanes and their impact on a state surrounded on three sides by water, the emergency management system in Florida was well developed. In some ways, it was a decentralized system. Each of the state's 67 counties had its own director of emergency management. Although Florida law gives the authority to issue evacuation orders only to the state's Governor, an executive order had, in 1988, delegated that authority to the chief elected officials of counties and municipalities (mayors and the chairs of county commissions.) But local officials worked closely with officials in the state capital of Tallahassee. No evacuation could be ordered anywhere in the state absent an Executive Order, issued by the Governor, formally declaring the existence of a state of emergency. Absent such an order, no county could begin its disaster response—whether that response was to order an evacuation, to open public shelters, or to order the closing of schools or businesses. As a practical matter, the key decisions about how to respond to disasters were made by local directors of emergency management. Says one county emergency management director: "It's a rare elected leader that would go against that recommendation."

The big picture planning for disasters, however—undertaken to prepare for disasters, not in response to one that was looming—was the responsibility of the state Division of Emergency Management in the Department of Community Affairs. The Division was set up to prepare and to

coordinate response to a wide range of potential disasters. Its work was divided amongst three major divisions. Each could be seen as corresponding to a different stage of a potential disaster.

The Office of Policy and Planning had the big-picture "before" responsibilities--envisioning, long before any specific threat loomed, what sorts of potential natural or manmade disasters Florida faced and then developing general plans for coping with those threats. If planners determined, for instance, that the best potential response to severe weather was a marked increase in the number of public shelters in the state, the office would include proposals for the funding of such shelters in a plan it would develop and submit to the Governor's office. If such funds were ultimately included in the state budget, counties would apply for grants for the actual construction or improvement. Notably, the Bureau extensively distributed information designed to help households decide whether or not to evacuate in the event of a major storm and what sorts of provisions to stock in order to remain safely at home, rather than evacuating. "Which path should you take?" the literature asked. "Do you live in a vulnerable area? Have you been asked to evacuate? Every Floridian should develop a family preparedness plan well in advance of a storm threat," the Bureau urged. Such a plan would not only provide for a supply of drinking water and non-perishable foods but encourage efforts to storm-proof existing homes and to purchase new homes built to withstand high winds.

The Bureau of Recovery and Mitigation was the "after" portion of the state response, the vehicle through which post-disaster relief funds were to be channeled to counties and individuals, as well as the bureau responsible for developing new approaches designed to reduce the potential impact of future disasters. Inevitably, some of this bureau's activities in response to the last storm began to take the form of a "before" response to the next storm. For instance, Recovery and Mitigation offered technical training for county building officials as to how to evaluate and improve structures that might be pressed into service as public emergency shelters, such that they could withstand high winds or water.

But it was the Bureau of Preparedness and Response which stood most clearly on the front lines of the state's reaction to an imminent disaster, through the coordination of response to actual emergencies, as they arose, through what was known as the Regional Evacuation Procedure. From its base operations in the state's ECC--its Emergency Command Center--in the state capital, the Bureau alerted county emergency management directors that a formal state of emergency was imminent and initiated a series of statewide (and even inter-state) conference calls in which dozens of county officials would discuss the nature of the appropriate response. What's more, Preparedness and Response would direct state agencies--ranging from law enforcement to transportation--to take actions to support the plans implemented by county officials. It was here that lay the heart of response to an actual emergency, particularly the approach to evacuation.

In the case of hurricanes, the Bureau had studied a wide range of scenarios, in order to provide advice to local officials. Specifically, the Bureau had estimated how many households

would be affected by storms of various magnitudes—ranging from the weakest so-called Category 1 storm, to the strongest, so-called Category 5 storm (as measured on the Saffir-Simpson hurricane rating scale). The estimates considered potential damage from severe flooding and water damage, known as storm surge and largely confined to immediate coastal areas, as well as wind damage, which could reach far inland. The potential impact of various types of storms had led the Bureau to estimate how many people would have to be ordered to evacuate, depending on the strength of the storm. Those estimates were tempered by the knowledge that, historically, some number of Floridians had chosen not to evacuate, despite orders that they do so. To take such behavior into account in its models, the Bureau had gone so far as to prepare statistical samples, based on surveys, to determine what percentage of those asked to evacuate would actually do so. The combination of estimating the impact of a storm, and estimating compliance levels with evacuation orders, had led state officials to their estimates of "clearance" times—the time it would take for evacuation traffic to clear and residents to reach safety—and thus how much in advance of a storm's potential impact an evacuation would have to start.

More broadly, the Bureau divided the response to major disasters such as hurricanes into four parts: decision-making (whether or not to declare an emergency, whether to order an evacuation and a determination of the extent of the evacuation); traffic management; sheltering; and emergency public information. Notwithstanding the resources available at the state level, it would, in the face of an actual emergency, always fall to county emergency management officials—each of whom had his own staff and emergency command center—to make the difficult call as to when, and to what extent, an evacuation should be called for and, significantly, to make sure the right information got to the public as a hurricane approached.

Floyd Approaches

Hurricanes have, historically, posed a threat to Florida. Between 1884 and 1999, the state was struck by an estimated 150 hurricanes of all types, as well as 260 tropical storms. Hurricanes which strike Florida, moreover, bring with them not only winds as high as 150 miles per hour but extremely high storm surge of ocean water—surges of a magnitude, by some estimates, exceeded only by the impact of cyclones from the Indian Ocean on Bangladesh. Such surges threatened to inundate low-lying areas, which had, in recent years, been heavily built up with resorts, marinas, and new homes. Construction had extended even to highly exposed coastal barrier islands. The fact that so many Florida residents (7 million of 11.5 million) lived so close to either the state's east or west coast, combined with the fact that the Florida peninsula was narrow meant there were a limited number of sheltered inland locations in the state. Thus, the National Hurricane Center (in Miami) had concluded that Florida was the state in the US most vulnerable to hurricanes.

Such longstanding vulnerability notwithstanding, the perception of hurricane threat in Florida in the 1990s was profoundly reinforced by one storm. Hurricane Andrew, which struck

south Florida in 1992, was, by any measure, a disaster of major proportions—leaving in its wake 26 dead, 160,000 homeless, and some \$25 billion in property damage. Although Andrew spared the central and northern parts of the state, its virtually unprecedented devastation¹ affected attitudes toward hurricanes statewide. Andrew had, in fact, precipitated aspects of the high-level storm preparation which was in place with the approach of Floyd.

Soon after it was being tracked as a tropical storm, at the start of the second week of September, 1999, Floyd was being specifically compared with Andrew—and judged to be larger and potentially more dangerous. As early as September 9, five days before Floyd was ultimately predicted to reach Florida, the Miami Herald characterized the storm as “large and likely to grow more potent.” By the 11th, the Herald was reporting predictions that Floyd would “turn sharply toward Florida.” By the 12th, already classified as a Category 3 hurricane, Floyd was said to be marching “relentlessly toward the Florida coast.” And on Monday morning, September 13, readers of the Herald throughout southeast Florida awoke to read that “forecasters were poised to post hurricane watches in Florida before dawn today as Hurricane Floyd developed the same catastrophic power as Hurricane Andrew—but grew much larger and prowled ever closer to the state. Floyd expanded to monstrous proportions Sunday night—a Category 4 storm—virtually as big in area as the entire state of Florida, with winds of 145 miles per hour. With nothing to inhibit it, Floyd could become that rare, top-of-the-scale Category 5 hurricane tonight, wind winds exceeding 155 mph.” A decision was “near”, the Herald reported, “on possible evacuations.” There was little doubt, however, that evacuations were in the offing when Governor Jeb Bush, as he issued an executive order declaring a state of emergency on Monday, September 13, observed publicly, “It’s scary. It’s very scary. Andrew hit Miami in the middle of the night and it was haunting. This is as strong and three times bigger.”

State Planning

The decision-making process on the specific form of evacuation to recommend was centered in Tallahassee, at the Division of Emergency Management’s Response and Preparation bureau. There, recalls the Division’s deputy director Robert Collins, state officials were applying all the techniques at their disposal to their effort to align recommendations about evacuation with their best estimate of the size, track and intensity of the storm.

“With Floyd, it was all happening,” laughs Collins. Fundamental to the state’s effort was its use of the Hurricane Evacuation, or HRVAC, computer imaging program, which drew on the information provided by the National Hurricane Information Center in Miami. Says Collins: “The program takes the four separate components of the advisory package from the National Hurricane

¹ Andrew was a Category 4 hurricane. In Florida history, its impact was second only to a Category 5 storm that struck the Florida Keys on Labor Day, 1935, killing 423 people. The only other Category 5 storm to hit the United States since hurricane records had been kept was Hurricane Camille, which struck the Mississippi Gulf Coast in 1969, killing 256.

Center and puts them into a graphical output that allows you, for instance, to look at the 72-hour forecast track, to look at the actual location of where the storm is for a specific advisory, and every previous advisory. So you can look at the entire course of the storm up to the advisory that you're using the program for." Based on forecasted storm tracks, the Bureau could turn to its statistical models and decide whether and when to suggest to county officials that evacuations should begin—and who should be told to evacuate. "With a 72-hour forecast period," observes Collins, "we can do things like factor in clearance times, how long we'll need to get people on and off the roads and when they'd have to leave their houses." And, he adds, state officials can estimate when they have to order other state officials to do their part of make evacuation possible. For instance, construction projects and toll collection on major highways must be halted and law enforcement personnel (e.g., the Florida Highway Patrol) be deployed to help direct traffic and deal with accidents and breakdowns, with their potential for significant delay.

On the morning of Monday, September 13, 1999, the decision-making process at the state Division of Emergency Management was moving rapidly toward a conclusion to recommend evacuations. In their conference calls, state officials included officials from 57 of Florida's 67 counties, including many more than those at risk from Floyd's direct impact. They felt it crucial to advise not just officials who might have to order evacuations but also emergency officials from potential "host" counties—areas in the central and western part of the state, and adjoining southeastern states, to which evacuees would head, looking for room at motels and public shelters. Such conference calls—such as the one held to discuss Floyd, at 9:00 a.m., Monday, September 13—were designed to serve as a forum through which a consensus about the specifics of the evacuation plan would be hammered out. Officials did not regard the response to Floyd as a straightforward call. Observes Bob Collins: "There's a conundrum we face every time we discuss evacuation. If we make a decision that's very catholic, we stand a chance of putting more people on the roads than the roads can process and we leave them stranded out on that roadway. But, if we're very conservative, we run the risk of leaving people in area that might be impacted by storm surge.' In the case of Floyd, the stakes in the evacuation planning were raised by the sheer size of the storm. Should officials base their planning on a storm track that portended limited impact, thousands could be at risk should the storm actually follow a different track—and evacuation orders were relatively limited.

Central to the evacuation planning was officials' belief, based on 72-hour forecasting capacity, that the storm would not strike Florida directly. Instead, they expected that it would track northeast, avoiding landfall but coming as close as 25 miles off the state's east coast. Such a track still posed grave peril for coastal areas. Storm surge could affect those on the immediate coast, while high winds threatened structures not able to withstand them—particularly tens of thousands of mobile homes that would be within reach of the storm's 140-plus mile per hour winds. Mobile homes were at risk of being blown off their foundations and into the air. Thus, the fact that the storm might not come ashore did not mean there was no need for evacuations. It did, however, mean those evacuations could be at least somewhat limited. Crucially, the storm was expected to

affect southeast Florida in a significantly different way than it was expected to affect the central and northeast coastal areas. Specifically, even though Floyd was, by Monday the 13th, classified as a Category 4 storm, its track was expected to mean that southeast Florida would experience it as only a Category 1 storm—with a relatively limited need for evacuation. The need for evacuation, says Bob Collins appeared not to be “terribly extensive, given the angle of approach that we were looking at for the particular storm and its proximity. And that’s why we just made the determination that even though this storm was almost a Category 5 event, that for that southeastern tier of counties, we were only going to evacuate to a Category 1 level.”

Thus it appeared that the evacuations which needed to occur first, as Floyd affected the southern part of the state, would be the most limited. Emergency officials did, however, expect that Floyd would have a more powerful effect on central and northeast Florida coastal areas—that winds would be higher there, and the potential for storm surge greater. They believed, however, that, because the first stage of evacuation—were it to begin on Monday, September 13 in south Florida—would not put that many cars on the road; there would still be enough capacity on the highways to accommodate the second wave of evacuees and enough room at motels and shelters for them at the end of their journey. The one wild card, as always when the subject was hurricanes, was the possibility that the storm could follow a different, more inland track. Should it do so, the risks were great. Even standard homes built on foundations and in full compliance with housing codes, might not be able to withstand winds of more than 125 miles per hour.

Such threats notwithstanding, by the end of the 57-county conference call on September 13, a staged evacuation strategy had taken shape: an evacuation to a Category 1 level for coastal counties in the southern quarter of the state, and evacuation to a Category 4 level—including structures within 20 miles of the coast and mobile homes farther inland—for the northern, three-quarters of the Florida east coast, roughly from Indian River to the Georgia border (See map Exhibit 1). It was expected that the evacuation orders would mean that 1.3 million people would leave their homes and head north and/or west.

This mass exodus would begin on Monday in the southeast, in counties including Dade County (metro Miami) and, 50 miles farther north, Palm Beach County.

Southeast Florida: Palm Beach County

Located 60 miles north of Miami, Palm Beach County’s 47 miles of beaches and luxury high-rise beachfront apartment buildings, looked to be at risk from Hurricane Floyd. However, the danger to this sprawling county—the single largest in land area east of the Mississippi River—was thought to be limited to the coastline. This was a locale in which the storm would be an effective Category 1 event. Thus, recalls County Director of Emergency Management William O’Brien, officials believed evacuation should be limited—and that, for the most part, it would mean relatively short drives. “We needed people to get off the beaches and drive west of Interstate 95,”

says O'Brien, referring to the north-south highway which runs through the county, only a few miles inland from the coast. Says O'Brien: "The National Hurricane Center was very confident the storm was going to turn. We ordered a Category 1 evacuation just to get people off the beach. There was no question in their minds it was going to turn."

He had reason to hope, too, that those at risk would know who they were. Like other Florida coastal counties, Palm Beach had sought to educate members of the public as to whether they lived in a storm surge area, which would have to evacuate, even for a Category 1 hurricane. Says O'Brien: "We distribute brochures which have evacuation zones clearly identified. People should be aware of whether they're in an evacuation zone or not." The county had sought to reach every household, distributing the evacuation zone brochures with utility bills, for instance. In addition, O'Brien, through extensive public speaking, had encouraged Palm Beach residents not to think of evacuation as a first option. Instead, he had urged that they take steps to reinforce their homes, as the best means of protection from most storms. At the same time, he had reason to believe that this education attempt had not penetrated all that deeply—at least in part because of the large number of newcomers arriving regularly in Palm Beach County. Says O'Brien: "We have an awful lot of new folks moving in. We're always trying to keep up public education to reach those folks. But it's hard; you find yourself thinking after several talks and the same speech that maybe you've reached reached everybody. But you know you haven't."

If the evacuation went as planned—and if only those at risk in a Category 1 storm evacuated—the event for Palm Beach County should have been a relatively small one. Says O'Brien: "As far as numbers, we were looking at something in the mid to low thousands." With the storm scheduled to begin to affect Palm Beach during the day on Tuesday the 14th, evacuation was officially ordered at 7 p.m. the day before. According to the official county press release, it was to be "ordered effective for residents of barrier islands, mobile homes and those areas subject to severe flooding." Officials believed, however, that even that description of who was in danger was likely an overstatement, in part because of the difficulty in describing the exact locations of those at risk. Says Bob Collins of the state Division of Emergency Management:

"Instead of trying to say, 'OK, everyone eastward or seaward of this very complicated line has to evacuate,' what we say is look, let's just generalize the evacuation zone and say we'll just evacuate everyone seaward of some major route. Because it's a lot easier to say everyone east of US 1 has to evacuate, rather than show them a map with a very complicated line and say, well, if you live in this blue area, you have to evacuate. They go, well, how in the hell do I know if I live east or west of this blue area?"

If officials regarded the Palm Beach County evacuation as a minor one, it was not portrayed to the public that way, largely because of the sheer size of the storm. "The media," says

Bill O'Brien, "made sure that everybody knew that this storm was Andrew's big brother." Indeed, the emphasis in television coverage of the storm--on key stations such as WFTS, a Fox network affiliate in the city of West Palm Beach--centered on three themes: the size of the storm, the question of the direction it would take, and the extent to which people were complying with the evacuation order which was issued late on the morning of Monday the 13th to be effective that evening. The clear underlying concern centered on the question of whether the full fury of Floyd might hit Palm Beach County. There was more discussion of what to do with pets if evacuating to a motel which might not accept them than there was about who should evacuate and who should not. Says the state Division of Emergency Management's Bob Collins: "Especially in those large media markets like, say, down in southeastern Florida, they're all competing, they're all scrapping for that scoop. Some of them have achieved a certain degree of notoriety based on reporting from previous hurricane events. And so unfortunately there is a large sort of tendency for sensationalism in the way that the meteorologists and certainly the news is reporting the hurricane situation. And so here we are, trying to say, well, if you live west of US 1, really you shouldn't evacuate. Meanwhile, you've got some wild-eyed meteorologist out there saying basically this storm is Andrew's bigger brother. You know, who do you think is actually going to hold sway in people's mind?"

One south Florida meteorologist, Steve Lyons of WFTS-TV, disagrees--saying that it was the sheer size of the storm, coupled with the inherent uncertainty of predictions, that led to widespread concern, rather than media hype. "You're always conscious of your responsibility to inform, not alarm," he says "But I'll be honest. When you looked at that satellite photograph of Floyd and compared its size to the size of the entire state of Florida, it scared the pants off you. It wouldn't have taken much for it to take a dodge to the west and we'd have been up to our ankles in all sorts of problems. If Floyd had hit where Andrew hit, we'd still be picking up the pieces. And so you had people evacuating who would never ordinarily evacuate. People weren't listening to the emergency operations folks. They were looking at the image of the storm and making the decision to get out of Dodge."

In fact, it was difficult to tell from the television coverage that officials had only ordered a limited evacuation. On WFTS, there were but passing references to the need for residents to determine if they were in a storm surge area or not. News anchors mentioned that residents who wanted to be sure could consult maps posted at branches of the local Publix supermarket chain. Nor was it made clear that, although Floyd was a Category 4 storm, Palm Beach County was under a Category 1 evacuation order. WFTS did not address the question of who should evacuate but, rather, where it was best to go--noting that there was limited public shelter space and that shelters should be considered a last resort, after seeking safe harbor with friends or family, or at motels. (See Video exhibit.)

There was, in fact, special reason to stress the limits of designated public shelters. A recent American Red Cross report had found that many Florida public buildings designated as hurricane

shelters were not up to the required high-wind standards. But, rather than acting as a deterrent for those considering whether to evacuate or not, the limits of shelter space appeared to reinforce plans by evacuating residents to leave the county altogether -- heading north and west.

So it was that the evacuation from Palm Beach County turned out not to be a minor event at all. "I'm sure," says WPBF meteorologist Steve Lyons, "there were many who evacuated who shouldn't have." In fact, a federal study² of the Floyd evacuation later found that significant percentages of households who were not supposed to be affected by the evacuation order -- including, for instance, 23 percent of households in non-surge zones near the coast and 22 percent in non-coastal areas -- nonetheless evacuated. In the emergency management business, this non-mandated level of departure is known as a "shadow evacuation."

Evacuation-related congestion was made worse by the routes followed by drivers. Most chose to take main routes, such as Interstate 95 and the Florida Turnpike (another north-south limited access highway, see map) rather than parallel secondary roads where congestion was less. Although the state effectively implemented its plan to halt construction work and stop toll collection, huge traffic jams nonetheless ensued. Clearance time for Palm Beach County evacuation traffic had been estimated at 22.5 hours; instead, actual clearance took 30 hours. Significant percentages of drivers took five to ten hours to reach their destinations. Says Bob Collins: "When we issued the evacuation order for southeastern Florida, we were expecting that most of those folks would pretty much stay in their own counties, that for the most part they wouldn't get in the car and drive all the way over to the other end of the state or way up north. But they did."

By late Monday and early Tuesday, evacuees from areas further north were hitting the road and beginning their own search for shelter. Those evacuating areas such as Brevard County, in the central portion of Florida's East Coast, would encounter the mounting wave of evacuees coming from the southeast.

Central Florida: Brevard County

Hurricane Floyd looked, on September 13th, to be a more important event for the central Florida coastline than for the areas farther south. Not only was Floyd expected to bring Category 4 winds to Brevard County, centered around the city of Melbourne, but much of the county's population clearly lived in high-risk areas. Of a population of just under 400,000, centered around Melbourne, no less than 185,000 lived on its barrier islands, connected to the mainland by a series of seven causeways. That population was at risk both because of storm surge on the islands and the possibility that the bridges could be inundated and access to mainland escape routes cut off. In

² *Hurricane Floyd Assessment: Review of Hurricane Evacuation Studies Utilization and Information Dissemination*, US Army Corps of Engineers, National Oceanic and Atmospheric Administration and Federal Emergency Management Agency, May, 2000.

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addition, large colonies of mobile home parks, although lying inland along the Indian River, were under a mandatory evacuation order in the event of a storm of Floyd's magnitude.

The risk to Brevard was such that by Sunday, September 12, county emergency management director Robert Lay was already leaning strongly toward an early evacuation order. He knew that the evacuation of identified special needs residents—including the handicapped and elderly—could take up to 30 hours and involved several thousand vulnerable residents and their "caregivers." (Special needs evacuation planning had been instituted statewide, in the aftermath of Hurricane Andrew.) And he knew that early warning might reinforce the seriousness of the storm in an area which had been spared the impact of Hurricane Andrew and had, in recent years, never been affected by any storm more powerful than a Category 1 hurricane which had passed some 60 miles south. With the Category 4 Floyd bearing down on the county, officials decided to issue a mandatory evacuation order for our barrier islands and manufactured home parks, effective at 4:00 p.m. Monday afternoon, September 13. In order to get information out as early as possible, director Lay briefed the press that day, just after 11 in the morning—warning of the 4:00 p.m. evacuation order.

Lay was acting on the belief that an early announcement would give people who wanted to get a head start the chance to do so. And that would help spread out the traffic." Thus, Lay was, in effect, ordering an evacuation at roughly the same time as that of Palm Beach County, although the closer proximity of the storm to the more southerly areas meant that many households there had begun their evacuation earlier, during the morning of the 13th. (Lay ordered Brevard's evacuation a day earlier than other central coast counties to the north.)

His announcement—coming in the context of the intense media coverage of the storm—had the desired effect. Brevard County responded to Floyd with the utmost seriousness. For the first time in its history, virtually all of the 12,500 employees of the Kennedy Space Center at Cape Canaveral were evacuated. (A skeleton crew of 109 remained behind.) Traffic began to fill the roads well before the four o'clock deadline for mandatory evacuation. Some evacuees took more than one car; others took larger vehicles, stocked with possessions. An account in a Tampa newspaper told the story of Steve Carver of Brevard's Satellite Beach who "packed a 22-foot rental truck with half his household goods. 'I couldn't get it all, but better something than nothing.'" Others, such as Shannon Bellinger of Melbourne, "had little more than a carton of cigarettes and a six-pack of Coke in his car. But Bellinger was concerned only with getting out of town. 'You'd have to be crazy to stay.'"

Lay believes the resulting levels of evacuation were, in contrast to those of Palm Beach County, appropriate: about 140,000 of the county's 400,000 residents left their homes. No one could be sure, says Lay, that even standard homes could withstand winds of 140 mph. He adds:

"If I lived in a home that was built in 1965 and the building code said that home was built to withstand 90

mile an hour winds and I'm watching TV and you tell me that storm is going to hit here with 125 mile an hour winds, am I staying in that house? No, I ain't staying in that house. That's what people said. And even though we tried to educate people, and I think we did a fairly good job of in terms of protecting their windows, protecting their doors, their garage doors, so that they can maintain the complete sealed envelope of that home, in many cases I think people had not actually done those kind of things."

An important complication in Brevard County, however, involved its system of public sheltering. Despite the size of the evacuation, a smaller-than-anticipated number of Brevard residents chose to use area shelters. Some 84 percent of those who evacuated, in fact, left the county entirely, while only 7,000 of an expected 8500 residents used county shelters. This may have been the result of warnings by county officials that shelters should be viewed as a last resort—and offered few amenities. Officials were concerned that, if the general population sought protection in the shelter, those with no other options might have no place to go. Thus, those who had other options—including relatives or access to motel rooms—were encouraged to choose them. Low use of shelters was, however, also a result of the fact that the county could not open all its shelter locations. County employees and volunteers expected to provide staffing chose, in many cases, to evacuate themselves, says Bob Lay:

"It was a problem for us with the people that staff the shelters and for people that might maybe do something else. Maybe they're highway workers. They lived in manufactured homes and they say 'I gotta go.' It turns out that you cannot expect families to split up, for one to stay and work while the rest of the family takes off somewhere."

The effect of there being large numbers of evacuees, along with their overwhelming preference to leave the county, heading north and west, set the stage for complications. The first was that of long traffic delays. While 70 percent of those evacuating expected they'd be able to reach their destinations in less than two hours, fewer than half were able to do so; residents of some "surge zones" took as long as 15 to 20 hours to reach their destinations. Although the actual numbers of cars on the road for that long was relatively small, such delays meant that hundreds were on the roads at a time when the brunt of the storm could possibly have hit. The traffic jams were caused both by the sheer number of evacuees from Brevard and other central Florida counties and by what was, in effect, their collision with the first wave of evacuees, coming up from the south along the main north-south interstate and limited-access highways, Interstate 95 and the Florida Turnpike. Bob Lay recalls wishing, once it became clear how large the south Florida

evacuation was and the impact it would have on areas farther north, that he could communicate with drivers to tell them to take alternate, secondary routes. But he could not do so. Says Lay: "We could talk to people over TV and we could talk to them over the radio but the minute they got in their car then we'd effectively lost them. Unless they were tuned to the right station at the right time, then they're not going to get the right information." Lay was aware of the potential of so-called variable messaging technology—electronic signs whose messages could be quickly updated to divert drivers to alternate routes, but the county lacked sufficient numbers of such signs for them to play a major role.

Had Floyd moved inland, the results of such traffic snafus could have been devastating. The number of drivers in such peril was relatively limited, says Bob Lay, only because the county ordered its evacuation relatively early. "I'll be honest with you, had we waited until Tuesday morning to order that evacuation, we would have waited until too late. We would have put people on the road and they would not have been able to get out where they needed to go and would have been on the road at a time of potentially high winds." (Actual overall clearance time for the county was 24 hours—some four hours more the county projected.) Residents who delayed faced the longest time on the road. Noted one newspaper account: "George and Marianne Hamilton packed up their son Joey, 9, and dog, Riley, grabbed important papers and left Melbourne Beach at 9:30 a.m. Tuesday. Their trip to Tampa, which normally takes 3 ½ hours, took almost 7."

All this had occurred even before the last, most northern stage of the planned evacuation had even gotten started. Bob Collins of Florida's Division of Emergency Management recalls that by the time evacuation from Florida's most northern major coastal city, Jacksonville, was set to start, virtually all the hotel rooms in the central and western parts of the state to which evacuees were likely to head, were already filled.

North Florida: Jacksonville

Like their counterparts in southeast Florida, emergency management officials in and around Jacksonville—the major city on the northeast Florida coast—would have liked to limit the Hurricane Floyd evacuation, focusing on those homes in coastal storm surge areas. Moreover, as it became clear, late Tuesday night, that Floyd might not be the punishing storm some feared—that, in fact, the track forecasted for it by the National Hurricane Center was correct (Category 4, likely to move parallel with the coast)—the case for a limited evacuation became stronger. If Floyd was to hit Jacksonville at all, it would be the immediate coast that would be most affected. However, as in southeastern Florida, limiting the evacuation proved to be easier said than done. Public concern about the storm track of the monster storm continued to run high. President Bill Clinton had, by Wednesday morning, September 15, gone so far as to issue a pre-emptive disaster declaration for the state of Florida. The Florida Times-Union, published in Jacksonville, described Floyd as "the strongest storm to threaten Jacksonville in the 20th century." The city's mayor, John Delaney, was

quoted as saying, "This could very well be a storm that could flatten hundreds of homes out at the beach."

Chip Patterson, director of emergency management for Duval County, the major northeastern Florida County (population, 778,000), found he faced a special problem. The fact that the St. Johns River met the Atlantic at Jacksonville complicated the contours of the storm surge zone. The hurricane, observed the Florida Times-Union, "could push ocean water into the St. Johns, causing the river to back up and flood." The county, says Patterson, had tried to conduct extensive "preparedness-type education" --including newspaper inserts designed to help residents learn whether they lived in an area at risk of storm surge. But, he says, "most people tune these things out, until the local media starts pumping the latest storm." Adds Patterson, "I'm constantly amazed at how little people know about where they live, even to the point of not knowing whether they're within 100 yards of a marsh or a river." Such information is important in determining the risk of storm surge.

The time when a storm is imminent, says Patterson, is no easier for communicating detailed information. "By the time the storm is coming, we've missed our window of opportunity," he says. "Now we're communicating in 15-second sound bites. And you can't communicate detailed information about storm surge zones under those circumstances. I think it's reasonable to say that we did not have ways to dampen the shadow evacuation." In other words, almost inevitably, an announcement instructing those at risk of storm surge to evacuate, would lead to a larger evacuation than necessary--although Patterson, like other county emergency management directors, also saw Floyd's high winds as a factor which could lead those not at risk from water to decide to leave, as well. Nor did he feel secure in telling them not to do so. "The capacity to issue a dampening message, to discourage evacuation, has everything to do with how you've been doing with mitigation and preparation. If I had felt confident that homeowners had been taking wind seriously and really had gone in and retrofitted their homes to withstand it, then I would have felt we had some immunity from the storm as a county. But we hadn't pushed retrofitting as energetically as we should have. So, although I did feel confident telling individuals that I knew--and whose homes I was familiar with--that they didn't have to leave, as far as making a public announcement, that was different. At the same time, we knew people could be at risk out on the highway."

That risk stemmed, in part from the fact that, like their counterparts elsewhere, northeast Florida residents chose to drive not only away from the coast but also out of the county and out of the state. The Associated Press reported that the "Vitkauskas family took 13 hours to drive from Edgewater in northeast Florida to south Georgia, a trip that usually takes four hours. The family of six traveled in a caravan of five cars with two cats, four dogs, family friends and two boats." Jacksonville evacuee Vicki Drake told the Tampa Tribune her experience traveling in a four-car caravan that included a pet bird restrained by a seat belt was "insane." Drake laughed when asked where she was heading. "We're not sure. Just west somewhere." Bob Collins of the state Division

of Emergency Management was struck by the number of families from inland areas—with no evident reason to evacuate—who nonetheless did so.

Notwithstanding such shadow evacuation, the northeast Florida clearance time was actually 7.5 hours less than that which officials had projected. For state and county officials, this was something of a triumph, reflecting not only early departures by some households but adept deployment of a wide range of services provided by state agencies. Tow trucks were deployed to prevent lanes being blocked by breakdowns. Tanker trucks filled with gasoline were deployed to prevent cars from running out of fuel, despite the long waits in slow traffic. Extra portable restrooms were put out at rest stops. But, from the point of view of evacuating households, it still took far longer than normal to reach such destinations as Tallahassee—where evacuees found no motel rooms were available.

More, says Chip Patterson, might have been able to take advantage of available space in public shelters. But the heavy traffic had had another side effect, he says: the county was not able to open all its shelters. In the Jacksonville area, unlike central Florida, this was not the result of emergency personnel choosing to evacuate rather than showing up for work. Rather, it was, says Patterson, the result of a plan to open shelters on a "as needed basis"—as one filled up, another would be opened. "This usually makes wonderful sense," he observes. "But it did not serve us well during the Hurricane Floyd evacuation." The problem was this: once it became clear that more shelters, particularly in the western part of the county, were needed, traffic had reached the point of such gridlock that emergency personnel simply could not reach the shelters in order to operate them. (Patterson later changed the policy to open all primary shelters—which are dispersed geographically throughout the county—at the same time.)

Perhaps because it became clear soon after the Jacksonville area evacuated that Floyd would not make landfall in Florida after all, public annoyance surfaced most notably here. Mary Ann Vitkauskas—of the family which traveled in a car caravan to rural Georgia, where they ended up spending the night parked on farmland—told the Florida Times-Union that any future evacuation "is going to have to be real mandatory for us to do what we did again." Observes Chip Patterson, tartly, "There are a lot of people for whom any inconvenience is deemed to be intolerable." Local elected officials defended the evacuation: "I don't think anyone that lives at the beach questions the decision," said Jacksonville Mayor John Delaney. "There was no way you could have taken the chance of that thing not turning and (then) tried to move those people." A similar tone of implicit defensiveness about the evacuation was struck by many local officials. A Wednesday, September 15 article in the Miami Herald was headlined, "Dade officials say they don't regret evacuation." The Herald went on to say, "Uprooted 24 hours earlier under orders of evacuation, thousands of coastal Miami-Dade residents went home Tuesday evening after weathering the storm that did not come ... Top county officials said if they had to do it again, they would order similar evacuations."

Aftermath

Hurricane Floyd caused only the most minor property damage and no fatalities as it skirted the state of Florida. Nonetheless, as hundreds of thousands of households slowly filtered back to their homes, there was a widespread sense in the state that the evacuation, if not a fiasco, could have been handled far more efficiently. Editorial writers throughout the US took notice of the fact that the Floyd evacuation routes had been, as the Columbus (Ohio) Dispatch had put it, "reduced to parking lots." Opined the Dispatch: "Fortunately the scene was not one of desperation. But many are asking, what if the threat had prompted the hysteria of an imminent Cold War attack? Would the highway system have been worst than just jammed? Might it not have become a death trap?"

By September 18, less than a week after the frenzy of public concern which surrounded the approach of Floyd, Florida Governor Jeb Bush ordered a special study of evacuation policies. As the Miami Herald wrote, "Governor Jeb Bush wants to know what worked and what didn't when more than a million Floridians had to flee their homes in advance of Hurricane Floyd earlier this week." A central part of the study was to be examination of what appeared to be a simple, commonsense step to cut down on evacuation-related traffic jams. So-called "reverse laning" would turn selected interstate highways into one-way roads, headed in the direction of the evacuation wave. It was a step which, on the surface, promised to be an easy way to increase highway capacity in an emergency, ostensibly doubling road capacity, temporarily, in a state in which road construction had not kept up with the growth in auto or total population. The idea was buttressed, in Floyd's wake, by the decision of South Carolina Governor Jim Hodges to reverse lane Interstate 26 for evacuees returning to Charleston, whose Mayor Joseph Riley had been an outspoken advocate of such a policy. (The St. Petersburg Times wrote that Hodges had made his decision only after "thousands of his constituents spent hours stuck in traffic, using their cell phones to blister him on radio talk shows.") The return appeared to go more smoothly than the evacuation, Mayor Riley observed. In addition, federal officials expressed the view that reverse-laning could be selectively employed to good effect. Said Federal Emergency Management Agency spokesman Marc Wolfson, "We'll look at the hurricane routes (to determine) where it's feasible to make major interstate move all in one direction."

Even as there was public clamor for such a policy, Florida emergency management officials themselves were not jumping unreservedly on the bandwagon. Major Kevin Guidry, in charge of evacuation issues for the Florida Highway Patrol, told the St. Petersburg Times, in effect, that in an evacuation traffic jams were inevitable. "There's just not enough road to handle that flow. From our standpoint, if the traffic keeps moving, that's about the best that people could expect." Guidry noted that, in order to ensure that traffic did not enter a reverse-laned highway and head in the prohibited direction, the state would need "enormous staffing and a lot of equipment. You have to have people at all the entrance ramps and you have to have backups to

relieve those people." Barriers alone would not prevent drivers from using closed entrance ramps, said Guidry. "I've seen people drive around wooden and concrete barriers. Cones certainly won't stop them." He noted, too, that, at some point the one-way designation must end. "What happens then? You are sending a whole lot of people from populated areas where there is law enforcement to unpopulated areas where there is almost no law enforcement." State emergency officials stressed, too, the need for evacuees to consider using secondary routes, instead of main highways, and to be made aware, perhaps through electronic messaging signs or through faxes sent to gas stations and restaurants, of places they could go—whether shelters or motels—so that traffic would gradually decrease as cars peeled off to destinations along the way.

But officials, in the weeks after the Hurricane Floyd evacuation and thereafter, most liked to emphasize their hope that somehow the magnitude of future evacuations could be decreased. Said Steve Seibert, Secretary of the Florida Department of Community Affairs, "If you live in an area not subject to storm surge, keep your family safe at home."

Hurricane Floyd had left in its wake little damage but, nonetheless, a new challenge for emergency management officials: devising ways to convince residents not to evacuate unnecessarily. "We've done a good job at telling people the sky is falling," says Bob Collins of the state's Division of Emergency Management. "We have to do a little better on the subtleties."

Epilogue

In February 2000, the Governor's Hurricane Evacuation Task Force Report—meant to recommend changes in Florida's emergency management system as a result of the Hurricane Floyd evacuation—was issued. It included 22 recommendations (see exhibit). It focused much of its attention on the possibility of "reverse-laning" major highways in order to increase their evacuation capacity. The Task Force concluded, however, that the safety and logistical problems posed by reverse-laning dictated that it "must only be used as a last resort when conditions are dire. The use of paved highway shoulders as a third lane of traffic was deemed to be more widely practical. And, although seven specific highways were identified for potential reverse-laning but, continued the report: "there are many less drastic steps which can be taken." Most broadly, the task force observed that "the state must focus more attention on finding alternatives to evacuation as one of our primary means of providing protective actions to its citizens." The report emphasized the need for efforts to encourage residents to retrofit their homes to become hurricane-proof, and the need for emergency management officials to encourage the use of neighborhood shelters—in order to "leave room on critical evacuation routes for those who truly need to leave and seek safety." The task force went so far as to call for the possible use of "military assets" as shelters, in order to augment the state's limited shelter capacity.

The report led to the use of the state's network of public radio stations be identified as the place to which drivers could reliably turn for information about traffic congestion and alternative

routes during a large-scale evacuation. It led, as well, to the expanded use of electronic variable message signage -which had been limited by a simple lack of such signs during the Floyd evacuation. The Task Force did not, however, offer a simple answer to the problem of shadow evacuation. Rather, it placed its faith in the potential for better public information dissemination and, particularly, the use of the internet to "improve the amount and availability of emergency information."