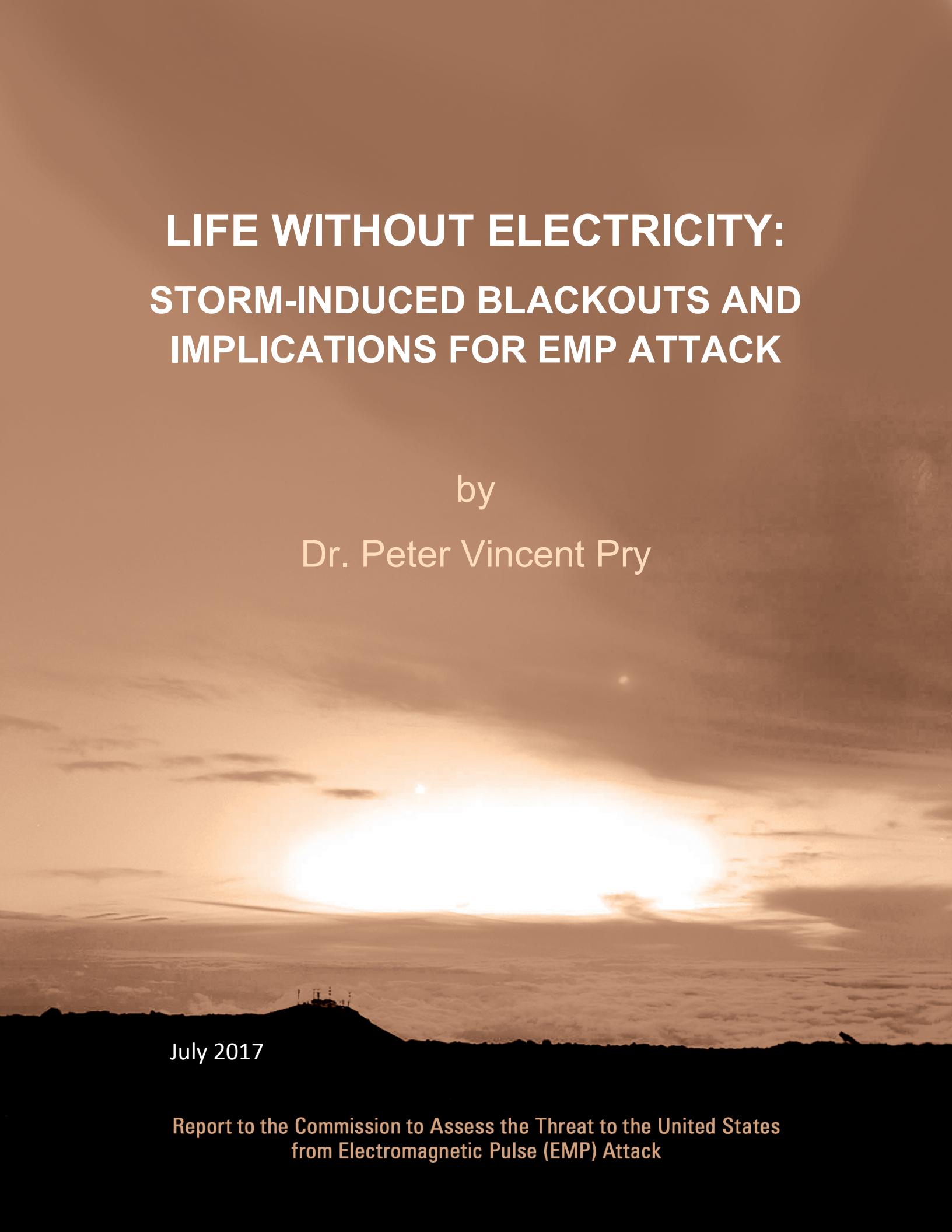


LIFE WITHOUT ELECTRICITY:

STORM-INDUCED BLACKOUTS AND IMPLICATIONS FOR EMP ATTACK

by

Dr. Peter Vincent Pry

July 2017

Report to the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack

REPORT TO THE COMMISSION TO ASSESS THE THREAT TO THE UNITED STATES FROM ELECTROMAGNETIC PULSE (EMP) ATTACK

LIFE WITHOUT ELECTRICITY:

STORM-INDUCED BLACKOUTS AND IMPLICATIONS FOR EMP ATTACK

by

Dr. Peter Vincent Pry

July 2017

This paper was drafted on June 20, 2003 to inform the work of the EMP Commission during 2001-2008, but could not be published because the Commission was terminated before Staff Papers could be submitted for security classification review. It is offered now for completeness of the analytical record.

The cover photo depicts Fishbowl Starfish Prime at 0 to 15 seconds from Maui Station in July 1962, courtesy of Los Alamos National Laboratory.

This report was produced to support the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack. The Commission was established by Congress in the FY2001 National Defense Authorization Act, Title XIV, and was continued per the FY2016 National Defense Authorization Act, Section 1089.

The Commission completed its information-gathering in June 2017. The report was cleared for open publication by the DoD Office of Prepublication and Security Review on October 19, 2017.

This report is unclassified and cleared for public release.

Table of Contents

Summary 2

Hurricane Lili (October 2002) 5

Hurricane Floyd (September 1999) 7

Ice Storm Washington, D.C. (14 January 1999) 8

The Great Ice Storm (January 1998) 9

Western Heat Wave (10 August 1996) 12

Hurricane Andrew (August 1992) 15

Summary

Storm-induced blackouts of the electric power grid are suggestive of the possible consequences of an electromagnetic pulse (EMP) attack, such as could be made by rogue states or terrorists detonating a nuclear weapon at high-altitude over the United States. Electric power grid failure caused by storms cascade through other critical infrastructures—such as communications, transportation, emergency medical services, food and water supply systems. Storm-induced blackouts provide an objective basis for extrapolating judgments about the threat posed by EMP to the civilian infrastructures that sustain economic, political, and social life.

The vulnerability of critical infrastructures to various forms of attack has been a growing concern in recent years, drawing presidential attention in the Marsh Commission, and receiving additional impetus after the terrorist attacks of September 11th that moved President Bush to establish the Department of Homeland Security. However, the science of analyzing critical infrastructures, their interdependencies, and their possible vulnerabilities is relatively new. Much effort and significant resources have been invested in an inductive approach to understanding the potential for cascading failures through the critical infrastructures that may result from failure of the power grid. The prevailing approach relies heavily on complex mathematical calculations, theoretical models, and computer simulations.

Analysis of storm-induced blackouts and their consequences offers an empirical approach that complements the predominant inductive approach to understanding infrastructure interdependence and vulnerability. Moreover, beyond the interdependence and potential vulnerability of critical infrastructures, analysis of storm-induced blackouts provides some empirical basis for estimating the effects of infrastructure failure on social order.

Storm-induced blackouts are an imperfect analogy to EMP attack from nuclear weapons of high-yield or special design. Taken at face value, storm-induced blackouts and their consequences grossly understate the threat posed by EMP attack. Storms are much more limited in geographic scope compared to EMP attack. So power grid recovery from storms, compared to recovery from EMP attack, is likely to be faster because of the "edge effect"—the capability of neighboring localities and states to provide recovery assistance. Because EMP attack is likely to damage or disrupt electronics over a much wider geographic area than storm-induced blackouts, rescuers from neighboring states and localities would face a much bigger job, and recovery probably would take a much longer time.

Nor do storm-induced blackouts replicate the damage from an EMP attack that may occur in small-scale electronic systems such as computers, aircraft, and automobiles. Compared to storms, nuclear weapons of high-yield or special design are likely to inflict, not only more widespread damage geographically, but deeper damage, affecting a much broader spectrum of electronic equipment.

Storms are merely suggestive of, and provide some basis for extrapolating, the greater destructive effects on infrastructures and social order by an EMP attack from a nuclear weapon

of high-yield or special design. Storm-induced blackouts and their consequent physical damage to other infrastructures may well be equivalent to an EMP attack from a nuclear weapon of low-yield and primitive design, such as terrorists might be able to build. In this latter case, storm-induced blackouts and the cascading physical effects on other infrastructures may be taken as representative of the lowest, and most benign, level of the EMP threat spectrum.

However, although some storms may be equivalent to a primitive EMP attack in their physical damage to the power grid and other infrastructures, storms probably understate even a primitive EMP attack in its psychological dimensions. Unlike EMP attack, hurricanes and other storms are familiar to the public and understood to be acts of nature, not the destructive agents of a foreign enemy. Public perceptions of and reactions to mass destruction differ markedly when the agent of destruction is a familiar natural event or accident, versus destruction by unfamiliar means inflicted deliberately by malignant actors. For example, the American people endure tornadoes and hurricanes without mass panic, and accept with equanimity 50,000 deaths yearly from automobile accidents. But the same number of deaths inflicted over a decade by a foreign enemy was enough to cause a political and cultural revolution in the United States, and broke the will of the people and political elites who accepted defeat in the Vietnam War. More recently, the 3,000 deaths and other destruction inflicted by the terrorist attacks of September 11 have moved the United States, with wide popular support, to prosecute successful wars in Afghanistan and Iraq as part of a broader ongoing war against terrorism. The United States government and people support this effort because, although U.S. society can survive the worst hurricane, the September 11 events forged a new consensus that U.S. society, and civilization itself, may not be able to survive future terrorist attacks.

Psychologically benign though storms may be, compared to terrorist attacks that inflict lesser or greater physical destruction, even storms challenge social order. This survey has found that some storm-induced blackouts have caused crime waves and disintegrated organized communities into disorganized refugees, for example.

Significantly, some observers of storm-induced blackouts—even when blackouts lasted only a day or two, as is commonly the case—were struck by the potential fragility of modern society and its near total dependence upon electricity. For example, a January 1999 ice storm that blacked-out electricity in the Washington, D.C. area moved the **Washington Post** to note that "daily life was crippled, if not halted—dramatically illustrating the fragile dependence of modern times on the flip of a switch."[1] The *Post* continued:

> *Automated teller machines were out, as were gasoline pumps at many service stations. WETA-TV (Channel 26) went black for more than 10 hours until employees found a diesel generator to put that station back on the air. The Montgomery County jail conducted bond hearings by flashlight. Families seeking refuge at Tysons Corner Center were booted out at 6 p.m. because of*

[1] Susan Levine and Tom Jackman, "Region Iced Over and Blacked Out," **Washington Post** (16 January 1999), p. A1.

water problems at the mall….Up and down Metro's Red Line, riders confronted stalled elevators, inoperable Farecard machines and even closed stations. Negotiating roads…was often no easier. Of more than 700 traffic signals in Montgomery, 430 were dead. Across the area, but especially in Montgomery, hotels filled to capacity with customers fleeing cold, dark homes. The 365-room Doubletree Hotel on Rockville Pike was sold out by 8 a.m…..Other residents, with pioneering spirit, decided to ride out the outage. More than two dozen people were waiting when the Home Depot in Germantown opened at 6 a.m.. By 10 a.m., the store had sold every generator, log of firewood, candle, kerosene heater and any other supply that could warm hands and feet.[2]

Another dramatic example of the dependency of social order upon electricity occurred in October 2002, during the aftermath of Hurricane Lili that blacked-out much of coastal Louisiana. In some areas, the absence of street lights caused "looting and vandalism bad enough to require enforcement of a dusk-to-dawn curfew."[3] Local police had to be reinforced by police from neighboring localities in order to cope with the crime wave. "The looting," remarked Abbeville Mayor Mark Piazza, "Is not expected to go away until the lights come on."[4]

Some experts claim that an EMP attack that collapses the power grid would, in effect, return society to a pre-industrial condition. A February 1987 snowstorm that blacked-out the Washington, D.C. area suggested exactly this to many of its victims. According to press reports, people were reduced to using open fires for heat, cooking and, in some areas, melting snow for water. Homes with fireplaces became havens for multiple families seeking refuge from houses heated by electric, gas, or oil that no longer worked. As she "stoked a fire and began sterilizing water for her baby's formula," one woman told reporters, "It's like the Colonial days."[5]

Storm-induced blackouts are localized and last usually no more than a day or two. Yet they can momentarily return part of our society to technological primitivism and begin cracks in the social order. Compared to storms, the consequences of an EMP attack would be far graver. Compared to the worst storms, an EMP attack would probably destroy infrastructures more completely within a region and over a much larger region—perhaps over the entire continental United States. An EMP attack, compared to the worst storms, would probably inflict more lasting damage—requiring perhaps weeks or months to repair.

Therefore, we can reasonably infer from the data on storm-induced blackouts and the known greater severity of high-altitude nuclear EMP that the consequences of an EMP attack on the United States' infrastructures and society would be an unprecedented and first order catastrophe.

---

2 Ibid.

3 Leslie Williams, "One Town's Battle," **Times-Picayune** (9 October 2002), p. 1.

4 Ibid.

5 John Lancaster and Chris Spolar, "Washington's Wet Blanket," **Washington Post** (24 February 1987), p. 1.

Some of the salient infrastructure and social consequences of storm-induced blackouts are listed below. Not all of the failures and effects described occurred during all storms. This survey was careful to select only failures and effects traceable to power grid failure. Failures and effects resulting from phenomenon other than electric power grid blackout (downed trees, flooding and etc.) are not reported here. Storm- and weather-related blackouts examined in this survey include Hurricane Lili (2002), Hurricane Floyd (1999), the Washington Ice Storm of 1999, the Great Ice Storm of 1998, the Western Heat Wave of 1996, and Hurricane Andrew (1992):

- **Social Order:** Looting requires dusk to dawn curfew. People become refugees as they flee powerless homes. Work force becomes differently employed at scavenging for basics, including water, food, and shelter.
- **Communications:** No TV, radio, or phone service.
- **Transportation:** Gas pumps inoperable. Failure of signal lights and street lights impedes traffic, stops traffic after dark. No mass transit metro service. Airlines stopped.
- **Water and Food:** No running water. Stoves and refrigerators inoperable. People melt snow, boil water, and cook over open fires. Local food supplies exhausted. Most stores close due to blackout.
- **Energy:** Oil and natural gas flows stop.
- **Emergency Medical:** Hospitals operate in dark. Patients on dialysis and other life support threatened. Medications administered and babies born by flashlight.
- **Death and Injury:** Casualties from exposure, carbon dioxide poisoning and house fires increase.
- **Edge Effect:** Recovery depends heavily on neighboring regions unaffected by blackout. For example, Louisiana rescued from Hurricane Lili blackout by 14,000 workers from 24 states.

Hurricane Lili (October 2002)

Hurricane Lili struck the coast of Louisiana on October 3, 2002, coming ashore at Vermillion Bay, the eye of the storm centered on Abbeville about 90 minutes after landfall.[6] Lili knocked down 35 transmission lines and destroyed 53 electric power substations.[7] More than 500,000 people were without electric power at the height of the blackout, immediately after the storm.[8] Three days later, on October 6, over 100,000 homes and businesses were still without power in coastal Louisiana, according to the state Office of Emergency Preparedness.[9] Six days after Lili, on October 9, in Abbeville and surrounding Vermillion Parish, an estimated 80 percent of the 20,000 homes and 50 percent of businesses were still without electricity.[10]

---

6 Williams, op. cit., p. 1.

7 Angela Simoneaux, "Flooded, Battered La. Gets Busy Cleaning Up," **Morning Advocate** (5 October 2002), p. 1A.

8 Angela Simoneaux, "Acadiana's Recovery," **The Advocate** (8 October 2002), p. 5B.

9 Kevin McGill, "Rise Seen In Carbon Monoxide Poisoning Cases," **The Advocate** (7 October 2002), p. 2B.

10 Williams, op. cit., p. 1.

As a consequence of the blackout, water and food were unavailable through the normal means to thousands. With no electricity, water pumping stations no longer worked. In south Louisiana, 30 supermarkets would not open because the blackout prevented their cash registers from operating. Those grocery stores that did open were stripped of food within hours. In Abbeville, the parking lots of shopping centers became watering and feeding stations run by churches and the state Office of Emergency Preparedness. Associated Grocers, that supplies food to supermarkets in Louisiana, Texas, and Mississippi, sent food and refrigerated trucks to the stricken area. The food emergency was reflected in a skyrocketing demand for dry ice to preserve food stuffs during the hot weather and to preserve refrigerated foods. Local supplies of dry ice were exhausted--one store selling 20,000 pounds of dry ice to hundreds of customers in two hours—and had to be supplemented with supplies from the Red Cross.[11]

The electrical outage deprived thousands of phone service for days after the Hurricane.[12] Television service was also blacked out.[13]

The blackout interfered with transportation by rendering signal lights inoperable.[14] Street lights were also inoperable, making driving at night difficult even for long-time local residents, who could not see landmarks and became disoriented in the dark.[15]

Power grid collapse caused failure in other energy infrastructures. Without electricity, natural gas service could not be restored for several days after Lili.[16]

Many hospitals were plunged into darkness during the blackout because they had no emergency generators or emergency power systems failed to work. There was no hot water for bathing patients or sterilization. “We have to give them medicines in the dark,” said one nurse, “We use a flashlight to make sure we don’t give them the wrong one.”[17]

The blackout caused indirectly some injuries and at least one death. Home generators used by people who lost power after Hurricane Lili led to more than 60 cases of carbon monoxide poisoning, including one fatality, according to Louisiana health officials.[18]

Some officials and citizens considered the blackout the worst part of Hurricane Lili. According to Mayor Chuck Butterfield, “We’ve taken electricity for granted and living without it for three or four days is devastating.”[19] Law enforcement officers blamed a surge of looting and vandalism on the blackout. The crime wave became bad enough to require the imposition of a dusk-to-dawn curfew and police reinforcements from neighboring areas unaffected by the storm.

---

11 Simoneaux, “Acadiana’s Recovery,” p. 5B. Williams, op. cit., p. 1. Simoneaux, “Flooded, Battered La. Gets Busy Cleaning Up,” p. 1A. Suzan Manuel, “Lili Leaves Residents Powerless,” **Daily Town Talk** (5 October 2002), p. 1A. Suzan Manuel, “Thousands Still Without Electricity Across Central La.,” **Daily Town Talk** (6 October 2002), p. 8A.

12 McGill, op. cit., p. 2B.

13 Simoneaux, “Acadiana’s Recovery,” p. 5B.

14 Manuel, “Lili Leaves Residents Powerless,” p. 1A.

15 Williams, op. cit., p. 1.

16 McGill, op. cit., p. 2b.

17 Manuel, “Lili Leaves Residents Powerless,” p. 1A.

18 McGill, op. cit., p. 2B.

19 Manuel, op. cit. p. 8A.

"The looting," according to the Abbeville Sherriff's Office, "Is not expected to go away until the lights come back on."[20]

Recovery from the blackout, described by a CLECO electric utility spokesman as "the biggest customer outage event in our history," depended heavily on outside assistance.[21] Some 14,000 electric utility workers from 24 states and the District of Colombia joined CLECO's 3,000 workers to make recovery possible in about one week.[22]

Hurricane Floyd (September 1999)

Expected to be a "killer storm" of rare power and destruction, when Hurricane Floyd made landfall near Cape Fear, North Carolina on September 16, 1999, it had subsided into a tropical storm that inundated much of the east coast with heavy rainfall and flooding. But there was little of the destruction anticipated by federal and state authorities that had prompted them to evacuate over 3 million people from the hurricane's path.[23]

Floyd did blackout electrical grids in many areas. However, the consequences of those blackouts for other infrastructures and for society are difficult to evaluate since blackouts tended to occur in areas where the population had already evacuated. Blackouts did interrupt phone service in North Carolina.[24] In Salisbury, North Carolina, more than 200 of 1,200 supermarkets were put out of operation by protracted blackouts, causing substantial food spoilage despite emergency efforts undertaken before the storm to preserve perishable goods in freezers.[25] Most cable TV customers lost service in Baltimore due to a blackout.

Floyd blackouts are notable for causing water treatment and sewage plants to fail in some Virginia localities and, most notably, in Baltimore. Blackout induced failure of Baltimore's Hampden sewage facility for several days raised concerns about a threat to public health. With its three pumps inoperable, Hampden spilled 24 million gallons of waste into Baltimore's Jones Falls waterway and the Inner Harbor.[26]

Perhaps Floyd's blackouts are most significant for complicating the largest evacuation and return of civilians in United States history. Electrical outages apparently prevented many from finding shelter—some traveled over 500 miles seeking accommodations, and found none. Blackout induced failure of traffic signals contributed to some of the largest traffic jams in the

---

20 Williams, op. cit., p. 1.

21 Simoneaux, "Flooded, Battered La. Gets Busy Cleaning Up," p. 1A.

22 Keith Darce, "Lights Blink Out All Over Louisiana," **Times-Picayune** (4 October 2002), p. 1. "Lili Left Half A Million Without Power," **Associated Press** (4 October 2002).

23 Brad Liston, Melissa August, Delphine Matthieussent, and Timothy Roche, "A Very Close Call," **Time** (27 September 1999), p. 34.

24 Amanda Milligan Hoffman and Sally Roberts, **Business Insurance** (Crain Communications: 1999).

25 Ibid.

26 Governors James Hunt and James Gilmore interviewed, "Hurricane Floyd Leaves Lingering Questions About Public Policy," **CNN Crossfire** (16 September 1999). Del Quentin Wilber, "Jones Falls Sewage Spill Lasts 2 Days," **Baltimore Sun** (19 September 1999), p. 1A.

nation's history as evacuees tried to return home. For example, one traffic jam on Interstate 10 from the Carolinas to Florida stretched 200 miles.[27]

Ice Storm Washington, D.C. (14 January 1999)

On January 14, 1999, an ice storm downed 250 high-voltage power lines in Washington D.C. and the neighboring suburbs in Maryland and Northern Virginia, causing what the Potomac Electric Power Company (PEPCO) described as "the worst power outage in the utility's 102-year history."[28] The blackout left 435,000 homes and businesses without power. Recovery took six days.[29]

Warm food, potentially a survival issue in the freezing winter conditions, was not available in most people's homes because electric ovens and microwaves no longer worked. Most gas-powered ovens also would not work because those built since the mid-1980s have electronic ignition and cannot be lit with a match.[30] Some resorted to cooking on camp stoves. Preserving refrigerated foods was also a concern that PEPCO tried to help address by giving away 120,000 pounds of dry ice, all it had.[31] Dry ice became a precious commodity.[32]

The blackout crippled ground and rail transportation. Gasoline pumps were rendered inoperable. Non-functioning traffic lights snarled traffic:

> *Up and down Metro's Red Line, riders confronted stalled elevators, inoperable fare card machines and even closed stations. Negotiating roads…was often no easier. Of more than 700 traffic signals in Montgomery, 430 were dead….Arlington County motorcycle officers proved especially resourceful, borrowing portable generators from the public library system to help run traffic lights at four major intersections.*[33]

A local television station, WETA-TV, went off the air for more than 10 hours because of the blackout.[34]

At least one hospital was blacked out. Babies were born by flashlight.[35] Emergency medical services suffered to such an extent that patients requiring life support were put at risk, PEPCO admitted:

---

27 Liston and et. al., op. cit., p. 34. Aaron Steckelberg, "Scenes From The Coast," **Atlanta Constitution** (16 September 1999), p. 10A.

28 Scott Wilson, "From Ice Storm To Firestorm," **Washington Post** (31 January 1999), p. A1. Manuel Perez-Rivas, "Six-Day Power Outage Is Over," **Washington Post** (21 January 1999), p. B1.

29 Ibid.

30 Phillip P. Pan and Spencer S. Hsu, "Without Power, Thousands Wait In Hotels, Malls And Cold Homes," **Washington Post** (17 January 1999), p. A1.

31 Perez-Rivas, op. cit., p. B1.

32 Wilson, op. cit. (31 January 1999), p. A1.

33 Susan Levine and Tom Jackman, "Region Iced Over and Blacked Out," **Washington Post** (16 January 1999), p. A1.

34 Ibid.

35 Wilson, op. cit. (31 January 1999), p. A1.

The extent of damage caused by last week's ice storm prevented PEPCO and other area utilities from giving priority to customers with serious medical conditions, including those on life-support systems or dialysis machines, company executives said yesterday.[36]

Ice storm induced blackout in freezing conditions posed a threat to life. Hypothermia surged among the elderly, trapped in their unheated homes. People tried to stay warm by burning charcoal indoors, causing an increase in carbon monoxide poisoning and house fires:

At least a dozen houses…in Montgomery were damaged by fires caused by residents' efforts to stay warm or cook…after burning charcoal indoors. More than a hundred people spent Friday night in emergency shelters…Hospitals reported an influx of elderly in their emergency rooms.[37]

In Maryland, the blackout moved Governor Parris Glendening to declare a state of emergency in six counties. The Governor activated the National Guard to assist firehouses.[38]

The power outage created a refugee population "of entire neighborhoods…searching for warmth and diversion at hotels, theaters, malls and even office towers."[39] Thousands were "fleeing cold, dark homes," according to press reports:

Across the area, but especially in Montgomery, hotels filled to capacity with customers fleeing cold, dark homes. The 365-room Doubletree Hotel on Rockville Pike was sold out by 8 a.m.. Residence Inn by Marriott, on Wisconsin Avenue in Bethesda, with 187 rooms, was sold out by noon.[40]

The blackout moved the **Washington Post** to observe that "daily life was crippled, if not halted—dramatically illustrating the fragile dependence of modern times on the flip of a switch."[41]

The Great Ice Storm (January 1998)

Starting on January 4th and for six days, until January 10, 1998, freezing rain fell across a 600-mile weather front that included parts of Ontario and Quebec in Canada, and Maine and upstate New York in the United States. Electric outages in the affected areas of Canada deprived 4.7 million people, or 16 percent of the Canadian population, of power, according to Emergency Preparedness Canada. In the United States, 546,000 people were without power (deprived of heat, light, and in many instances water) in the cold of mid-winter.[42]

---

36 Scott Wilson, "Utilities Say Blackout Overwhelmed Medical Priorities," **Washington Post** (22 January 1999), p. B3.

37 Pan and Hsu, op. cit., p. A1.

38 Ibid

39 Ibid.

40 Ibid. Levine and Jackman, op. cit., p. A1.

41 Levine and Jackman, op. cit., p. 1.

42 Eugene L. Lecomte, Alan W. Pang, and James W. Russell, **Ice Storm '98** (Institute for Business and Home Safety: December 1998), pp. 1-2.

Some of the 5.2 million people affected by the Great Ice Storm of 1998 went without power for five weeks. It was the greatest natural disaster in Canadian history, and generated more insurance claims than Hurricane Andrew, the costliest natural disaster in U.S. history.[43]

One historian of the Great Ice Storm notes that "the storm's biggest impact was, in a sense, not weather-related: It was the loss of electricity":

> *Ice accumulations caused the collapse of more than a thousand…transmission towers…More than 7,500 transformers stopped working….Some parts of Monteregie, a region of 1.3 million people southeast of Montreal, went without power for so long that the area became known as "the Dark Triangle."*[44]

The blackout caused an immediate and life-threatening emergency in Montreal's water supply that depended upon electricity for filtration and pumping. At 12:20 P.M. on January 9th, the two water filtration plants that served 1.5 million people in the Montreal region went down, leaving the area with only enough water to last 4 to 8 hours. Government officials kept the water crisis secret, fearing public knowledge would exacerbate the crisis by water hoarding. However:

> *Even as officials deliberated,* w*ater pipes in some households were already dry. As reports and rumors of a water shortage spread, consumption jumped by 10 percent anyway, and bottled water disappeared from stores.*[45]

The **Toronto Star**, in an article entitled "Millions Shiver In Dark: How A Major City is Being Crippled by Deadly Ice Storm," reported that parts of Montreal had run out of water, "and those who still had it were warned not to drink tap water without boiling it first." [46] But most people had no way of boiling water.

Officials feared not only a shortage of drinking water, but an inadequate supply of water for fighting fires. So desperate was the situation that Alain Michaud, Fire Chief of Montreal, prepared to fight fires with a demolition crane instead of water, hoping that "if a building caught fire, it might burn to the ground, but the crane would demolish neighboring structures to prevent the fire's spread."[47] By 9:30 P.M. on January 9th, one of Montreal's major reservoirs was nearly empty. Provincial officials considered evacuating the city. However, Hydro-Quebec, the government electric utility, managed to restore power to the filtration plants and restore water service.[48]

The blackout also threatened the food supply: "Food poisoning has become a real threat as embattled Montrealers, unable to get to stores, eat food that has been kept too long in

---

43 Jacques Leslie, "Powerless," **Wired** (April 1999), p.120.

44 Ibid.

45 Ibid, p. 176.

46 Sandro Contenta, "Millions Shiver In Dark: How A Major City Is Being Crippled By Deadly Ice Storm," **Toronto Star** (10 January 1998), p. A1.

47 Leslie, op. cit., p. 176.

48 Ibid.

refrigerators that don't work."[49] In upstate New York, the electric utility Niagara Mohawk announced that it was focusing restoration of electric power on more populated areas "so that supermarkets, gasoline stations and hotels could reopen, and people in the more rural areas could find food and shelter."[50] New York State Electric and Gas helped customers get to shelters and distributed 200,000 pounds of dry ice for storing food."[51] One typical resident of Canada's "Dark Triangle" complained, "I've lost all my food…I melt ice for water. It's no way for a family to live."[52]

Shelter, another basic necessity for survival, was also threatened by the mid-winter blackout: "People without power discovered just how many facets of their lives depended on electricity. Their stoves, appliances, and heating didn't work."[53] Many of Canada's newer, well-insulated homes relied on inexpensive electric heat.[54] Thousands of people fled their cold, dark homes to seek refuge in government and charitable shelters. The situation in Saint-Jean-sur-Richelieu, a working-class town of 36,000 was typical, where 3,600 people became shelter refugees, one-tenth of the population.[55] St. Hyacinthe in the "Dark Triangle" lost nearly half its residents, who mostly fled the city.[56] About 100,000 people took refuge in shelters.[57]

Communications, financial, and transportation infrastructures failed massively during the blackout. In upstate New York, only French Canadian radio stations were still on the air. In Ontario, 50,000 telephones went dead, frustrating the electric utility from restoring power service, since it relied on customer phone calls to locate power failures. Credit cards and ATM machines became useless, so all financial transactions had to be in cash.[58] The blackout shut down Montreal's four subway lines for the first time in the system's 30-year history.[59]

Underscoring that the blackout, not the ice storm, was the real crisis, the Canadian Premier Lucien Bouchard declared that "the most urgent need" was for generators, and appealed to anyone in Canada with a generator to help.[60] Bouchard also appealed to the U.S. Federal Emergency Management Agency, "asking for beds and generators to provide shelters with heat and light."[61]

Hospitals in Canada and the United States were nearly overwhelmed with blackout victims. In Maine, where six out of ten residents lost power, a single hospital, in Lewiston, reported

---

49 Contenta, op. cit., p. A1.
50 "Monster Ice Storm Slays Transmission Facilities In Quebec, Upstate New York," **Northeast Power Report** (McGraw-Hill: 16 January 1998), p. 1.
51 "Canada And New England Still Reeling," **Electric Utility Week** (19 January 1998), p. 1.
52 Jack Beaudoin, "Quebec In Crisis," **Portland Press Herald** (8 February 1998), p. 45.
53 Leslie, op. cit., p. 176.
54 Beaudoin, op. cit., p. 45.
55 Leslie, op. cit., p. 178.
56 Beaudoin, op. cit., p. 45.
57 Leslie, op. cit., p. 122.
58 Ibid, p. 176.
59 Contenta, op. cit., p. A1.
60 Mark Dunn, "Ice Storm Holds Eastern Ontario In Its Beautiful But Deadly Grip," **The Record** (9 January 1998), p. A1.
61 Contenta, op. cit., p. A1.

treating for carbon monoxide poisoning 120 people "who ran generators, kerosene heaters and even charcoal grills in their homes to keep warm."[62]

Hospital medical services underwent a crisis during the protracted blackout when their emergency generators failed. For example, at Montreal's LeMoyne Hospital:

> *The generators broke down on the sixth day, and the staff instantly switched to flashlights. For two hours until the generators were repaired, the hospital lost the use of its life-support and monitoring equipment: Nurses pumped air by hand into the lungs of patients on respirators and manually took each patient's pulse and blood pressure every 15 minutes. Instead of one nurse for each six patients, a ratio of at least one-to-one was needed.*[63]

The blackout indirectly caused hundreds of deaths in Canada and the U.S., according to Great Ice Storm historian Jacques Leslie. Leslie criticizes the official death toll figures as too low:

> *The official de*ath toll was 45-28 fatalities in Canada, 17 in the U.S.—but those numbers understate *the ice storm's effects. Hundreds of ill and elderly people, weakened by extended stays in shelters where flu became epidemic, died weeks or months later, succumbing to ailments they might otherwise have overcome.*[64]

Over a year after the Great Ice Storm ended, according to Jaques Leslie, "The people who experienced it remain aware of one overriding lesson: Their dependence on electricity makes them more vulnerable than they'd ever imagined."[65] Mark Abley, author of **The Ice Storm**, makes a similar observation:

> *Huddling in school gyms, church halls, shopping malls, and other shelters, the evacuees didn't pray for a return of fine weather. They prayed for a return of power. The ice storm demonstrated not that we are prisoners of brutal weather, but that we are all now hostages to electricity."*[66]

Western Heat Wave (10 August 1996)

A heat wave, with near record high temperatures, blacked out large parts of nine western states on a torrid Saturday afternoon, August 10th, 1996. Near-record high temperatures covered most of the West at the time: for example, over 100 degrees in eastern Oregon and the San Joaquin Valley, 113 degrees in Red Bluff, and 104 degrees in Boise, Idaho.[67] Initial speculation that the blackout was sparked by a brushfire near Oregon was later discounted. According to

---

62 Peter Pochna and Abby Zimet, "Facing Down An Ice Storm," **Portland Press Herald** (18 January 1998), p. 1A.
63 Leslie, op. cit., pp. 178, 180.
64 Ibid, pp. 122-123.
65 Ibid, p. 123.
66 Ibid.
67 Rich Connell, "Massive Power Outage Hits Seven Western States," **Los Angeles Times** (11 August 1996), p. 1.

Dulcy Mahar, spokeswoman for the Bonneville Power Administration, the blackout was caused by the heat wave:

> *Some of the lines sagged because of the heat. Some of those lines sagged down onto trees and then tripped off for safety reasons. The power that those lines were carrying was moved off to other lines and overloaded those, and then the safety devices tripped those lines off and you had the outages.*[68]

Although the blackout lasted less than 24 hours, it was "one of the largest power outages on record."[69] The blackout affected "an estimated 4 million people in nine states, trapping people in elevators, snarling traffic and generally causing widespread chaos."[70] The blackout caused problems that could have become a significant threat to life and society, had they been more protracted.

Water supplies were interrupted in some regions because electric pumps would not work. Arizona, New Mexico, Oregon, Nevada, Texas, and Idaho experienced blackout-induced disruption in water service during the heat wave. For example:

> *In Fresno, where most of the city receives water from wells powered by electric pumps, the city manager declared a local emergency. Only two of the city's 16 fire stations had water sources and most of the fire hydrants were out. The county and Air National Guard rushed in tankers to boost the Fire Department's capacity.*[71]

Air and ground transportation systems experienced significant disruptions because of the blackout. For example, at San Francisco International Airport, although an emergency generator powered the control tower, other systems—security, computers, elevators, and luggage carousels—would not work. Jetways could not be positioned at airplane doors. An estimated 6,000 passengers were stranded.[72] Incoming flights had to be diverted to San Jose and Oakland. Airport Spokesman Bob Schneider announced, "We are pretty much out of business."[73]

Signal lights failed, causing massive traffic jams in San Francisco and San Diego. "Traffic is a nightmare," declared San Francisco Police Department spokesman Bruce Metdors, "They're just backed up everywhere. It's gridlock."[74] San Francisco mass transit—electric trollies and BART metro trains—were stalled by the blackout.[75] "We're responding in what amounts to our earthquake mode," said Orange County Fire Captain Dan Young, "We certainly had an increase

---

68 Tim Golden, "Power Failure in 6 Weeks Creates Havoc for the West," **New York Times** (12 August 1996), p. 13. See also Tina Griego, "Regulators Will Take Up Western Power Failures," **Albuquerque Tribune** (12 August 1996), p. A1.

69 Connell, op. cit., p. 1.

70 Robert Dintleman, "Western Power Failures Traced To Soaring Temperatures," **All Things Considered, National Public Radio** (11 August 1996), Transcript #2302-5.

71 Connell, op. cit., p. 1.

72 Ray Delgado, "Huge Blackout Hits West Coast," **San Francisco Examiner** (11 August 1996), p. A1.

73 Connell, op. cit., p. 1

74 Ibid.

75 Delgado, op. cit., p. A1.

in traffic collisions, since you've got thousands of signals with no control on them."[76] Gas pumps were out of order, stranding motorists who needed to refuel. "All the pumps run on electricity," explained one station attendant, "When you think about it, everything runs on electricity."[77]

"Even a few hours without electricity caused chaos," according to press reports:

> *Los Angeles police went on a citywide tactical alert as supervisors ordered some day shift officers to stay on duty into the night. Firefighters patrolled the city, responding to dozens of reports of stuck elevators. Department of Transportation crews checked on 4,000 intersections where the outage could have put traffic lights on the fritz. Blaring fire alarms and broken water lines added to the havoc.*[78]

Communications were disrupted by the blackout. "Radio stations reported power outages at locations throughout the midsection of California," according to press reports, "In San Francisco, TV stations KPIX and KQED were off-line for some time due to the outage."[79] Radio Station KNBR and the Canadian Broadcast Corporation went off the air.[80] Cable television networks crashed.[81]

Emergency medical services were disrupted by the blackout because "trauma rooms across the state [California] were cut off for hours from the radio that tells them an emergency is heading their way."[82] Fire crews equipped with portable power generators were sent to doctors' offices so the physicians could complete surgeries.[83] In Orange County, 200 fire units were dedicated to providing power to hospitals with emergency vehicles.[84]

The blackout disrupted control systems in some major industrial facilities. For example, the Chevron refinery in Richmond, California, "was unable to control flues due to the outage," releasing "huge clouds of black smoke."[85] The blackout caused power plants throughout the west—"including nuclear plants near Central California's Morro Bay and west of Phoenix"—to shut down.[86] The Diablo Canyon nuclear power plant, near San Luis Obispo, shut down, and required several days for technicians to complete safety checks before it could be started again.[87]

---

76 Kim Boatman and Lori Aratani, "Millions Lose Power," **San Jose Mercury News** (11 August 1996), p. 1A.

77 Marilyn Kalfus, Ana Menendez, and Julio Laboy, "Blackout Brings Much Of O.C. To A Halt," **Orange County Register** (11 August 1996), p. A1.

78 Connell, op. cit., p. 1.

79 Delgado, op. cit., p. 1.

80 Boatman and Aratani, op. cit., p. A1.

81 Kalfus and et. al., op. cit., p. A1.

82 Ibid.

83 Douglas E. Beeman, "Hot West Goes Dim," **The Press Enterprise** (11 August 1996), p. A1.

84 Jim Hill, "West Coast Power Outage Easing In Some Locations," **Show, CNN** (10 August 1996), Transcript #1600-4.

85 Delgado, op. cit., p. 1.

86 Beeman, op. cit., p. A1.

87 Golden, op. cit., p. 13.

The Bonneville Power Administration told the press, "All of the utilities are relying on each other, and it has a cascading effect when one part experiences a major failure."[88]

Hurricane Andrew (August 1992)

Hurricane Andrew struck southern Florida on August 24, 1992 and reached the coast of Louisiana on August 26, two days later. Andrew has been described by some experts as the worst natural disaster in U.S. history. [89] Andrew laid waste to 165 square miles in South Florida, destroying some 100,000 homes in Florida and Louisiana, and leaving more than 3.3 million homes and businesses without electricity.[90]

Federal and state officials were at first unaware of the magnitude of the disaster and slow to react. Three days into the crisis, Kate Hale, the Director of Dade County's Office of Emergency Management called a press conference to demand of state and federal authorities, "Where the hell is the cavalry on this one? We need food. We need water. We need people. For God's sake, where are they?"[91]

By the end of the first week, President Bush had ordered 14,400 troops into the Florida disaster area "with mobile kitchens, tents, electrical generators, water and blankets….Even those lucky enough to have homes may not have electricity for more than a month."[92]

Andrew's aftermath posed an immediate threat to life in South Florida because of damage to the infrastructures for water and food. A widespread electrical blackout prevented pumps from working, so there was no running water.[93] Most grocery stores had been destroyed. Massive traffic jams, caused in part by non-functioning signal and street lights, prevented the surviving supermarkets from being re-supplied. To meet the crisis, the Army Corps of Engineers distributed more than 200,000 gallons of water and the Department of Agriculture gave out tons of surplus food.[94] Nonetheless, two weeks after the hurricane, food was still not reaching many victims. On September 7, fifteen days after Andrew struck, reporters witnessed the following scene:

> *In the ruins, Charlie Myers, 65, stood holding a peach and a loaf of bread. "This is all I have left, he said. What plans did he have? "Survive buddy."*[95]

Andrew's blackout of the power grid made the crisis over water, food, and shelter worse by severing communications between relief workers and victims. Without power, there was an

---

88 Delgado, op. cit., p. 1.

89 "Mother Nature's Angriest Child," **Time** (7 September 1992), p. 15.

90 Tom Mathews, Peter Katel, Todd Barrett, Douglas Waller, Clara Bingham, Melinda Liu, Steven Waldman, and Ginny Carrol, "What Went Wrong," **Newsweek** (7 September 1992), p. 23.

91 Ibid.

92 "Mother Nature's Angriest Child," op. cit., p. 16.

93 William Booth and Mary Jordan, "Hurricane Rips Miami Area, Aims at Gulf States," **Washington Post** (25 August 1992), p. A7.

94 Mathews and et. al., op. cit., p. 27.

95 Ibid.

almost complete collapse of communications—no phones, radio or television.[96] "Without electricity to power radio and television sets, mass communication remains difficult or impossible," according to authorities and press reports.[97] Consequently, people were unaware of relief efforts or of where to go for help. For example, although the U.S. Marines erected "tent cities" able to accommodate thousands of homeless hurricane victims, many did not know of this refuge: "Many people in the vast storm-stricken area, even those who live within easy walking distance of the sprawling encampment, said they were not aware of the tents' existence."[98] Unable to communicate where victims could get water, relief workers stacked "pyramids of bottled water…on street corners, free for the taking."[99]

The blackout of power and communications, according to press reports, imbued "South Florida with an end-of-the world aura":

> *Hundreds of thousands of people found themselves in a Stone Age existence, left to pursue hunting and gathering, forced to forage for food and water. Because many people in the devastated areas had no radios or batteries, the location of food distribution sites has been a mystery….Each time word spread about establishment of a new relief outlet, people suddenly would swarm forward on foot, and National Guard troops often had to be summoned to keep order. The hurricane robbed steamy South Florida of the two amenities deemed essential to life here: air conditioning and ice cubes. "We can't stand this heat any longer," said Rita Larraz, whose house in South Dade County was spared but who, like 750,000 customers here, still had no electricity, and therefore no air conditioning in the 90-plus degree heat and humidity…"The heat is killing us."*[100]

The blackout crippled the transportation infrastructure, further impeding relief efforts. "More than 5,000 traffic lights are on the blink…," according to press reports. Consequently, "Traffic was snarled for miles. The simplest chore, indeed almost everything, seemed to take forever."[101]

Andrew's blackout of the power grid contributed significantly to societal anarchy in South Florida. With the blackout induced collapse of communications there was no way for survivors of Andrew to report crimes in progress. An orgy of looting provoked vigilantism. Unable to rely on the police, individuals armed themselves to protect their homes and remaining possessions.

---

96 One report indicates the phone system continued to operate or experienced only partial failure. See John Mintz, "Phones Withstand Hurricane's Fury," **Washington Post** (26 August 1992), p. F1. For a different view see Booth and Jordan, op. cit. (25 August 1992), p. A7.

97 Laurie Goodstein and William Booth, "Marines Ready Tent Cities in South Florida," **Washington Post** (1 September 1992), p. A1.

98 Ibid.

99 Ibid.

100 William Booth, "Hurricane's Fury Left 165 Square Miles Pounded Into the Ground," **Washington Post** (30 August 1992), p. A1.

101 Goodstein and Booth, op. cit., p. A1.

"Andrew had made one zone of society come unglued," according to **Newsweek**, "Disasters penetrate like lasers, revealing weaknesses beneath the smooth surfaces of a community."[102] Lack of streetlights encouraged "thieves…to take advantage of a general feeling of lawlessness, particularly before federal troops began arriving":

> *At night, in darkened streets cordoned by National Guard troops enforcing a curfew, machine-gun fire has been heard. Spray-painted on the side of a house in Perrine was: "I'm armed and dangerous! Looters shot on sight!" "Everyone is armed, everyone is walking around with guns," said Navy physician Sharon Wood, who worked at a mobile hospital in Homestead, where workers refused to dispense calming drugs such as valium for fear that word might get out and the hospital might be robbed. In Kendall, senior citizens sleep at night with revolvers by their sides….Miami and its surrounding municipalities, which have a long history of racial and ethnic tension, were considered a tinderbox.*[103]

Some 3,300 National Guard troops enforced a dusk-to-dawn curfew, when looting was worst, under cover of darkness. More than 200 people were arrested for looting or violating the curfew.[104] However, some efforts to restore law and order impeded relief efforts:

> *Roadblocks set up to stop looters continued to hamper delivery of emergency food supplies. Truckers with emergency food aid were forced to wait for police escorts after reports that some drivers had been shot and beaten by thugs. State troopers thwarted the progress of some private help when they began stopping all trucks entering the state, demanding that the drivers show that they and their cargo had been officially requested and that they were from a recognizable organization.*[105]

Ultimately, some 16,000 federal troops from every branch of the armed forces turned the lights back on and restored order to South Florida.[106]

---

102 Mathews and et. al., op. cit., p. 24.

103 Booth, op. cit., p. A18.

104 William Booth and Mary Jordan, "Painful Awakening in South Florida," **Washington Post** (26 August 1992), p. A27.

105 Mary Jordan, "President Orders Military to Aid Florida," **Washington Post** (28 August 1992), p. A14.

106 Rick Gore, "Andrew Aftermath," **National Geographic** (April 1993), p. 20.