Effect of Hurricane Andrew on the Turkey Point Nuclear Generating Station from August 20–30, 1992

Jointly sponsored by the Institute of Nuclear Power Operations and the U.S. Nuclear Regulatory Commission

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ABSTRACT

On August 24, 1992, Hurricane Andrew, a Category 4 hurricane, struck the Turkey Point Electrical Generating Station with sustained winds of 145 mph (233 km/h). This is the report of the team that the U.S. Nuclear Regulatory Commission (NRC) and the Institute of Nuclear Power Operations (INPO) jointly sponsored (1) to review the damage that the hurricane caused the nuclear units and the utility's actions to prepare for the storm and recover from it, and (2) to compile lessons that might benefit other nuclear reactor facilities.

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ACRONYMS

EDG	Emergency Diesel Generators
EOF	Emergency Operations Facility
EPIP	Emergency Plan Implementing Procedure
EPZ	Emergency Preparedness Zone
FPL	Florida Power and Light
IPE	Individual Plant Examination
NRC	U.S. Nuclear Regulatory Commission
OSC	Operational Support Center
RHR	Residual Heat Removal
TSC	Technical Support Center

TEAM COMPOSITION

On September 10, 1992, the U.S. Nuclear Regulatory Commission and the Institute of Nuclear Power Operations agreed to establish a team to compile the experience gained from Hurricane Andrew's impact on Turkey Point. Appendix A is a copy of the team's charter. The team included the following members:

Team Co-leaders

Michael Haydin, Department Manager, Human Performance Department, Institute of Nuclear Power Operations

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Team Support

The team wishes to acknowledge the contribution of the following individuals who assisted in preparing this report.

Jeffrey Main, U.S. Nuclear Regulatory Commission, provided technical editorial support for this report.

Mike Mueller, Institute of Nuclear Power Operations, provided logistics and team support while at INPO offices in Atlanta.

Michelle Smith, U.S. Nuclear Regulatory Commission, provided secretarial support while at NRC offices in Bethesda, Maryland.

Frank Varona, Florida Power and Light, provided logistics and technical information and supported team activities while at Turkey Point.

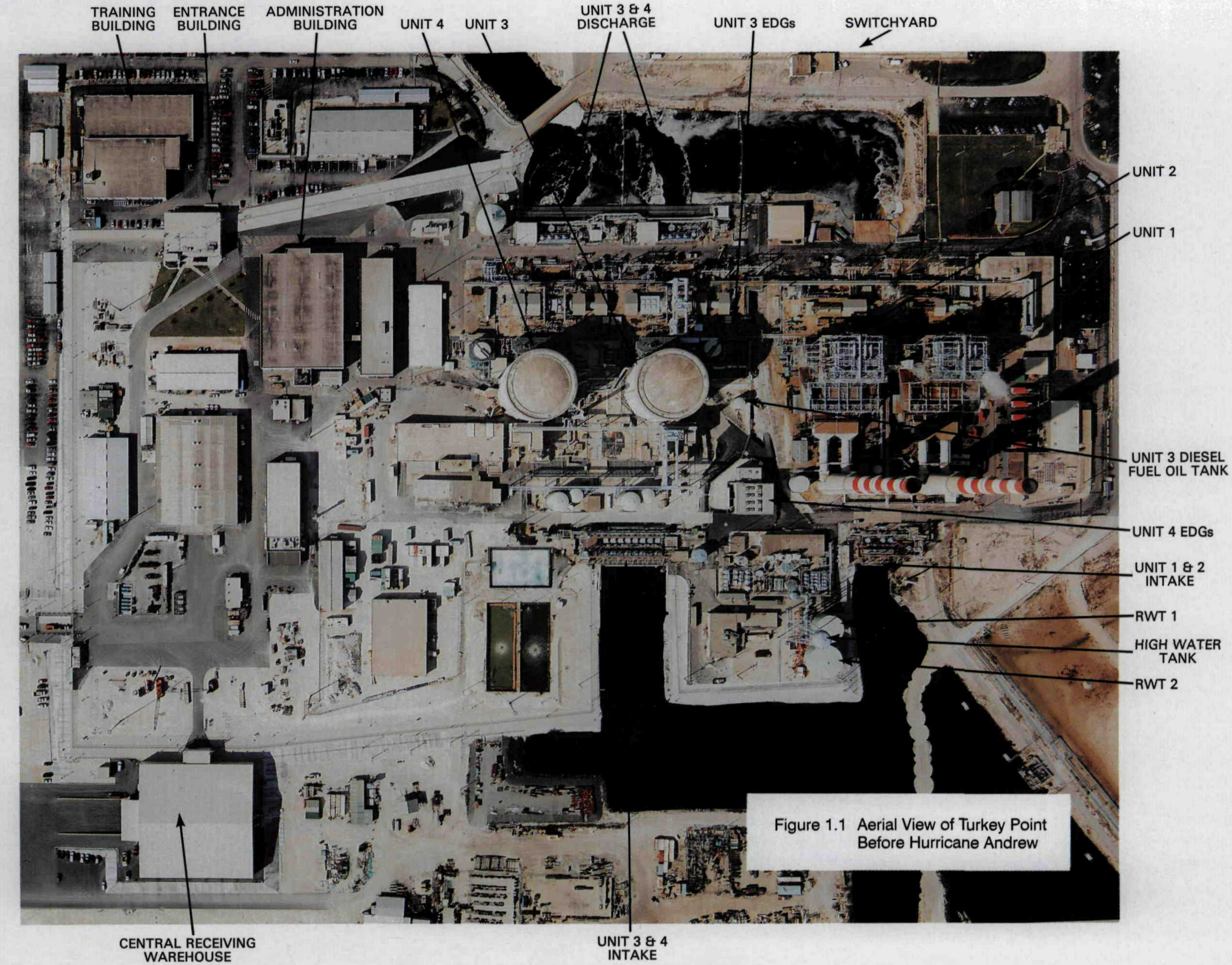

Figure 1.1 Aerial View of Turkey Point Before Hurricane Andrew

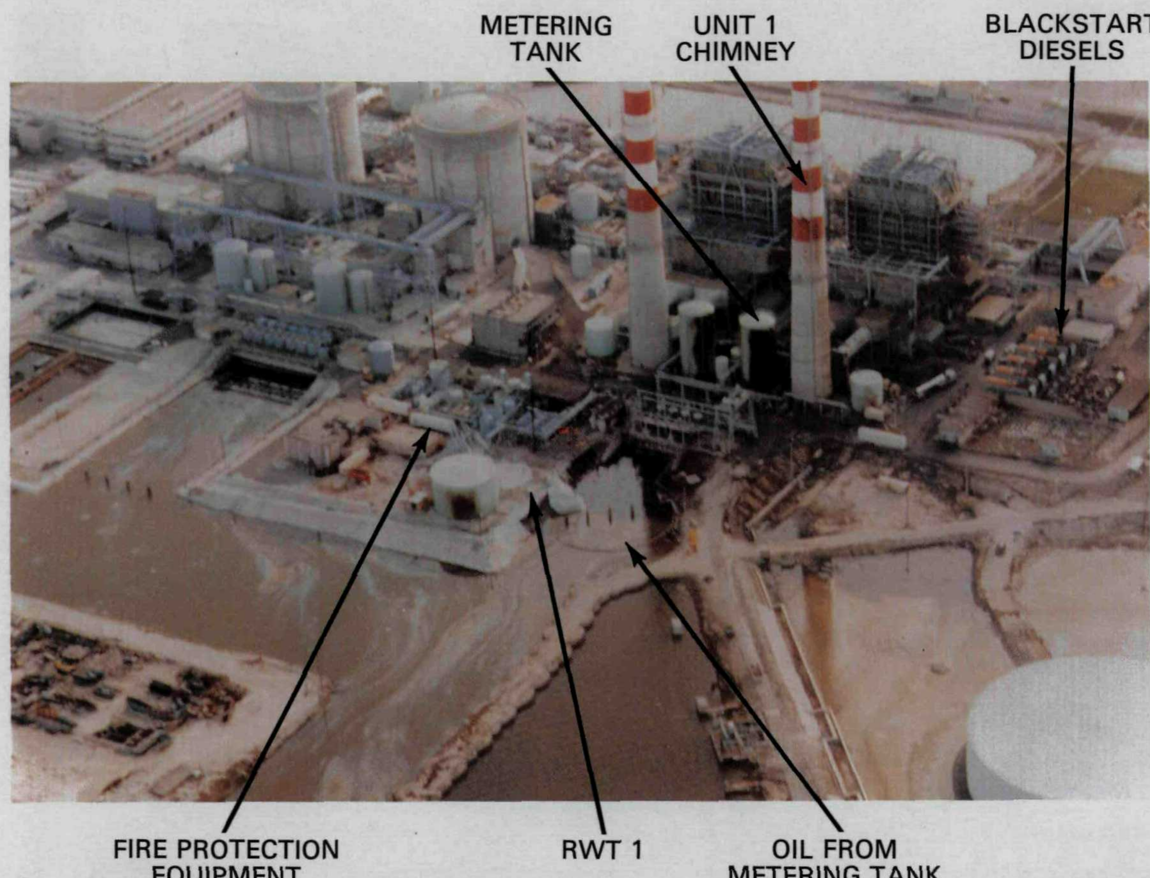

Figure 1.2 Aerial View of Turkey Point (Diagonal View)

1 EXECUTIVE SUMMARY

The Turkey Point Electrical Generating Station consists of four units. Units 1 and 2 are fossil fueled each with a capacity of 430 MW(e), and Units 3 and 4 are nuclear fueled each with a capacity of 760 MW(e).

Detailed, methodical preparations were made before the storm. The nuclear plants were placed in a safe shutdown condition on normal residual heat removal cooling well before the arrival of hurricane force winds.

At about 4:00 a.m. Monday morning, August 24, 1992, Hurricane Andrew passed directly over the Turkey Point site in a westerly direction with sustained wind speeds of 145 mph (233 km/h) and gusts of at least 175 mph (282 km/h).

The nuclear portion of the plant contained within Class I structures is designed to withstand these wind velocities and suffered no damage from the hurricane except for minor water intrusion and some damage to insulation and paint. The ability of the Class I structures, systems, and components to withstand the storm without damage, and the operation of emergency diesel generators and normal cooling systems to sustain the plant in a safe shutdown condition reduced the impact of Hurricane Andrew at Turkey Point.

The plant lost all offsite power during the storm and for over 5 days. Emergency diesel generators automatically picked up safety-related loads and maintained the plant during the recovery until site power was restored on August 30.

All offsite communications were lost during the storm for about 4 hours, and the access roads to the plant were blocked with trees and utility poles. Helicopters and portable communications equipment were used to sustain the plant until the access road and more permanent communications were restored on Tuesday, August 25.

The hurricane caused some damage to the nonnuclear Class III structures, systems, and components, which are designed to withstand 120-mph (193-km/h) winds. Most of the damage occurred when the 100,000-gallon (380,000-L) water tower collapsed, destroying a raw water tank and portions of the fire protection system piping, and disrupting the city water system supply. Electrical service and instrumentation associated with those equipments struck by the water tower were also destroyed, rendering the fire protection system inoperable. Temporary fire protection measures were instituted.

The security system sustained extensive damage to equipment such as lighting, cameras, intrusion detection equipment, protective area fencing, and the entrance building.

Numerous outlying facilities and buildings were damaged. The Central Receiving Facility, containing a large spare parts inventory, sustained extensive structural damage.

Because there was very limited damage to the safety-related portions of the plant, plant management was able to concentrate attention on repairing the nonsafety-related portion of the plant, and on helping employees cope with the destruction to their homes. The amount of time and effort expended meeting the physical and emotional needs of the plant staff and their families far exceeded anything anticipated prior to the storm. A significant effort was expended in providing food, temporary living quarters, and basic necessitites to a number of employees and their families.

The staff at the St. Lucie plant, another nuclear power plant operated by the utility, gave significant help to Turkey Point without detailed request. This assistance made the recovery much faster and more efficient than would have been otherwise possible.

2 LESSONS REINFORCED AND LESSONS LEARNED

Turkey Point procedures required the plant to be shut down (i.e., be in Mode 4) at least 2 hours before the onset of hurricane force winds at the site. As a result, both units were in Mode 4 when Hurricane Andrew struck. The commitments made in response to the Station Blackout rule concerning the timing of plant shutdown in anticipation of hurricane force winds were less conservative, and could have resulted in the plant being in the midst of a dual-unit shutdown when the hurricane struck and offsite power was lost.

Having both units shut down and on residual heat removal when the storm struck and offsite power was lost reduced the possibility that damage or failures might jeopardize core cooling.

Humanitarian aid for the plant staff included housing, feeding, and transporting family members and staff for several days after the storm.

The time and effort expended in meeting the physical and emotional needs of the plant staff and their families exceeded anything anticipated before the storm. See Section 3.7 for more information on maintaining a staff of experienced personnel.

Using the control room simulator to train operators immediately before the storm enabled the operators to be more alert to any likely plant transients.

The plant benefited greatly from the prior experience of the plant staff and the extensive preplanning such as was done in preparing and implementing the Emergency Plan Implementing Procedure (EPIP) 20106, "Natural Emergencies."

EPIP 20106 was significantly expanded as a result of the insights gained, at least in part, from the individual plant examination (IPE). These additional procedures, which dealt with preparations for a Category 5 hurricane, contributed significantly to the preparations for Hurricane Andrew.

Stationing operators in buildings that would be inaccessible because of the inability to move between buildings during the height of the storm ensured they were available to take corrective action if failures occurred during the storm.

"Life lines" installed around the plant enabled personnel to safely move about when absolutely necessary during the storm.

Although extensive and redundant communications equipment existed, offsite communications were lost during and after the storm. Additional planning for the restoration of communications (e.g., portable communications equipment and spare antennas stored in a Class I structure) could have speeded the recovery.

The temporary satellite communications system provided by the U.S. Nuclear Regulatory Commission (NRC) considerably aided recovery efforts, and would have been more beneficial if it had been on site before the storm.

The plant experienced a considerable delay in establishing backup emergency communications due to the inability to run temporary cables into the closed environment of the control room.

Cellular telephones did not prove to be as reliable as might be expected because the repeating stations needed to support the system were badly damaged out to a distance beyond the range of the available phones and because of the heavy traffic on the available circuits. Portable cellular phones were particularly affected due to their limited range.

Diesel-powered pumps (staged for draining flooded areas) were used to rapidly restore fire fighting capability when the collapse of the high water tank destroyed portions of the fire protection system. The fire protection halon suppression system in the cable spreading and inverter rooms remained operational throughout the storm.

Offsite power was unreliable for a period after it was initially restored. The site staff waited about 2 days after offsite power was restored before energizing the startup transformers and shutting down the emergency diesel generators (EDGs).

The food stored for the hurricane ran out because of the unexpected consumption by personnel preparing for the arrival of the storm and by other personnel in addition to the nuclear plant staff, before access by road was re-established. Helicopters were used to resupply the plant.

The materials and resources supplied by St. Lucie were helpful in the recovery. Similar purchasing and warehouse procedures at St. Lucie and Turkey Point and the ability to communicate electronically facilitated the assistance efforts.

Section 50.54(x) of Title 10 of the Code of Federal Regulations (10 CFR 50.54(x)) was invoked to allow plant personnel to be moved to safe locations during the storm. This regulation gave the flexibility needed to adapt to situations that developed during and immediately after the hurricane.

Specialized equipment for clearing roads, removing debris, and providing food services was in short supply at the plant after the storm. Additional portable equipment for removing trees and determining if downed power lines were energized could have facilitated the cleanup effort.

The radioactive waste stored on site was adequately protected from the elements. This prevented the spread of low level radioactive waste during the storm.

The meteorological instruments failed early in the storm but did not affect the ability of the station to deal with potential radiological releases. Wind speed and direction information available in the control room consisted of 15-minute average data. Instantaneous data about wind speed and direction may have been useful if it had become necessary to send personnel outside the plant during or immediately after the storm.

A procedure for analyzing diesel fuel before it was sent to the site was developed, permitting better use of fuel trucks, which were critical to the recovery of the surrounding community.

The major radiological release path could not be monitored because of damage to the plant stack and ductwork, and associated monitoring equipment. If an unplanned release had occurred or a planned release had been necessary, it could not have been monitored by the normal plant stack monitoring equipment.

3 NARRATIVE

At about 4:00 a.m. on Monday, August 24, 1992, Hurricane Andrew passed directly over the Turkey Point Electrical Generating Station with sustained wind speeds of 145 mph (233 km/h) and gusts of at least 175 mph (282 km/h). For over 3 hours, the site was pounded by the storm. The following sections describe the preparations that were made for the storm, the experience of enduring the storm, the damage it caused, and the recovery up to the restoration of normal offsite power to the station on August 30, 1992. Appendix Q is a detailed chronology of events of the storm.

3.1 Preparing for the Approaching Storm

On August 14, 1992, the National Hurricane Center noted a developing tropical storm close to the coast of Africa. By August 17, the storm was named Tropical Storm Andrew (see Figure 3.1 for the storm track) and the station began plotting the position of Andrew on a chart in the control room.

Many members of the Turkey Point staff had endured hurricanes before. In 1979, the plant manager had been in the control room at St. Lucie when Hurricane David passed over. Upon considering this experience and results from the individual plant examination (IPE) (see Appendix B for details), an extensive revision to the Emergency Plan Implementing Procedure (EPIP) had been developed before the 1992 hurricane season to control the preparations for an approaching hurricane. Appendix R is a copy of the procedure.

On Friday, August 21, preparations at Turkey Point commenced using the EPIP even though Andrew was still a tropical storm about 800 miles (1300 km) away. Most activities involved removing equipment from outside areas, tying down equipment, and preparing for the expected storm surge of ocean water. Sandbags were filled and placed, and drains were plugged to prevent water from surging into buildings. Anything that was removable was placed in more secure areas inside buildings. Of particular concern was material staged for the Unit 3 outage, which was scheduled to begin on August 24. The plant staff removed much of this pre-staged equipment to protect the Unit 3 diesel fuel oil tank that was nearby, and that does not have missile protection.

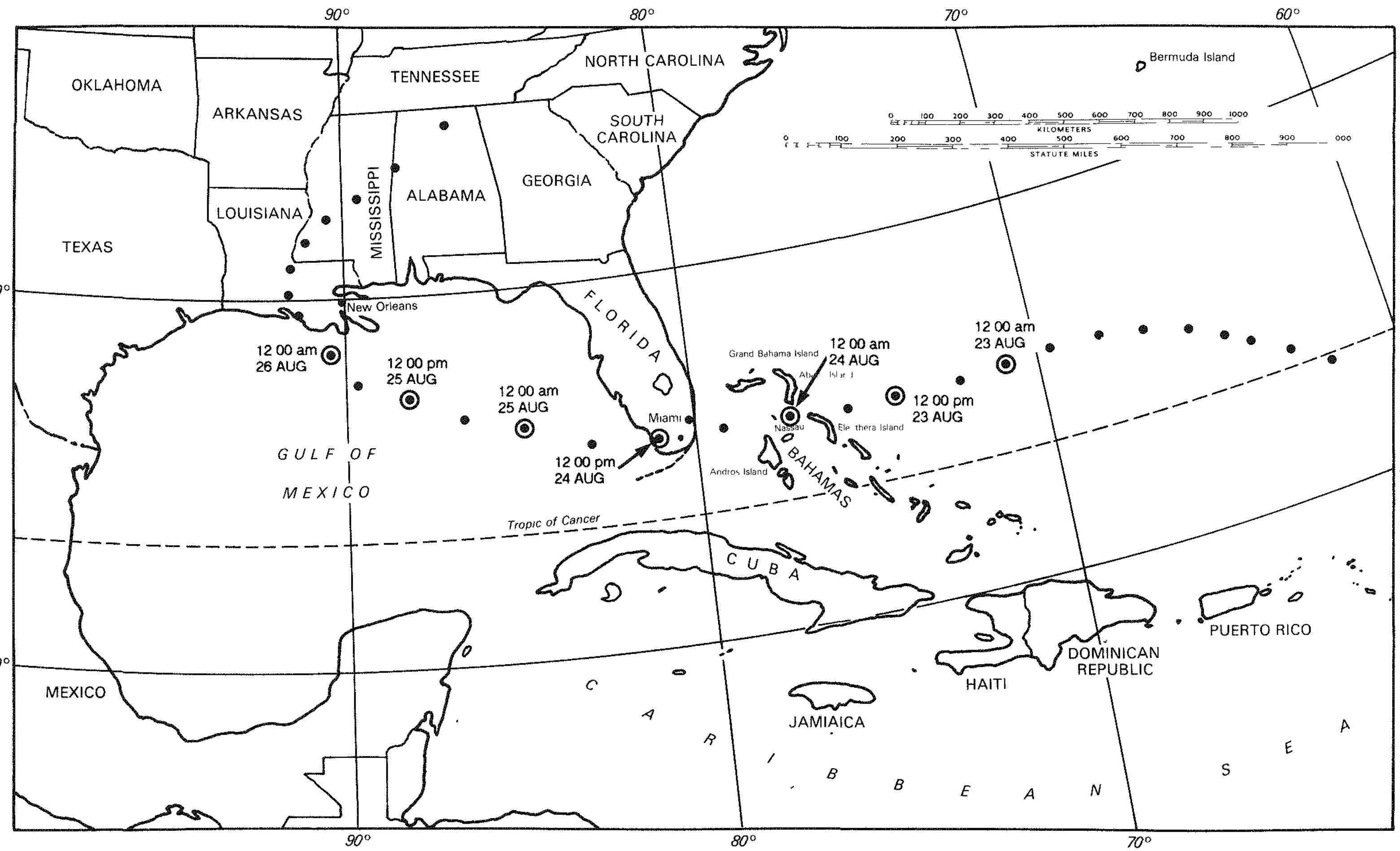

Figure 3.1 Track of Hurricane Andrew

On the morning of Sunday, August 23, the site vice president and the plant manager learned that the Nation Hurricane Center had issued a Hurricane Warning for the Flordia eastern coast from Vero Beach southward through the Florida Keys. Evacuation had been ordered for areas of Monroe, Dade, and Broward counties. The hurricane continued on a steady course with the Turkey Point site directly in its path. FPL responded by declaring an Unusual Event in accordance with site procedures, and began preparations in accordance with the EPIP for a Category 5 hurricane.

By noon on Sunday, the plant mangager ordered the plant staff to begin shutting down Turkey Point Units 3 and 4 at 6:00 p.m. FPL estimated that it would take about 8 hours to complete an orderly shutdown, and decided to stagger the shutdown of the two units by about 2 hours. Thus, for conservatism FPL planned to begin shutting down the first unit about 12 hours before the predicted landfall of Hurricane Andrew. This was conservative since Turkey Point's commitment based on the Station Blackout Rule was to commence a shutdown at least 2 hours prior to the onset of hurricane winds. However, Turkey Point procedures required both units be <u>at least in Mode 4</u> 2 hours before the onset of hurricane winds. Since Turkey Point's main turbines and balance-of-plant supporting equipment are located on an open air turbine deck, it was of interest to have the plant secured well before the onset of winds that would prevent personnel from working outside.

Volunteers who would remain at the plant during the hurricane were identified. Two hundred thirty-five individuals stayed at the two nuclear units during the storm. Throughout the remainder of Sunday, preparations for the storm were completed, and personnel who would remain at the site were allowed to take time off to ensure the safety of their families and to minimize damage to their homes and property. By 6:00 p.m., only those individuals who would stay at the plant during the storm remained.

At 6:00 p.m., the shutdown of Unit 3 began, and 2 hours later, the shutdown of Unit 4 was initiated. The plants were kept in Mode 4 (hot shutdown) rather than Mode 5 (cold shutdown) to retain the steam-driven auxiliary feedwater pumps as an immediate backup method of removing decay heat.

Although EPIP 20106 does not require additional training, the plant manager decided on Saturday to have the operating crews take simulator training on scenarios likely to occur during the hurricane. The operators completed scenarios for loss of instrument air, loss of residual heat removal (RHR), loss of offsite power, and loss of all ac power.

To prepare for the arrival of the hurricane's full force, operators were positioned in each of the EDG control centers located within the Class I diesel buildings. The Unit 3 diesel building and the Unit 4 diesel building are not accessible from the other Class I structures without going outside. Thus, during the height of the storm, personnel might not be able to go to either diesel building or go from one diesel building to the other to check on the diesel operation or to correct any problems that might develop. These operators remained in contact with the control room using onsite communications equipment.

The Technical Support Center (TSC) and the Operational Support Center (OSC) were established in the cable spreading room and the auxiliary building, respectively, where personnel would be safe from the expected high winds and storm surge. The TSC and OSC were declared operational at 11:22 p.m.

By midnight, preparations for the storm were complete, and all personnel were located within Class I structures. Some safeguards duties outside Class I structures and fire watches were discontinued under the provisions of 10 CFR 50.54(x) (see Appendix C). At 2:00 a.m., the plant staff searched the plant site to ensure everyone was in a safe location. By 3:00 a.m., everyone was accounted for.

3.2 Enduring the Storm

By 2:00 a.m., the arrival of Hurricane Andrew began to be felt at the Turkey Point site. Table 3.1 contains instantaneous wind speed data from the 10-meter meteorological tower, which gives an indication of the changing conditions at the site. This information was not available in the control room during the storm.

Table 3.1 Wind Conditions at Turkey Point
on August 24, 1992

Time	Sustained winds		Wind gusts	
(EDT)	(mph)	(km/h)	(mph)	(km/h)
12:00 a.m.	10	16	15	24
2:00 a.m.	24	39	35	56
3:00 a.m.	30	48	45	72
3:30 a.m.	40	64	55	88
4:00 a.m.	60	97	85	137
4:10 a.m.			98*	158*

*anemometer failed

Since the entire plant staff was assembled inside the Class I structures, very little information was available about conditions outside. Since the wind speed data is intended for radiological emergency planning purposes, the data transmitted from the meteorological tower to the control room is collected in 15-minute averages. This data was of limited value, even before the towers and equipment failed. By this time, the eye of the storm had reached the plant. Sustained winds of over 100 mph (160 km/h) had already been experienced. Appendix E contains more information on the performance of the meteorological towers.

The increase in the severity of the storm caused various control board annunciators to alarm. The spent fuel pit low level alarm was received, which caused some concern because the spent fuel pit was not accessible during the storm. Another alarm that caused concern was an instrument air low pressure alarm. Both alarms proved to be spurious, as indicated by other control room instruments.

Between 4:15 and 5:35 a.m., offsite electronic communications were lost. Onsite communications remained available.

At 4:40 a.m., Unit 3 lost offsite power, and at 5:22 a.m., Unit 4 lost offsite power. The emergency diesel generators automatically started and loaded. The smoothness with which the loss of power was handled was due at least in part to the simulator sessions just conducted.

As the storm continued to intensify, the wind and water began to damage electrical equipment. The breaker for motor-operated valve 744A, "RHR Discharge Valve to Cold Legs," failed because of water damage. The redundant train of RHR was not affected. In addition, battery charger 4A2 failed; however, the battery and a redundant battery charger were not affected.

At about 4:40 a.m., the eye of Hurricane Andrew reached Turkey Point. During this period, the winds dropped to less than 20 mph (32 km). The diameter of the eye was approximately 13 miles (21 km), and the center of the eye passed about 1 mile (1.6 km) north of the site. Since Hurricane Andrew was traveling at approximately 16 mph (26 km/h), it took about 45 minutes for the eye to pass over Turkey Point.

The second half of the storm seemed more intense. Sounds of metal twisting could be clearly heard, probably from the turbine canopy covers that had fallen. Much more banging and loud noises were heard during the next hour.

Throughout this period and the recovery, the reactor plant remained in a stable shutdown condition. The plant vital areas were secure and never jeopardized by the storm. See Appendix F for details of the performance of the core cooling system.

3.3 Assessing the Damage

At 7:05 a.m., after the winds had subsided a turbine operator toured the site. In his initial damage report to the control room, he confirmed that no damage was visible to any Class I building or equipment.

At approximately 8:00 a.m., health physics survey teams were dispatched from the TSC and OSC and began surveying the site for radiation. By 10:00 a.m., the entire site was surveyed, and no radiation or contamination was detected (see Appendix G for details). Results were similar to the results of surveys completed before the storm, except that water intrusion had caused slight contamination of the RHR equipment areas, which were posted accordingly. The RHR pit areas for both Units 3 and 4 exhibited slight increases in radiation levels, as expected, because of equipment operation.

Appendix H is a summary of the damage from the storm.

3.4 Managing the Recovery

Damage assessment teams determined the nuclear plant was in a safe condition and relatively undamaged. Thus, efforts were directed to ensuring all other areas of the site were safe for workers. This included determining the structural integrity of damaged buildings and structures, de-energizing downed electrical wires, and removing broken glass and damaged ceilings.

At 8:00 a.m., the site was able to contact the utility General Office in Miami with the message that the Turkey Point nuclear plant was safe, that the plant was in a normal shutdown mode using RHR cooling with all emergency diesel generators operating, and that all plant personnel were safe and accounted for.

One of the earliest and most significant findings of the teams sent to survey the damage to the remainder of the site was that the fire water system had been damaged and was inoperable (see Figure 3.2). Several teams were immediately assigned to establish an emergency fire water system.

The site managers met to organize the immediate recovery of the plant and to prioritize the recovery activities. The following were immediate concerns:

Maintain the plant in a safe shutdown condition on RHR cooling.

Restore fire protection.

Remove, rope off, or otherwise resolve unsafe conditions around the site, such as broken glass, downed power lines, and unstable structures.

Establish reliable external communications.

Restore electrical power to equipment, components, building, structures.

Open roads into the town of Homestead.

Inform utility support at Vero Beach and St. Lucie of the immediate needs: food, water, fuel oil for diesel generators, portable electrical generators, chain saws, hand tools, dry clothes, and personal items.

Restore site physical security and safeguards.

Provide for the humanitarian needs of site personnel.

The Emergency Coordinator was confirmed as the authority for all site recovery activities. The TSC and OSC continued as the site organizations responsible for the recovery. All personnel on site were organized into teams to support the recovery.

During the hurricane, the TSC and OSC buildings were evacuated since they are not Class I structures and not strategically located. The TSC building sustained severe damage and was near the damaged Unit 2 chimney (see Figure 3.3). Therefore, the TSC was moved from the cable spreading room to the Entrance Building, which had lighting from an emergency generator and had sustained relatively minor damage. The OSC was moved to the administration building, and later the TSC was also moved to the administration building when lighting was restored.

Helicopters began arriving with critical supplies by the end of the day of the storm.

Although tree removal equipment on site was inadequate, site personnel opened a path through the levee road by Tuesday morning (day 2). By 6:15 p.m., Palm Drive was opened from U.S. Highway 1 to the site (see Figure 3.4). Site personnel overcame many challenges in clearing debris from the road. For example, the site could not locate a high-voltage detector and had to throw a length of chain over downed electrical cables to determine if they were still energized before continuing to clear and clean the roadway.

The following sections describe the initial efforts to resolve principal concerns. The discussion of each issue is presented in its entirety for continuity; however, the actual events were occurring concurrently.

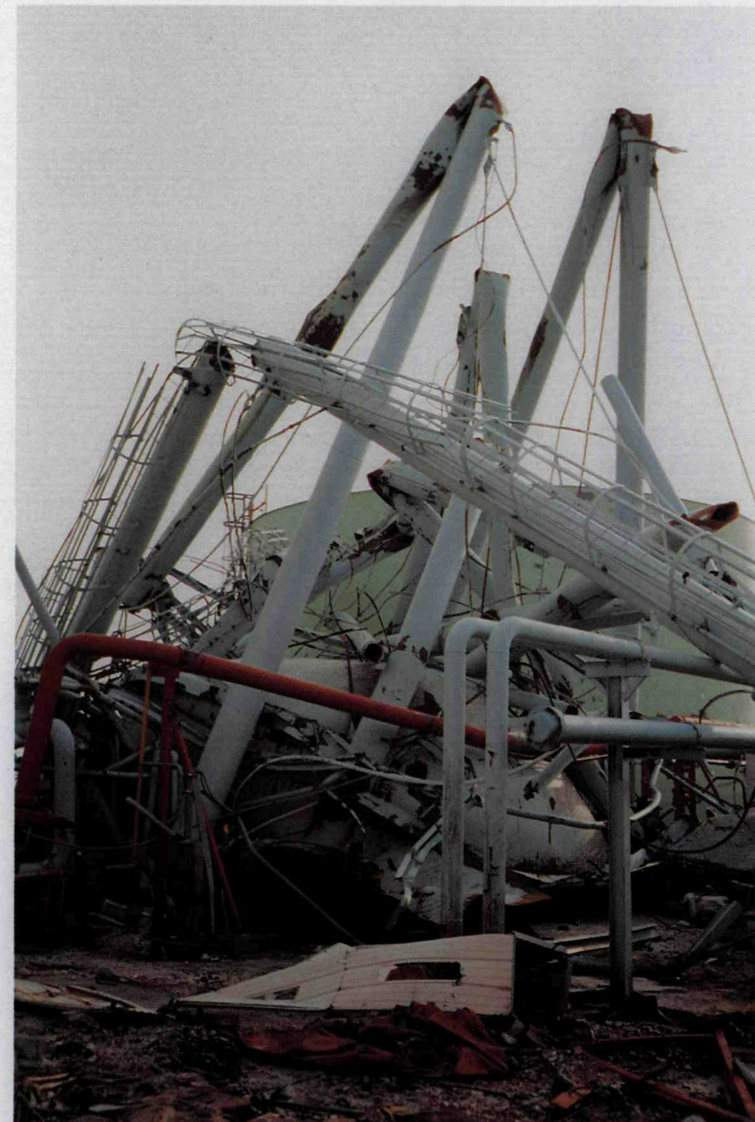

Figure 3.2 Water Tower

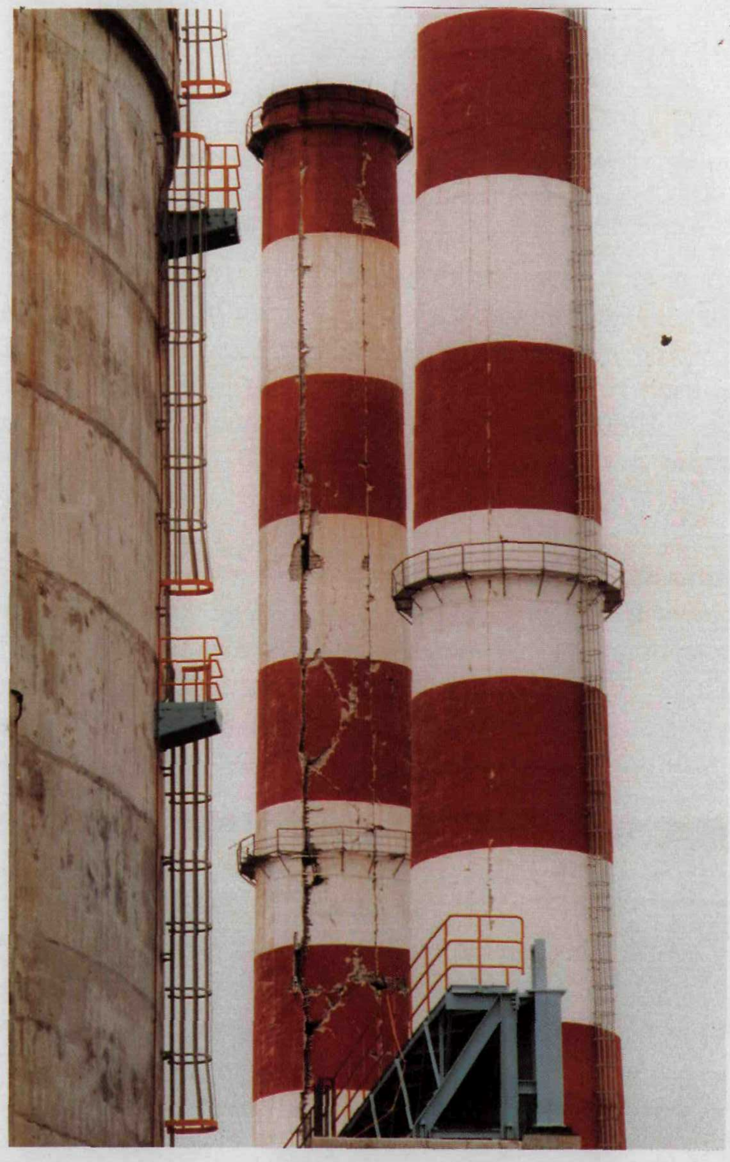

Figure 3.3 Chimneys for Units 1 and 2

3.5 Restoring Offsite Communications

Between 4:15 and 5:35 a.m. on August 24, all offsite communications were lost (see Appendix I for details). The main access road to the facility was also blocked by downed trees.

After the storm, communications were first established using a hand-held radio on the company FM system. This system is not normally used by the nuclear facility; however, the utility Telecommunications Department maintained one portable unit at the site. This system is used in all service trucks by crews in the field to restore power in storm damaged areas. About 8:00 a.m. on Monday, communications were established using the portable radio from the roof of the Security Building to the Lejune Flagler Office Building. Utility Telecommunications then used a commercial telephone to advise the NRC Region II that the Turkey Point facility was in a safe condition and that no personnel were injured. This was the first communication from Turkey Point to the NRC Region II Incident Response Center in approximately 3.5 hours. Region II requested that the telephone line between Telecommunications and NRC be maintained open and that the Turkey Point site give status updates each hour by radio. However, communications were lost again shortly after 9:00 a.m. and were not restored until about 3:30 p.m. Contact with the surrounding areas was made through helicopter flights, with the first flight arriving onsite at 2:00 p.m. on August 24. On the morning of August 25, routine round trip flights began between St. Lucie, the Juno Office, the Miami General Office, and Turkey Point. These flights brought in needed supplies and personnel.

Throughout the day on Monday, attempts were made to establish communications by using portable cellular telephones and by repairing antennas for the permanent cellular phones. At approximately 3:30 p.m., communications were established with the NRC and the State of Florida using a portable cellular telephone in a private automobile in the parking lot. Between 4:00 p.m. and 7:50 p.m., cellular communications became unreliable, but during this period a spare roof antenna for the cellular telephone backup system was installed. This antenna enabled the first outside communications between Turkey Point and the St. Lucie control room. St. Lucie then established continuous communications with the NRC and began relaying information between Turkey Point, NRC, and the Emergency Operations Facility (EOF) in Miami.

On August 24, the NRC made arrangements with the U.S. Department of the Interior, Bureau of Land Management, Boise Interagency Fire Center to provide temporary emergency satellite communications between the Turkey Point control room, NRC, and the EOF. On Monday evening, three technicians and the equipment arrived at the Ft. Lauderdale airport. The individuals and equipment were transported by helicopter to the Turkey Point site, and by 8:15 a.m. on Tuesday, a portion of the system became operational, approximately 28 hours after communications were originally lost.

3.6 Compensating for the Fire Protection System

The high water tank collapsed on raw water tank number 1, destroying portions of the fire water system (see Figure 3.2). The high water tank was a 100,000-gallon (380,000-L) tank that was part of the service water system. The tank was supported on four tubular steel legs. Bracing was provided by compression struts at three different elevations and diagonal tension rods. The height from the ground to the bottom of the tank was about 175 feet (53 m). Appendix J contains additional details on this system's performance.

The fire protection main distribution system consists of two fire pumps which deliver water to the fire protection system main headers. Either pump can take suction from either raw water tank. The screen wash pumps are a backup water supply from the cooling canal once a hose is connected to a fire hydrant.

There are three probable causes for the failure of the high water tank: hurricane winds, a tornado, or a wind-generated missile. The most likely cause of the failure was a wind-generated missile. A missile probably impacted one or more compression struts or tension rods, causing them to fail. This caused the tank support columns to fail, which caused the tank to collapse.

When the high water tower fell, it impacted raw water tank number 1 and caused it to fail. The tower also tore a feeder header for the main water line from raw water tank number 2. This caused raw water tank number 2 to drain. The fire protection electric pump was damaged beyond repair, and the fire pump controller was damaged, rendering the diesel-powered pump inoperable. The two jockey pumps that continuously pressurize the header were also damaged and could not function. These failures caused the fire suppression system to be declared inoperable. This condition and the overall level of damage prompted an Alert to be declared at 9:16 a.m., August 24. At 3:56 p.m., after establishing communications, the utility notified the offsite agencies that an Alert had been declared. Because of the inability to staff continuous fire watches in selected areas after the Alert declaration, continuous roving watches were used.

A special team was formed to temporarily repair the system. The pumps that were staged before the storm for dewatering were used as portable fire pumps, providing an emergency fire water system.

No fires during or immediately after Hurricane Andrew required the use of the automated fire detection and suppression system.

Figure 3.4 Site Access Road (Palm Drive) After Opening

Figure 3.5 View From the Security Building

Figure 3.6 Materials Warehouse

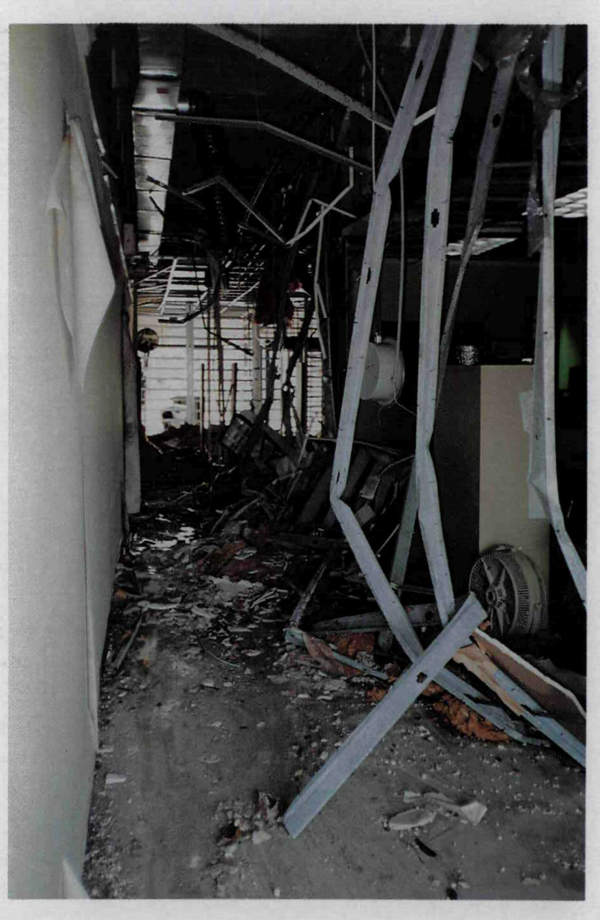

Figure 3.7 Nuclear Entrance Building

Figure 3.8 Employees' Automobiles

Figure 3.9 Employee Parking Lot

3.7 Meeting the Needs of Plant Personnel and Their Families

Most people obeyed the order to evacuate Homestead, Florida City, and the nearby coastal areas. Spouses and children of the site staff were sent north to safe sanctuary. After the winds subsided and daylight came, the effect of Hurricane Andrew was learned. Damage was evident everywhere at the plant. Some Class III buildings and office trailers were destroyed or severely damaged, many windows were broken, and most trees were down or stripped of any foliage (see Figure 3.5). Buildings were damaged (see Figures 3.6 and 3.7) and cars were smashed against one another in the parking lot, some upside down (see Figures 3.8 and 3.9).

With the loss of offsite communications, plant personnel did not know the damage to the surrounding area. Upon hearing the reports from helicopter pilots, some began feeling concern for their families and homes. It was not until late Tuesday that anyone could leave the site and see what happened in the surrounding areas (see Figures 3.10 and 3.11). Most people busied themselves with the work at hand, recognizing they could not communicate with their families or get to their homes with the access roads blocked. Plant volunteers and contractors worked around the clock to clear Palm Drive of fallen trees, power lines, and poles. They cut and removed an estimated 2,500 trees to open the road by 3:00 p.m. on Tuesday.

In the first 2 days after the storm, personnel at the plant had to meet difficult challenges. Much needed to be done, and the plant lacked personnel, materials, and processes normally used to conduct work. There were no lights in support buildings, no computers, few support vehicles that could be used, no basic services and facilities, and only limited bathrooms, drinking water, and food. Everyone at the site helped in the recovery actions. The staff worked around the clock, clearing glass and debris, removing wet and ruined materials from buildings and offices, establishing food services, and starting temporary diesel generators and connecting them to power buildings, secondary plant systems, and lights.

By Wednesday, August 26, a tremendous amount had been accomplished. Air conditioning and power to many of the buildings and plant systems were restored. Trucks were arriving with diesel fuel and basic materials. The first hot meals were served to 500 people in the plant and to another 400 or more in the training center. Schedules were established for working and sleeping, and work was prioritized, and was documented when it was completed. Vehicles were becoming available. An outside vendor was stationed in the parking lot to repair or replace flat tires, as many as 50 each day.

To help employees affected by the storm, a comprehensive employee assistance program was established. The site staff completed activities that went far beyond what anyone had imagined. These activities included the following:

Figure 3.10 Houses in Homestead

Figure 3.11 Damage in Homestead Area

- Living quarters were located or purchased for plant employees. This included mobile homes, motel rooms, and modular buildings.

- Brochures were distributed listing services available at the plant, including emergency phone numbers to call to give or obtain information on families. Locating missing persons was given a priority.

- Personnel were disptached from the plant to look for employees and families known to have lived in the general area.

- Three cellular phones were set up for employees to make calls of up to 10 minutes.

- Cash was brought in by helicopter to enable employees to begin salvaging their property and purchasing basic items. This "bank" operated 24 hours each day for a week until temporary banks were established in the parking lot.

- A small store was set up at the plant and stocked with necessities such as soap, shampoo, clothing, medicine, and items needed by infants and children.

- A daycare center for small children was set up in the training center so that parents could work.

- Seventy rental cars were brought to Turkey Point for employees to use in getting to and from their homes or temporary living quarters.

- Plant workers were organized into repair crews to help employees salvage their homes. These crews repaired over 400 roofs on employees' houses and dried the interiors.

- Food services were established. By Thursday, the Turkey Point staff was feeding about 800 people.

- Field showers were erected on site using typgon tubing connected to water containers and shower heads. This greatly improved morale.

3.8 Restoring Offsite Power

A high priority was placed on restoring offsite power to Turkey Point. The Davis 1 line to the Turkey Point switchyard was energized 4½ days after the storm, but suffered intermittent losses for several hours.

Six and one-half days after the storm, the startup transformers for Units 3 and 4 were energized, and the EDGs were shut down. A second offsite line became available about a day later (see Appendix K for details).

When offsite power was not available, the four EDGs ran continuously to supply plant safety-related loads. An EDG tripped on two instances during this period. Seven hours after the storm had passed, the "A" EDG for Unit 4 tripped during efforts to troubleshoot and isolate a ground on the dc control power supply. The crew immediately recognized that the troubleshooting procedure in use applied when the bus is energized from offsite power but not when the EDG is supplying loads. The EDG was restarted again after a few minutes, and the procedure revised.

The "A" EDG for Unit 3 tripped 3½ days after the storm. Troubleshooting to locate the cause of the trip was unsuccessful, and the EDG was successfully restarted in 2½ hours. No further problems were encountered.

Each EDG was consuming 100 gallons (379 L) of fuel oil an hour. An initial supply of 50,000 gallons (190,000 L) was available for the two Unit 3 EDGs, a 10-day supply. The Unit 4 EDGs had an initial supply of 76,000 gallons (290,000 L) and could have operated for 16 days. Nevertheless, high priority was given to continually replenishing the EDG fuel oil supply. The first delivery was made on Wednesday, shortly after Palm Drive was cleared. Over the next 5 days, 11 truckloads [approximately 77,500 gallons (290,000 L)] of diesel fuel oil were delivered to the site. Thus, when offsite power was restored on August 30, the diesel fuel oil tanks were nearly full.

3.9 Restoring Security and Safeguards

After safeguards were suspended at 2:45 a.m. Monday, August 24, security officers remained in the plant computer room for the duration of the hurricane. After the hurricane passed, crews were sent into the plant to assess the damage to the plant security systems.

At 10:00 a.m., security personnel entered the central alarm station and found the security computer de-energized. The security computer log revealed that the backup security diesel had started when offsite power was interrupted, but had then abruptly tripped. The shutdown was caused by equipment inside the cubicle that sends a shutdown signal when smoke is detected. The diesel exhaust was likely blown back into the cubicle by the high winds and differential pressures during the storm, tripping the diesel. At 10:30 a.m., after an inspection, the site staff restarted the security diesel and restored power to the security system.

Security officers were placed on roving patrols to compensate for the loss of physical integrity of the protected area. Instrument and control technicians were assigned to repair protected area sensors and cameras, and construction personnel were assigned to restore area fences. A detailed plan for restoring each section of the security system was prepared, and on August 29, construction work orders were issued to contract personnel.

By August 29, fences were restored in most areas. Security officers continuously staffed the posts in areas that could not be immediately repaired to compensate for the lack of a physical barrier. Other areas were patrolled or were monitored by security cameras. High priority was given to restoring lighting. Diesel-powered lighting units were used to compensate for lights that had been destroyed.

Badging equipment was damaged and could not be used after the storm. Special badging procedures were established to allow authorized personnel unescorted access. Access controls remained in effect continuously after the hurricane. Appendix L contains additional details of the security system.

3.10 The Effect on Emergency Preparedness

After Hurricane Andrew passed, emergency preparedness personnel began to determine the extent of damage to emergency preparedness equipment and to determine the extent to which the emergency plan could be implemented.

Some of the equipment relied upon for radiological monitoring was rendered inoperable. All communications capability with outside agencies was lost during the storm. However, the existing emergency plan considers these circumstances and contains contingency measures. Most of the emergency preparedness zone (EPZ) had already been evacuated before the hurricane, and both units were shut down and stable in Mode 4. By 2:00 a.m. August 27, communication systems were re-established.

Although most emergency sirens had been destroyed, the State of Florida's radiological emergency plan has a contingency plan for the loss of emergency notification sirens. Appropriate city and county agencies are used to alert people in the surrounding areas in lieu of the sirens.

Both the 10-meter and the 60-meter meteorological towers and their attendant equipment were inoperable after the hurricane. However, the emergency plan allows the use of worst-case default data in dose assessment calculations. This approach is more conservative than using actual meteorological data.

The storm damaged or destroyed the environmental monitoring equipment maintained by the plant, the NRC, and the State in and around the EPZ. Some monitors were found during searches of areas where the equipment had been. The storm also destroyed air-sample stations; however, portable air-sampling equipment and dosimetry equipment were available at the site if needed. Computer systems used for emergency response include the dose assessment computer (calculates offsite dose), the FPL grid computer (used for monitoring the FPL electrical grid), and the Emergency Response Data Acquisition Display System (monitors plant parameters). These computers were not damaged and were available when temporary power was supplied.

3.11 Spare Parts and Supplies

The spare parts warehouse was extensively damaged (see Figure 3.6), and most of the spare parts were damaged or scattered. Parts that were found in apparently satisfactory condition had to be evaluated and perhaps tested before use. The hurricane also disabled the normal Turkey Point onsite procurement process because the process requires the use of a computer, and these computer systems were without power for several days.

During the first week after the hurricane, personnel at the St. Lucie plant were extremely helpful in procuring emergency supplies and equipment for Turkey Point. Later in the recovery, St. Lucie personnel also supplied many maintenance spare parts. Turkey Point and St. Lucie use the same plant work order system, improving the ability to procure and share spare parts.

3.12 Miscellaneous Issues and Problems

Appendix M is a further description of the performance of the plant lighting system. Appendix N details the spent fuel pool performance. Appendix O is a description of the design and performance of the turbine canopy. Appendix P includes details of the fossil plant's two chimneys and the damage which they received during the storm. The Unit 1 chimney was severely cracked and was removed by controlled demolition on September 4. Figure 5 shows the condition of the chimney after the storm.

APPENDIX A

NRC/INPO TEAM CHARTER

FOR HURRICANE ANDREW'S IMPACT

ON TURKEY POINT UNITS 3 AND 4

APPENDIX A

NRC/INPO TEAM CHARTER FOR HURRICANE ANDREW'S IMPACT ON TURKEY POINT UNITS 3 AND 4

The overall goal of the review is to describe the damage and compile the experience gained from the impact of Hurricane Andrew on Turkey Point Units 3 and 4 that may benefit Turkey Point and other reactor facilities subject to hurricanes. The emphasis of this review is to identify those areas, events or conditions which were problematic for the facility and staff, as well as those special preparations or actions which had a positive effect on the course and consequences of events relevant to plant safety. This review should cover the prior planning and preparations and initial actions taken by the utility up through the restoration of an external ac power source.

The team shall begin its onsite review at such time that the utility and Region II agree that site conditions have sufficiently improved to accommodate the team. The onsite review shall be conducted in a manner which is nonintrusive to the utility's recovery activities.

The scope of the review should include a qualitative determination and description of the effects on the safety-related structures, systems, and major components, including system (or structural) interactions. The review also should separately include a qualitative determination and description on the effects to the remainder of the plant and site; with an emphasis on plant equipment needed for power operations. Where possible (or feasible), the time and approximate wind speed at which damage or failure occurred should be determined. The related compensatory measures that were taken and their effectiveness should also be determined and described.

Within the overall goal and framework of this scope the team should compile the experience related to:

> Facility operating and human resource decisions as a result of advance weather predictions and existing procedures and plans.

Emergency preparedness and emergency response as it relates to utility internal actions and interactions with local counterparts (State and local authorities); the onsite and offsite communications systems; and the security systems.

The impact on safety equipment of nonsafety-related equipment damage.

Problems with systems, such as the fire protection, and plant lighting, resulting from the hurricane and the respective compensatory measures taken.

Human performance and needs related to shift manning and coping, including issues associated with food and potable water supplies and site access.

The scope of this review does not include:

Assessment of violations of NRC rules and requirements.

Review of the design and licensing bases for the facility except as necessary to understand the significance of the experience.

Assessment of offsite emergency response capabilities of State and local authorities.

Team membership, conditions of the review and report preparation shall be as follows:

Management oversight of the team will be provided by the Director, Office for Analysis and Evaluation of Operational Data (AEOD), NRC, and the Vice President and Director, Analysis Division, INPO.

Team leadership will be joint with Co-leaders provided by NRC and INPO.

Team membership will be approved jointly by the Director, AEOD and the Vice President and Director, Analysis Division, INPO.

Team member expertise should include operational knowledge with related knowledge in structural, reactor/plant systems, electrical systems, emergency preparedness and response, human performance, and telecommunications.

The team size should not exceed eight members.

The review shall be confined to information collection and compilation of experience. Photographs of damage should be collected and used where possible.

The duration of the onsite review is proposed to be about 1 week.

The team shall prepare a single report, containing the combined NRC and Industry review results. Where appropriate, the report may be structured to provide for individual views, as they relate to the factual information to be contained in the report. The team report may include conclusions but shall not include recommendations. Final review and approval of the team report will be made jointly by the Director, AEOD and the Vice President and Director, Analysis Division, INPO.

The combined team report should be completed within about 45 days after the team departs from the site. The team report may be used or referenced by the utility. The team report will be published and made publicly available in the PDR.

Approved:	Approved:
James M. Taylor Executive Director for Operations U.S. Nuclear Regulatory Commission	Zack T. Pate President Institute of Nuclear Power Operations

Effective Date: September 10, 1992

APPENDIX B

INDIVIDUAL PLANT EXAMINATION

AND INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS

APPENDIX B

INDIVIDUAL PLANT EXAMINATION AND INDIVIDUAL PLANT EXAMINATION OF EXTERNAL EVENTS

In implementing the U.S. Nuclear Regulatory Commission (NRC) Severe Accident Policy Statement, the NRC has requested licensees to perform systematic examinations of their nuclear power plants to find plant-specific vulnerabilities to severe accidents, which are beyond the design basis. The NRC requested these evaluations for internally initiated events in Generic Letter (GL) 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities," and for external events in GL 88-20, Supplement 4.

In June 1991, Florida Power and Light (FPL) submitted its individual plant examination (IPE) for internally initiated events, which also included the results of analyses of external events caused by wind and fire.

In determining the susceptibility to wind hazard, calculations of chimney failure based on a 145-mph (233-km/h) wind speed required to overturn the chimney were performed. Various structures and components that could be damaged by the chimney failure were found. These were declared as "failed" in the analytical model and core damage frequencies obtained for a number of sequences. In all cases, the sequence frequencies were less than the 1E-7 screening criterion used and were not considered further.

The IPE analyses also included a determination of plant susceptibility to storm surge. Storm surge is an abnormal rise in the local water level caused by the wind and pressure forces of a hurricane. The nuclear units are designed to withstand a storm surge of 20 feet (6.1 m). This is based on the protection provided by flood walls and stoplogs around the perimeter of the plant.

The conclusion in the hurricane analysis for the IPE was that storm surge dominated all other hurricane hazard components. Some plant modifications were identified, which included improved stop logs and component cooling water (CCW) system flood wall modifications completed before the storm. On August 11, 1992, the utility issued a revision of EPIP 20106, "Natural Emergencies," which included specific procedures and steps to be implemented for a Class 5 hurricane. The revised procedure was used in preparing for Hurricane Andrew.

The NRC informed the utility that its IPE submittal met the intent of GL 88-20. However, the review of the external events analyses has been deferred until the remaining analyses of external events, such as those for the earthquake, were submitted in response to GL 88-20, Supplement 4.

APPENDIX C

THE USE OF 10 CFR 50.54(X)

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THE USE OF 10 CFR 50.54(X)

The provisions of Section 50.54(x) of Title 10 of the Code of Federal Regulations (10 CFR 50.54(x)) allow senior licensed personnel to take reasonable action that departs from a license condition or technical specification in an emergency when this action is immediately needed to protect the plant and the public health and safety and when no action consistent with license conditions and technical specifications that can give adequate or equivalent protection is immediately apparent. The following is a list of departures from technical specification requirements at Turkey Point during Hurricane Andrew where plant operating personnel invoked the provisions of 10 CFR 50.54(x).

(1) On August 24, 1992, at 2:45 a.m., all fire watches were suspended. The emergency coordinator suspended the fire watches under the provision of 10 CFR 50.54(x) to ensure the safety of these personnel during Hurricane Andrew. By 4:45 p.m., a 30-minute fire patrol of all posts was established. Compliance with Bulletin 92-01, "Failure of Thermo-lay 330 Fire Barrier System to Maintain Cabling in Wide Cable Trays and Small Conduits Free from Fire Damage," issues involving Thermo-Lag was being accomplished by closed circuit television (CCTV) with a continuous fire watch before Hurricane Andrew. After Hurricane Andrew, the Bulletin 92-01 areas were compensated by 10-minute fire patrols which were established at 4:45 p.m. on August 24, 1992. At 4:45 p.m. on August 24, full technical specifications compliance for fire watches was achieved. At 9:00 a.m. on September 8, the CCTV monitors with a continuous fire watch were re-established.

(2) On August 24 at 2:45 a.m., the emergency coordinator brought security officers into the plant computer room for the duration of the hurricane under the provisions of Section 3.2.3 of the Turkey Point Security Plan and 10 CFR 50.54(x) to ensure the safety of these personnel. Compensatory security measures were taken immediately after the hurricane. All safeguards were reinstated at 12:20 p.m., September 22, 1992. Those security zones not in normal operation at this time were compensated with continuous security watches.

(3) Technical Specification 3.4.9.3, "Overpressure Mitigating Systems," states that in Modes 4, 5, and 6 with the reactor vessel head installed and with the reactor coolant system average temperature of below 275 °F (135 °C), at least one of the following two overpressure mitigating systems shall be operable.

- two power-operated relief valves each with a lift setting of 415 (±15) psig [2861 (±103) kPa], or

- the reactor coolant system depressurized with a vent of internal cross section greater than or equal to 2.20 square inches (14.2 cm^2).

Action statement b.2 states that, with both power-operated relief valves inoperable, the licensee must depressurize and vent the reactor coolant system through at least a 2.20-square-inch (14.2-cm^2) vent within 24 hours.

On August 24, 1992, at 4:30 a.m., with both units in Mode 4, the temperature in the Unit 3 reactor coolant system fell to below 275 °F (135 °C). On August 25, 1992, at 2:30 a.m., the temperature in the Unit 4 reactor coolant system fell to below 275 °F (135 °C). The overpressure mitigating system was not verified operable, and the reactor coolant system was not depressurized or vented within 24 hours. The utility took these actions under the provisions of 10 CFR 50.54(x) to avoid performing the system tests after finding an increased potential that an error could degrade (depressurize) the reactor coolant system. Operations personnel concluded that the use of emergency portable lights would be required inside containment to perform this surveillance and that these portable lights would make an error more likely.

The control room portion of the testing of the overpressure mitigation system (OMS) was successfully accomplished by cycling the power-operated relief valves. The complete OMS for Unit 4 was tested and verified operational on September 6 at 2:25 p.m., and the OMS for Unit 3 was tested and verified operational on September 7 at 3:00 a.m. for Unit 3. These tests were performed after stable offsite power was restored and normal lighting was again available inside containment.

(4) Technical Specification 3.8.1.1, "AC Sources," requires two startup transformers and their associated circuits for Modes 1 through 4. Action statement (e) states that with two of the required startup transformers or their associated circuits inoperable, in addition to other required actions, the operator must restore at least one of the inoperable startup transformers to operable status within 24 hours or cause the reactor to be in hot standby within 6 hours and in cold shutdown within the next 30 hours.

The plant has three steam-driven auxiliary feedwater (AFW) pumps shared between Units 3 and 4. Operation of these AFW pumps requires that the plant be in at least hot shutdown mode so that steam is available to operate the pumps. Both units remained in hot shutdown during and immediately after the hurricane. Under the provisions of 10 CFR 50.54(x), both units were maintained in hot shutdown mode to ensure two methods of cooldown were always available. This provided two methods of reactor cooling: the residual heat removal (RHR) system with electrical power from the emergency diesel generators and, as backup, the use of AFW with the steam dumps.

(5) Technical Specification 3.8.1.2, "AC Sources," requires that specified ac electrical power sources be operable for Modes 5 and 6. These power sources include one startup transformer and associated circuits, or an alternate circuit, between the offsite transmission network and the 4160-V bus, "A" or "B." The action statement states that with less than the above minimum required ac electrical power sources, the operator must within 8 hours depressurize and vent the reactor coolant system through a vent with an internal cross section greater than or equal to 2.20 square inches (14.2 cm^2).

Under the provisions of 10 CFR 50.54(x), the licensee did not depressurize and vent Units 3 and 4 within 8 hours to ensure that two methods of removing decay heat (RHR and AFW) were always available.

Thus, Hurricane Andrew prompted FPL to invoke 10 CFR 50.54(x) in several cases. Management concluded that 10 CFR 50.54(x) provided the necessary flexibility to cope with and recover from the effects of the storm.

APPENDIX D

HURRICANES AND HURRICANE PREDICTION

APPENDIX D

HURRICANES AND HURRICANE PREDICTION

Hurricane Characteristics

Major hurricanes, particularly those rated as Category 4 or 5, are of most concern for nuclear power plants. Category 5 hurricanes are quite rare; only two (the Florida Keys Hurricane in 1935, and Hurricane Camille in 1969) have hit the U.S. coast since 1900.

Table 1.1 Saffir/Simpson Hurricane Scale
(U.S.)

Category	Pressure (millibars)	Winds speed (mph)	Storm surge (feet)
1	>979	74-95	4-5
2	965-979	96-110	6-8
3	945-964	111-130	9-12
4	920-944	131-155	13-18
5	<920	>155	>18

(metric)

Category	Pressure (kPa)	Winds speed (km/h)	Storm surge (m)
1	>97.9	119-153	1.2-1.5
2	96.5-97.9	154-177	1.6-2.4
3	94.5-96.4	178-209	2.5-3.7
4	92.0-94.4	210-249	3.8-5.5
5	<92.0	>249	>5.5

However, Category 4 hurricanes are not infrequent events. Fourteen have hit the United States since 1900. On the average, a Category 4 or 5 hurricane strikes the U.S. every 6 years, although there were 20 years between the last two Category 4 or 5 hurricanes, Hurricane Camille in 1969 and Hurricane Hugo in 1989. Two major hurricanes (i.e., Category 3 or above) strike the U.S. every 3 years.

Although wind speed is the factor of most interest related to a hurricane, it is generally not a reliable indicator of the intensity of a hurricane. Most anemometers are designed to measure winds only up to about 100 mph (161 km/h) and generally will fail at wind speeds found in Category 4 and 5 hurricanes. This was the case for Hurricane Andrew. Not a single anemometer exposed to the highest winds of Hurricane Andrew survived. Thus, there are no official data of the sustained surface wind speed in the region of maximum wind speed at the U.S. landfall of Hurricane Andrew.

Wind speed in a hurricane varies significantly with altitude. The standard measurements are made at a height of 10 meters. However, wind speeds at elevations above 80-100 feet (24.4-30.5 m) may be 20-25 percent higher than those observed at 10 meters.

Barometric pressure in the eye of the storm is a more reliable measure of a storm's intensity. Several barometers in locations that experienced the worst conditions during Hurricane Andrew survived and recorded reliable information about the storm.

The National Hurricane Center estimated that the lowest barometric pressure produced by Hurricane Andrew was 926 millibars (mb) (92.6 kPa). This would rank Hurricane Andrew as the third most intense storm to hit the United States since 1900. The following is a table of the most intense hurricanes to hit the United States since 1900.

Table 1.2 Most Intense Hurricanes, United States 1900-1991

Hurricane	Year	Pressure (mb)	(kPa)	Category
1 Florida Keys	1935	892	89.2	5
2 Camille	1969	909	90.9	5
3 Andrew	**1992**	**926**	**92.6**	**4**
4 Florida Keys	1919	927	92.7	4
5 Florida Keys	1928	929	92.9	4
6 Donna	1960	930	93.0	4
11 Hugo	1989	934	93.4	4

There is a strong correlation between barometric pressure and wind speed. A pressure of 926 mb (92.6 kPa) would correlate to wind speeds of approximately 145-155 mph (233-249 km/h) with gusts to at least 175 mph (93 kPa).

A 125-mile (201.17-km) diameter circle approximates the region of hurricane force winds for a "typical" hurricane. A Category 4 hurricane would typically have hurricane winds out to 50 miles (80 km) to the left of the direction of motion of the hurricane, and 75 miles (121 km) to the right of the direction of motion. By contrast, Hurricane Andrew was relatively compact for its intensity, generating hurricane force winds for only about 20 miles (32 km) to the left (south) and 40 miles (64 km) to the right (north) of its track. The radius of maximum winds was about 12 miles (19 km).

Storm Surge

Typically the storm surge creates the greatest damage associated with a hurricane. The extreme low pressure in the eye of a hurricane lifts water into the eye as if it were being sucked up into a straw. When this mass of water reaches the shallow shore line, it produces a surge of water that rushes ashore. The height of this storm surge will be compounded by wind-driven waves and may be compounded by local high tides.

The storm surge generally causes the greatest loss of life, greater than that caused by the extreme winds. Therefore, the extent of the evacuation associated with a major hurricane is generally based on the expected effect of the storm surge.

The highest storm surge of Hurricane Andrew was 16.9 feet (5.15 m) at a location approximately 10 miles (16 km) north of Turkey Point. This is the highest storm surge ever recorded in Florida. Miraculously, this surge occurred in a relatively unpopulated area which had been thoroughly evacuated. This surge did not cause a single life to be lost.

By contrast, the storm surge at Turkey Point was less than 7 feet (2 m). Turkey Point is designed to withstand a storm surge of at least 20 feet (7 m). Extensive preparations were made in accordance with EPIP 20106 to cope with the expected storm surge.

Tornadoes

Tornadoes generally form around the fringe of a hurricane. These tornadoes are generally not as severe as those produced by summer thunderstorms. The National Hurricane Center did extensive investigations after Hurricane Andrew to determine whether tornadoes were formed as Hurricane Andrew passed over Florida. Only one location was found where a tornado might have touched down. Thus it is very unlikely that a tornado hit Turkey Point and caused the extensive damage to the Unit 1 chimney.

Storm Prediction and Nuclear Plant Preparations

The Turkey Point plant staff had previously experienced several hurricanes and knew they would need to act early to prepare for Hurricane Andrew. Initial preparations began almost 4 days before Hurricane Andrew hit the site, and significant effort was spent during the 24 hours before for the storm.

Turkey Point had very detailed procedures (i.e., EPIP 20106) and experience which lead to the extensive preparations for Hurricane Andrew. Comparable procedures and experience may not exist at other plants.

On August 22, Hurricane Andrew turned due west and continued on this straight track for over 60 hours until it made landfall near Turkey Point. The storm accelerated as it moved westward, making landfall about 2 hours earlier than initially expected. Although Hurricane Andrew was quite predictable, other hurricanes have been remarkably unpredictable. Hurricane Diana, which hit the Brunswick Nuclear Plant in 1984, demonstrated this unpredictability. Hurricane Diana headed directly away from Brunswick less than 18 hours before it hit the site. Figure D.1 depicts the track of Hurricane Diana.

Although Hurricane Andrew arrived at Turkey Point about 2 hours earlier than initially expected, the plant and the plant staff were ready. The operators had reviewed the applicable procedures on the simulator, personnel had been moved to safe locations, and the plant was shut down in Mode 4.

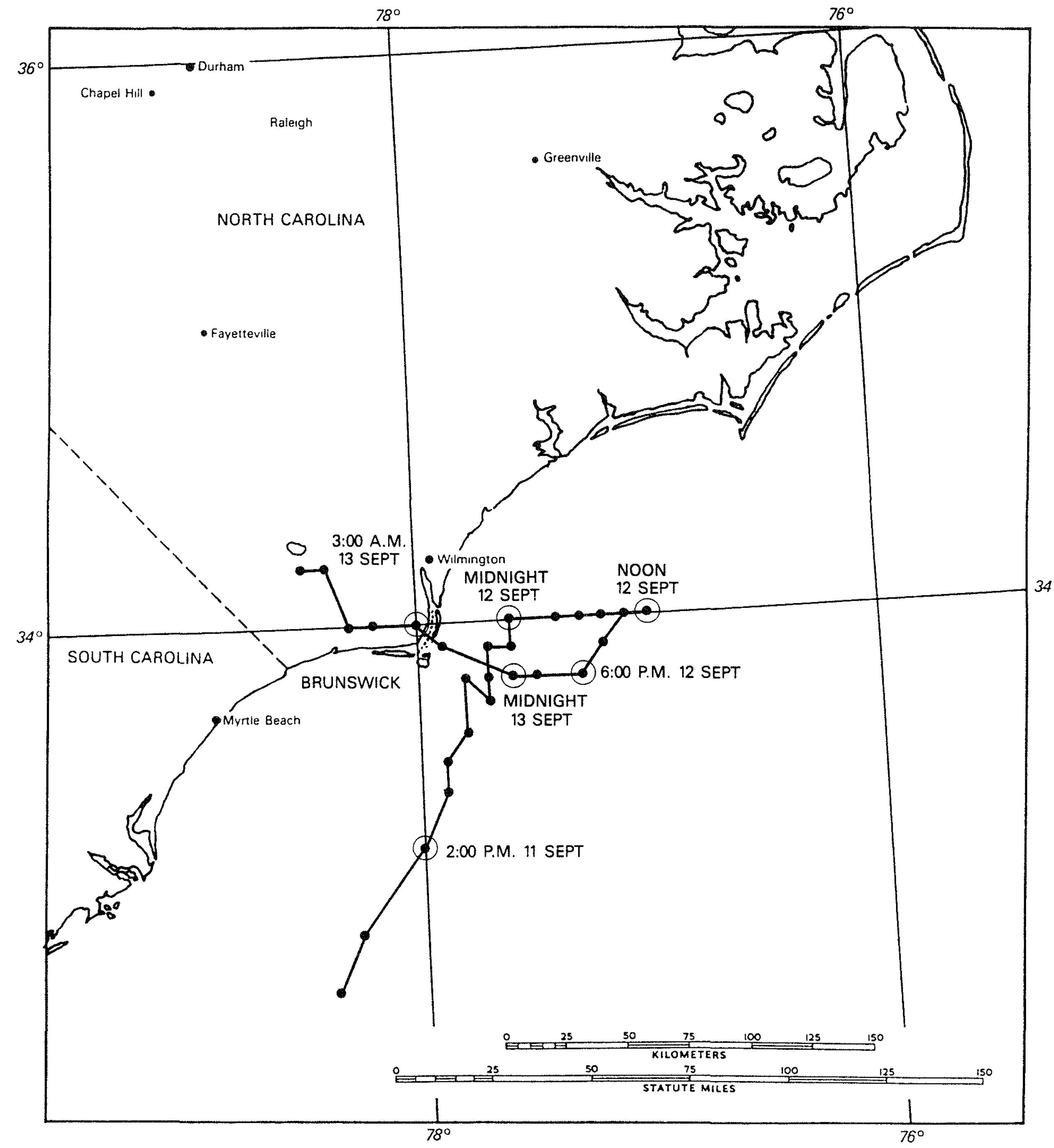

Figure D.1 Track of Hurricane Diana

APPENDIX E

METEOROLOGICAL TOWER

APPENDIX E

METEOROLOGICAL TOWER

Turkey Point maintains two meteorological towers, a 10-meter tower and a 60-meter tower. The instruments on these towers supply data to the control room, the Technical Support Center (TSC), and the Emergency Operations Facility (EOF) through the Emergency Response Data Acquisition and Display System (ERDADS).

Meteorological data is required to estimate offsite radiation exposure in the event of a release of gaseous radioactivity. The parameters needed are wind speed, wind direction, and a measure of atmospheric stability (temperature measured at two elevations).

The 10-meter tower was 2 miles (3 km) southwest from the plant. The tower is a 40-foot (12-m) wooden utility pole. The tower included a wind direction indicator and a wind speed anemometer designed to record wind speeds from 0-100 mph (0-161 km/h). These instruments supplied the control room with 15-minute averages of wind velocity and direction.

The 60-meter tower is located 7 miles (11 km) southwest from the plant. The tower is a metal lattice structure secured by wires and includes instruments at the 10-meter and 60-meter levels. The instruments include a wind speed anemometer (0-100 mph), a wind direction indicator, and two temperature sensors. The data supplied to the site includes 15-minute averages of the wind velocity and direction.

Each tower site includes an instrument building and an emergency diesel generator (EDG) designed to start on a loss of power to the tower. A radio transmitter uses a radio antenna on the tower to transmit data from the tower to the plant. The instrument building for the 10-meter tower is constructed of concrete blocks, and the building for the 60-meter tower is a steel structure.

The 10-meter tower was severed at ground level, but the block building that housed the instruments was not damaged. The highest wind velocity measured by the 10-meter tower was 100 mph (161 km/h).

The 60-meter tower was not structurally damaged. However, the instruments, including the anemometer, were destroyed.

The EDG for the 60-meter tower apparently attempted to start when power to the tower was lost. However, the diesel failed to successfully complete the starting cycle. The sudden and severe changes in air pressure caused by the high winds in the diesel intake and discharge were a likely cause of the failure to start.

The radio antenna on the 60-meter tower survived the hurricane, and the transmitter and antenna worked properly when power was later restored.

APPENDIX F

EMERGENCY CORE COOLING SYSTEM

APPENDIX F

EMERGENCY CORE COOLING SYSTEM

Emergency Core Cooling System

The emergency core cooling system (ECCS) performed as designed. When offsite power was lost, the associated emergency diesel generators (EDGs) automatically started and loaded, but core cooling was momentarily interrupted. The residual heat removal (RHR) pumps were restarted with power from the associated EDGs. The RHR pumps for Unit 3 were off for a total of 1 minute and those for Unit 4 were off for 3 minutes.

The ECCS consists of the safety injection system, the accumulators, and the RHR system. The four high head safety injection pumps take a suction on the two 335,000-gallon (1,268,000-L) refueling water storage tanks (RWSTs) and deliver borated water to the cold legs of the reactor coolant system (RCS). Any two safety injection pumps can perform the intended safety function for a single unit.

The safety injection system functions under emergency conditions to deliver borated water from the refueling water storage tank to the RCS cold legs during the injection phase of a loss-of-coolant accident. During the recirculation phase, the RHR system operates with the safety injection, containment spray, intake cooling water (ICW), and component cooling water (CCW) systems to remove heat from the core and from the containment atmosphere.

The RHR is normally used to remove the decay heat during plant startup, cooldown and refueling when coolant pressure is less than 450 psig (310 kPa) and temperature is less than 350 °F (177 °C). During normal decay heat removal operations, either or both pumps take suction from the loop "C" hot leg through a header and discharge through two heat exchangers to the RCS. The CCW system cools the heat exchangers in a closed-cycle system that is cooled by the ICW system.

The ECCS is a Class I system contained in Class I structures. However, the RWSTs are located outside near the auxiliary building and are not protected from wind-driven missiles.

Intake Cooling Water System

The ICW system cools the RCS during Modes 4 and 5 by way of the RHR system and the CCW system. Sea water from the intake canal enters four separate intake bays for each unit. A traveling screen in each bay removes trash from the water. Three of these bays include a separate suction for one of the three ICW pumps for each unit. Each of three ICW pumps for each unit discharges through basket strainers to normally cross-connected, redundant headers, such that the heat exchangers in the CCW system receive sea water flow from either header. The basket strainers are backflushed to clean them.

The ICW system includes isolation valves between the 100-percent capacity headers and the three pumps. To ensure the ICW pumps operate under flood conditions such as during a hurricane storm surge, the motors are installed above the maximum flood level. The ICW pumps are beside the main circulating water pumps, and are not protected from wind-driven missiles. The CCW pumps are inside missile shields next to the auxiliary building. The nonsafety-related condenser circulating water (CC) pumps also take suction from these intake bays.

The ICW, CCW, and RHR are all Class 1 systems. The "A" and "B" ICW pumps are powered by 4160-V buses which can be powered by associated EDGs. The "C" pump is powered by a swing 4160-V safety-related bus which can be powered by aligning the bus manually to either EDG. The traveling screen wash pumps are powered from a nonsafety-related source.

The ICW pump lower bearing is normally lubricated by fresh water from the nonsafety-related service water system (SWS). If the SWS is lost, the ICW pump lower bearing is self lubricated with sea water. The ICW pump is designed to operate for up to 30 days in this self-lubricating mode. During normal operation, two ICW pumps supply flow to the three CC heat exchangers. When a unit is shut down, only one ICW pump supplies flow to two CC heat exchangers.

The ICW system continued to operate as designed throughout the hurricane and recovery. The storm caused only minor, superficial damage to the system even though the RWSTs and the ICW pumps are located outside and are not protected from wind-driven missiles. After the loss of offsite power, an EDG powered one ICW pump for each unit. The ICW pumps continued to provide ample cooling water flow to the ICW system throughout the hurricane and the recovery.

After the loss of offsite power, the nonsafety-related traveling screens and screen wash pumps lost electrical power. The nonsafety-related "C" bus later supplied the screen wash pumps with power to temporarily supply the damaged fire water system.

During the hurricane, a high bearing temperature alarm was received for the "3A" ICW pump motor. The operators stopped the pump and placed another in service. No cause for the alarm was found during subsequent troubleshooting.

The initial damage assessment on Monday morning revealed that about 1500 gallons (5,700 L) of Bunker C fuel oil had spilled on to the surface of the intake canal at the intake structure. This spill prompted concern about the consequences to the environment and to the screen wash pumps, which supply the fire water header from this canal. However, water samples from these systems showed that the oil did not enter the pump suctions. The suctions for the ICW and screen wash pumps are approximately 12 and 8 feet (3.7 and 2.4 m) below the surface, respectively. The oil was removed at the end of the week.

High differential pressures were measured across the ICW basket strainers after the hurricane. However, all cooling water temperatures were well within limits. The strainers were backflushed and checked each hour thereafter.

APPENDIX G

RADIATION PROTECTION

APPENDIX G

RADIATION PROTECTION

Radioactive Waste

Minimal quantities of low level radioactive waste (LLRW) and dry active waste (DAW) were stored at the site awaiting processing. In recent years, Florida Power and Light (FPL) had reduced the stored quantities of these materials to approximately 2500 cubic feet (70.8 m^3) stored in 32 Sealand containers used for storing construction materials contaminated with low levels of radioactive material. In addition, one high integrity container of solidified resins was stored in an area of the radwaste building that was not effected by the storm. Before the storm, radioactive materials were secured, including the DAW and 32 SeaLand containers. After the storm, the storage containers were inspected, but none were found breached. Radiation surveys in areas around the stored materials showed no changes in radiation levels and no contamination released as a result of the storm.

Radiological Surveys

Immediately after the storm, at approximately 8:00 a.m. on August 24, survey teams dispatched from the technical support center (TSC) and the operational support center (OSC) surveyed the site using micro-R survey meters and verified that no adverse radiological conditions existed. Radiation and contamination area boundaries were posted or reposted where required. Control points were established at the TSC and OSC in accordance with the emergency plan. The teams found that the radiation levels inside the plant boundaries were within expected background levels or were similar to the levels found during surveys before the storm, with one exception. Water intrusion caused the residual heat removal (RHR) equipment areas to be slightly contaminated. In addition, the team found that the radiation levels in the RHR pit areas for both Units 3 and 4 had increased as expected because of equipment operation.

Within a few hours of the storm, most of the remaining work involved restoring radiation protection facilities including records, monitoring equipment, health physics (HP) offices, and RCA portals. The hurricane damaged the roof of the HP building, which allowed water to enter the building, damaging some equipment and materials.

For example, the water rendered the whole body counter temporarily out of service. FPL leased a stationary bed geometry whole body counter to supplement the damaged unit.

Radiological Monitoring Systems

Liquid Effluent Systems

When the site lost offsite power, the main waste disposal system effluent lines and the steam generator blowdown effluent lines were isolated. There were no planned or unplanned releases of liquid effluent during or immediately after the storm.

Gaseous Effluent Systems

The main stack can receive effluent from the Unit 3 and 4 containments, the Unit 4 spent fuel pool, the Auxiliary Building, and the radwaste building. Unlike the spent fuel pool for Unit 4, the Unit 3 spent fuel pool exhausts directly to the atmosphere with separate radiation effluent monitors. The steam jet air ejectors for each unit exhaust directly to the atmosphere and are fitted with effluent monitors.

Vent Stack and Radiation Monitoring Systems

The vent stack is supported on the Auxiliary Building roof and is attached to the top of the Unit 4 containment. The stack extends approximately 200 feet (61 m) above the Auxiliary Building. The vent stack is a Class III structure. The design wind pressure is 37 psi (1.77 kPa) [120-mph (193-km/h) wind speed equivalent] with appropriate shape factors as required by the South Florida Building Code. Tornado loads are not considered in the design of Class III structures.

At 1:00 a.m. on August 24, the approaching hurricane caused the first minor damage: the loss of system particulate, iodine, and noble gas (SPING) monitoring. The reason for the loss of SPING monitoring at 1:00 a.m. is not known.

The vent stack remained intact, but wind caused damage to the anchorage of the stack to the Auxiliary Building roof. The vent stack base anchors lifted 3/8 inch (0.95 cm), and the concrete topping slab spalled. The failure of the vent stack anchorage caused no direct consequences.

Wind or wind-generated missiles caused failures of some ductwork. The major failure was of the ductwork from the Radioactive Waste Building to the vent stack. The exhaust ductwork from the Radioactive Waste and Auxiliary Building was damaged. There was minor damage to other Auxiliary Building ductwork. Failure of the ductwork could have resulted in releases directly to the atmosphere at the roof-level.

Radiation-monitoring systems became inoperable. Thus, the major release path could not be monitored because it was not independent of Class III structures. However, these failures did not cause any unmonitored releases, as evidenced by the fact that FPL found no indications that effluents were released to the vent stack during or immediately after Hurricane Andrew. This was verified during a systematic review of system parameters, data sheets, and logs.

Offsite Environmental Monitors

The State of Florida administers the Radiological Environmental Monitoring Program (REMP), which includes requirements to analyze exposure pathways and samples for direct radiation and airborne radioiodine and particulates. Many REMP systems and devices both on and off the site were damaged or lost as a result of the storm, as discussed below.

Offsite Direct Radiation Monitoring: Of those thermolumonescent devices (TLDs) used to monitor direct radiation, 13 of 21 required and 5 of 9 supplemental TLDs were recovered and subsequently processed. No unexpected radiation levels were found.

Airborne Iodine and Particulates: Both storm damage and the lack of electrical power rendered four of five sampling stations inoperable.

U.S. Nuclear Regulatory Commission (NRC) Offsite Direct Radiation Monitoring: The NRC maintains 35 of its own TLDs in the area around the plant. Approximately 50 percent of these devices were retrieved and processed after the storm. No unexpected radiation levels were found.

Onsite Supplemental Exposure Monitoring: Of those TLDs placed on site to monitor quarterly exposures at the RCA and protected area boundaries, 52 of 76 TLDs were recovered and processed. Results adjusted to the normal quarterly exposure period were similar to data collected in the previous quarter.

Control of Radioactive Sources

Several cross-check and calibration sources were temporarily stored in the Central Receiving Warehouse. The storm caused major damage to the warehouse. After the storm, the container housing the sources was found intact inside the damaged building. The access to the building was then controlled until the sources could be transferred to a more secure area.

APPENDIX H

SUMMARY OF DAMAGE

APPENDIX H

SUMMARY OF DAMAGE

Design Basis

Class III structures are designed for a wind velocity of approximately 120 mph (193 km/h) in accordance with the South Florida Building Code, which is one of the most strict in the country.

The Class I structures are designed to maintain elastic behavior when subjected to various combinations of dead loads, accident loads, thermal loads and wind or seismic loads. For Class I structures other than the containment structure, the wind load replaces the design earthquake load whenever it produces higher stresses.

The Class I structures are designed to withstand a wind velocity of 145 mph (233 km/h) and to resist the effects of a tornado. The containment structure design also considers other loads such as thermal loads with tornado loads. For other structures the forces resulting from a tornado are combined with dead loads only. Dead loads include piping and all other permanently attached or located items. Class I buildings are designed to remain within the elastic limit under the action of a tornado wind of 225 mph (362 km/h) acting simultaneously with a differential pressure of 1.5 psi (10.3 kPa). No loss of function will be experienced under the action of a wind of 337 mph (542 km/h) and a differential pressure of 2.25 psi (15.5 kPa).

Hypothetical missiles that could be generated either from various components of the unit or by hurricanes and tornadoes, are considered in the design. Components and systems that are essential for the safety of the public and are required to function immediately after a maximum hypothetical accident, are protected by either of the following:

enclosure by either concrete or steel structures

redundancy and spacing of the components and equipment

It has been generally assumed that a storm surge would cause the principal damage from a hurricane. However, the storm surge from Hurricane Andrew was minor and caused no damage.

Class I structures survived with no damage. In general, the only damage noted was that caused by water that entered a small portion of the electrical systems and cables, and damage to the paint and insulation of structures and piping. A small amount of water entered into the Auxiliary Building and the Control Building.

During the extended outage of both nuclear units from November 1990 to October 1991, the emergency power system was upgraded and security gratings were installed around important equipment such as the auxiliary feedwater system. These gratings were very effective missile shields.

All Class III buildings were evacuated before the storm. The hurricane caused various degrees of damage to all Class III structures. The damage varied from severe to minimal. Detailed explanation of damage to structures is given below.

The Central Receiving Warehouse was almost completely destroyed, as were other outlying Class III structures such as the New Fabrication Shop, the Paint Shop, the Personnel Processing Facility, the Tool Room, and the Operating Engineers Shop. Other Class III structures survived with minimal structural damage. Butler-type buildings constructed from sheet metal roofing and sides over a steel frame were most prone to heavy damage. The hurricane caused less damage to buildings with masonry or concrete walls and structural steel framed roofs anchored to the walls.

After the hurricane, engineering and technical department system engineers walked down all plant systems independently and found instances of damage or discrepancies. A list of all discrepancies was issued and corrective actions have begun. The following is a summary of some of the more significant equipment damage. All listed equipment is nonsafety-related except as noted.

Control Building (Class I)

The storm caused some damage to the roofing membrane in local areas of the control building.

Entrance Building (Class III)

- Some glass doors were shattered.
- Water damaged the interior ceilings, walls, and contents.

- Entrance and exit portals were not working.

Administration Building (Class III)

- Several windows had been blown in.
- Material impact damaged the built-up roof, allowing water to leak into the third floor.
- Water damaged the ceiling tiles, carpet, computers, records, files, furniture.
- There was flashing and miscellaneous architectural damage to the exterior of the building, including the entryway canopies, roof parapet, doors, walls, and stucco.

Construction Warehouse (Class III)

- Four roll-up doors on the east and south walls of the warehouse were destroyed.
- Roof was removed on the southeast side of the building.
- Roof was removed on the west end of the building.
- Heating, ventilating, and air conditioning (HVAC), fire protection, lighting, and conduit were destroyed in the west end of the building.
- Sections of the wall panel on all walls were removed or damaged.
- Miscellaneous damage was observed to flashing, gutters, and other architectural features.
- Wind, water and flying objects damaged the racks and stored materials.

Blackstart Diesel Generators

- Blackstart control and relay panels were covered with Bunker C fuel oil.
- Moisture intruded into blackstart control and relay panels.
- The loss of the soak back pump caused a loss of prelubrication to the turbochargers on the diesel motors.
- Moisture intruded into the "C" buses, rendering them unable to support the use of the blackstart diesel generators.

Unit 4 Emergency Diesel Generator Building

- Three of the four normal air conditioning units were off their supports. These air conditioning units are not safety related, since ventilation is available if air conditioning is lost.

- Two of the air conditioning units fell onto the covers for the ventilation fans. The fans worked, but flow was slightly restricted.

Unit 3 4160-V Switchgear Chiller Units

- These units were not safety-related; backup ventilation fans were available.

- One unit was damaged. Its cover and fan came off.

- The fan grills on two other units had minor damage.

- One unit continued running.

Turbine Deck and Hall Area

- The turbine canopies for both units were blown off the crane rails. The Unit 3 turbine canopy was found resting on the Unit 3 condensate storage tank (CST) and on some cable trays.

- The western parking restraint at the southern end of the rail for the turbine gantry crane failed.

- The turbine voltage regulator enclosure was blown off.

Containment Vent Stack

- The containment vent stack base anchors lifted approximately three-eighths of an inch (1 cm).

- Tubing and conduit attached to the vent stack failed.

Radioactive Waste Building and Associated Structures

- Air exhaust ducts from the radioactive waste and auxiliary buildings were damaged.

- The radioactive waste building ventilation duct was damaged.

- The auxiliary building duct had some minor damage.
- The laundry room exhaust filter covers were blown off.
- The laundry room had a large opening in the roof.
- The fence at the south end of the Unit 4 component cooling water (CCW) heat exchanger area roof failed.

Condensate Polisher Buildings

- The sheaths on both units were damaged.
- The roof was missing.

Service Water

- This system supplies nonsafety-related potable water.
- The storm damaged the service water system.
- The falling high head storage tower bent or broke the service pipe headers.
- The falling high water tank resulted in the loss of raw water tank 1 (RWT 1).
- Debris from the collapsed high head storage tower destroyed the raw water booster pumps.
- Flying debris caused the pipes for the water treatment equipment to become dented and bent. This equipment was also covered with Bunker C fuel oil from the fossil units.

Fire Protection

- The falling high head storage tower destroyed the fire water pump powered by an electric motor.
- The fire protection system lost a dedicated supply of fire water with the destruction of RWT 1 tank caused by the collapse of the high water tank.
- The collapsed high head storage tower bent or broke fire water headers.

- The impact of the collapsed high head storage tower damaged the jockey pumps for the fire protection system.

- The storm caused minor damage to the closed circuit television (CCTV) system used to monitor Thermolag 330, destroying 3 of 39 cameras.

Fossil Units

- The Unit 1 exhaust stack was damaged.

- There was minor damage on the Unit 2 stack.

- One of the Bunker C fuel oil metering tanks was ruptured during the storm, covering portions of the fossil and nuclear units with the oil.

Machine Shop (Class III)

- Flashing at the roof parapet was damaged or removed.

- Lights, fire protection, fire proofing, material, and miscellaneous framing were damaged in the open burn area at the east end of the building.

- Areas of the roof panel were removed or punctured.

- Several windows were blown out.

- Numerous external wall areas on all sides of the building were damaged as evidenced by gouges, dents, punctures, and removed areas.

- Minor water damage occurred inside the building.

- HVAC units on the roof appeared to be in good condition.

Maintenance Building (Class III)

- Several windows and roll-up doors were damaged.

- The built-up roof was damaged.

- Water caused minor damage to ceiling tiles, carpet, computers, records, files, and furniture.

- Flashing and miscellaneous external architectural features of the building were damaged including the entryways, roof parapet, doors, walls, and stucco.

Health Physics Building (Class III)

- The wall and roof panels were damaged and small areas of the panel were blown off.
- Water damage was noted in the building.
- Miscellaneous architectural damage was noted on all sides and roof of the building.
- The roll-up door on the west wall was destroyed.

Waste Storage Building (Class III)

- Flashing at the roof eaves was damaged.
- Roll-up doors on the north wall were slightly bent.
- Miscellaneous exterior architectural features to the building were damaged.

Construction Craft Building (Class III)

- A roof panel was blown off.
- Wall panels were damaged or blown off on the east, north, and south sides.
- Damage was noted to the lighting, conduit, public address (PA) system speakers and other miscellaneous equipment.
- Miscellaneous structural steel was damaged, but most of the structural steel was undamaged.

Dry Storage Warehouse (Class III)

- Miscellaneous equipment mounted on the building exterior was damaged such as PA system equipment.
- Minor architectural damage was noted to the building exterior walls, doors, and building eaves.

- Water was noted in a small area on the floor of the building, but no apparent room damage was noted (from grade) that could have allowed a leak.

Access and Dress Facility (Class III)

- Minor architectural damage was noted to the exterior eaves and walls of the building.

- No structural damage was noted.

Training Building (Class III)

- Roof damage to west end of the building allowed water to intrude into the building.

- Flashing at the roof parapet was damaged.

- Miscellaneous architectural damage was noted on the building exterior.

- Windows were blown out.

New Fabrication Facility (Class III)

- This Butler building—72 by 96 by 24 feet high (21.9 by 29.2 by 7.3 m)—was totally destroyed.

- Building was placed in service on July 12, 1992, and was built and certified to the South Florida Building Code.

- Building was used for fabricating piping, piping supports, electrical supports, welding, sheet metal work, carpenter fabrication shop, structural prefabrication and all other heavy construction fabrication work.

Time Trailer (General Engineered Facility)

- This trailer was totally destroyed.

- It was a single 12- by 60-foot (3.65- by 18.24-m) trailer secured with hurricane anchors.

- This trailer was used as the time trailer for construction manual (craft) workers.

Old Fabrication Shop/Facility (General Engineered Facility)

- This was a Butler building—60 by 120 by 16 feet high—built in 1982.
- The roof and siding were destroyed, with 20 percent structural damage.

Paint Shop/Sand Blasting Facility (General Engineered Facility)

- This was a Kelly building—20- by 24-foot with a 15- by 25-foot (4.6 by 7.6 m) spray booth that was built in 1982.
- This facility was 70 percent destroyed.

Personnel Processing Facility (General Engineered Facility)

- This was a triple wide trailer—36 by 60 feet (10.9 by 18.2 m)—secured with hurricane anchors.
- This facility was totally destroyed.

Overflow Facility (General Engineered Facility)

- This was a Butler building—100 by 150 feet—built in 1988.
- The roof and siding were heavily damaged, and the building sustained 20-percent structural damage.

Tool Room (General Engineered Facility)

- This was a Butler building—24 by 36 feet (7.3 by 10.9 m)—with tie-down anchors built in 1982.
- This building was totally destroyed.

Insulator Work Facility (General Engineered Facility)

- This facility was built in 1982 with hurricane anchors. It had a pavilion work area to hold eight cargo vans.
- This facility was heavily damaged.

Operating Engineers Shop

- This steel and wood structure was built in the middle 1970s.
- This shop was totally destroyed; only structural steel remained.

Central Receiving Warehouse (Class III structure)

- This Butler building—200 by 400 by 40 feet (960.8 by 121.6 by 12.2 m) high—was placed into service in 1990.
- This building was totally destroyed.

Issue Warehouse (Class III)

- This Butler building—120 by 240 by 24 feet (36.5 by 73 by 7.3 m) high—was built in the late 1970s.
- Severe damage was noted to the roof, siding, and structure.

APPENDIX I

COMMUNICATIONS SYSTEMS

APPENDIX I

COMMUNICATIONS SYSTEMS

Telephone Systems

Southern Bell aerial cooper wire systems

Numerous lines connect this system to the plant through the switchboard in the Administrative Building for normal telephone service. Between 4:15 and 5:45 a.m. on August 24, 1992, all of this system failed because the hurricane blew down lines near Palm Drive. At about noon on August 28, Southern Bell restored service.

Emergency Telecommunications Circuits

The State of Florida's hot ring down system includes telephones installed in the control room, the Technical Support Center (TSC), and the Emergency Operations Facility (EOF) and uses dedicated commercial telephone lines. This system is used to give the initial notification and all status updates of an emergency to the State Division of Emergency Management and the County Emergency Management Directors. This system failed at 4:15 a.m. on August 24, 1992.

The Emergency Notification System (ENS) for notifying the U.S. Nuclear Regulatory Commission (NRC) Operations Center is part of the Federal Telecommunications System (FTS)-2000 network. ENS extensions on the network are located in the control room, the TSC, the simulator control room, the NRC resident inspector's office, and the EOF. FTS 2000 was one of the first lines to be lost, which occurred at about 4:15 a.m. on Monday morning.

The Intelligent Tandem Network (ITN) system is the telephone exchange allowing direct dialing between offices. This phone circuit is incorporated into the Southern Bell/AT&T system handsets throughout the plant. The system allows callers to dial the Radio Paging System (beepers) to reach pagers in most areas of Dade, Broward, Palm Beach, and Sarasota counties. It also enables transmission of data using the Emergency Response Data and Display System (ERDADS) to the EOF in the Florida Power and Light (FPL) Lejune Flagler Office (Miami).

At about 5:45 a.m. on August 24, this system failed because a cable was severed along a section where the cable is routed on 240-kV transmission line structures. The system was placed back in service at 2:00 a.m. on August 27, 1992.

Radio Systems

The Local Government Radio (LGR) System is installed in the control room, TSC, and EOF and can be used to communicate with the State Department of Health and Rehabilitative Services, the Mobile Emergency Radiological Laboratory, and the emergency management directors. LGR provides reliable communications for a range of approximately 20 miles. This system was lost during the storm because the wind damaged the antennas at the site. The storm also destroyed antennas and related equipment at various State and local government facilities.

The 900 Mhz trunked radio system consists of portable radio transmitter and receiver sets that supplement fixed communications equipment in the plant. The small battery-operated sets may be carried to any location on the plant site to provide communications among all plant departments and provide access to the telephone system. During the storm, winds damaged the antennas at the site, interrupting and diminishing communications at the site. Plant personnel could communicate between hand sets.

The Security Department maintained one hand-held radio for the company FM radio system, which includes its own antenna and power source. The Security Department normally used this radio to communicate with maintenance crews not associated with the nuclear division. About 8:00 a.m. on August 24, this system was used to make the first direct link with the utility's General Office in Miami.

In-plant Communications Systems

The plant page system is a solid-state public address system that includes handsets located throughout the plant site. The system includes two channels: one paging channel and one party channel. This system continued to function throughout the storm.

The motor maintenance and refueling circuit (wire) is separate from the plant page system and consists of various outlets throughout the plant near major equipment, both inside and outside the containments, and at the fuel handling areas. A headset, with attached microphone, can be plugged into these outlets. This system continued to function throughout the storm.

The station-to-station telephone circuits are incorporated into the handsets throughout the plant. Although offsite communications were lost through the Southern Bell and utility fiber optic systems, all station-to-station communications within the facility functioned throughout and after the storm.

Cellular Telephone Systems

The cellular telephone system consists of separate cellular telephone sets in the control room and the site vice president's office. These sets are connected with permanently installed cellular telephones in the telephone frame room, which have a permanently installed backup battery and receive ac power from the security system load center, which is backed up by a diesel generator. This permanent system has a greater range than the typical cellular telephones, such as those installed in automobiles, because it operates at higher power and has a permanently installed more efficient antenna. The system could not function because the storm winds damaged the antennas at the site and damaged repeating stations located offsite.

The cellular telephones in the central alarm station (CAS) and the secondary alarm stations (SAS) provide backup communications with local law enforcement agencies. They have uninterruptable power supplies, and primary and backup antennas. The system could not function because the storm damaged the antennas at the site and damaged repeating stations located offsite.

Portable cellular telephones contain their own batteries and are considered self-contained. Cellular telephones are used to communicate between the emergency response teams offsite and the plant when other systems are not available. The medical facility telephone is used to discuss the status of the transportation and treatment of a contaminated injured individual who is to be sent to an offsite medical facility. These telephones can only function using nearby cells or repeaters. After the storm, the telephones generally could not function because the storm had damaged the surrounding offsite repeating stations. These telephones operate at low power, have small antennas, and could not reliably use the more distant undamaged cells.

The Alert and Notification System

This system is used to alert the population of a need to take protective actions in the event of a radiological emergency. The utility installed and maintains this system, which is operated by the Dade and Monroe County Emergency Response Directors. The system consists of 41 electronic sirens located throughout the emergency planning zone. The sirens also can broadcast vocal messages in a public address mode.

The hurricane severely damaged the system, causing it to lose all remote functions.

Restoring Communications

Between 4:15 and 5:35 a.m. on August 24, the storm halted all offsite electronic communications. Further, the access road to the facility was blocked by downed trees. At about 8:00 a.m. a portable radio was used from the roof of the Security Building with the company FM system to contact the Telecommunications Department in the Lejune Flagler Office Building. Telecommunications relayed a message by commercial telephone to the NRC Region II Incident Response Center that the facility was in a safe condition and that no personnel were injured. This was the first communication to the NRC Region II Incident Response Center in approximately 3.5 hours.

At this same time, attempts were made to establish communications through cellular telephones, either by using portable telephones or by repairing antennas for the permanent cellular telephones. At approximately 3:30 p.m. on August 24, contact was made with the NRC and the State of Florida using a portable cellular telephone in a private automobile in the parking lot. These cellular communications became intermittent between 4:00 and 7:50 p.m. During this time, a spare roof antenna was installed for the cellular telephone backup system. This system was more effective than the "portable" telephones, using the greater power and larger more efficient antennas of the permanent cellular telephones. At 7:50 p.m., communications were established between Turkey Point and the St. Lucie control room. St. Lucie established communications with the NRC and began relaying messages between Turkey Point, NRC, and the EOF in Miami. After numerous attempts, efforts to establish direct communications between Turkey Point and the NRC were abandoned. The local cells were probably overloaded, preventing this link from being successfully established.

At 2:00 p.m., on August 24, the first helicopter arrived on site. Helicopter flights resumed on the morning of August 25, 1992, making routine round trip flights between the St. Lucie plant, the Juno Office, and the Miami General Office. These flights were used to bring in needed supplies and personnel.

On August 24, the NRC activated an existing contract with the U.S. Department of the Interior, Bureau of Land Management, Boise Interagency Fire Center to provide temporary emergency satellite communications between the Turkey Point Control Room, NRC, and EOF. Three technicians and the equipment arrived at the Ft. Lauderdale airport on the evening of August 24, 1992. FPL transported the individuals and equipment by helicopter to the Turkey Point site. Unfortunately, the technicians could find no easily accessible paths or openings through which to route temporary cabling. Locating an acceptable path for routing cables from the satellite communications system on the roof into the control room consumed much of the time needed to install the system. At 8:15 a.m. on August 25, a portion of the system became operational, establishing reliable continuous communications between the Turkey Point control room, NRC, and EOF approximately 28 hours after communications were lost.

APPENDIX J

FIRE PROTECTION SYSTEM

APPENDIX J

FIRE PROTECTION SYSTEM

High Water Tower

During the hurricane, the high water tank and supporting structure collapsed, affecting the raw water, fire water, and nonsafety-related service water systems.

The high water tank was part of the nonsafety-related service water system. It supplied water pressure and was a backup source to the principal water source, two raw water storage tanks (RWT 1 and RWT 2). The tank was supported on four tubular steel legs, which were braced by compression struts at three different elevations and diagonal tension rods. The height from the base to the bottom tank capacity line was 175 feet (53 m), and the tank could hold 100,000 gallons (380,000 L) of water.

The high water tank was designed to withstand a wind pressure of 55 psi (2.63 kPa) [approximately 147 mph (236 km/h)] on flat surfaces with a 0.7 shape factor to all curved surfaces. This was higher than the 37-psi (1.77-kPa) [120-mph (193-km/h) wind speed equivalent with appropriate shape factors] stated in the final safety analysis report (FSAR) for Class III structures. Earthquake and tornado loads are not considered in design of Class III structures.

There are three probable causes for the failure of the high water tank: hurricane winds, a tornado, or a wind generated missile. A survey performed by the National Hurricane Center in southern Florida after Hurricane Andrew, indicated that Hurricane Andrew most likely did not produce a tornado near the site.

The wind produced by Hurricane Andrew did not damage other high water tanks of similar configuration. The design basis for these tanks was not investigated; however, their performance indicates that the hurricane wind probably did not directly cause the high water tank to fail.

Therefore, the most likely cause of failure was a wind-generated missile. The missile could have come from the laydown area outside the security fence. A wind-generated missile may have impacted one or more compression struts or tension rods causing them to fail. The redistribution of the water in the tank and the hurricane wind caused the two tank support columns on the north side to fail, allowing the tank to collapse.

Fire Protection System

When the high water tower collapsed, it fell on RWT 1 and various fire protection pumps and pipes (see Figures J.1-J.3). This rendered the fire protection water supply and distribution system inoperable. The fire protection halon suppression system in the cable spreading and invertor rooms remained intact and operable throughout the hurricane. Staged fire-fighting equipment, such as extinguishers and protective clothing, was also available for immediate response to a fire in areas accessible during the hurricane, and throughout the plant after the hurricane force winds ceased.

The fire protection main distribution system includes two fire pumps which deliver water to the fire protection system main headers. One pump is powered by an electric motor, and the other is powered by a diesel engine. Two small jockey pumps, one of which runs continuously, maintain system pressure at about 140 psig (965 kPa). The electric pump starts when the pressure falls to between 80 and 88 psig (551-607 kPa); the diesel starts when the pressure falls to between 70 and 80 psig (483-551 kPa). When the system is in normal alignment, the electric pump suction is aligned to RWT 1 and the diesel pump suction header aligned to RWT 2. Either pump can take suction from either RWT.

The two RWTs are the main water supply for the fire water system. RWT 1 contains up to 500,000 gallons (1,900,000 L) and RWT 2 contains up to 750,000 gallons (2,839,000 L) of water. A city water main supplies water to these tanks. In each tank, 300,000 gallons (1,136,000 L) of water is dedicated to the fire water system. The additional water above the technical specification limit of 300,000 gallons (1,140,000 L) is available to the plant service water system.

The screen wash pumps provide a backup water supply from the cooling canal, which contains salt water. The fire brigade can access this backup supply by connecting a hose through a manually installed spool connection to the nearest fire hydrant. This connection would introduce salt water into the fire system and thus must first be authorized by the Nuclear Plant Supervisor, under emergency conditions.

The fire protection system meets Appendix R to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR Part 50). The piping configurations and design pressures meet applicable requirements of the American Society of Mechanical Engineers (ASME), the Institute of Electrical and Electronic Engineers (IEEE),

Figure J.1 Potable Water Tank and Fire Main

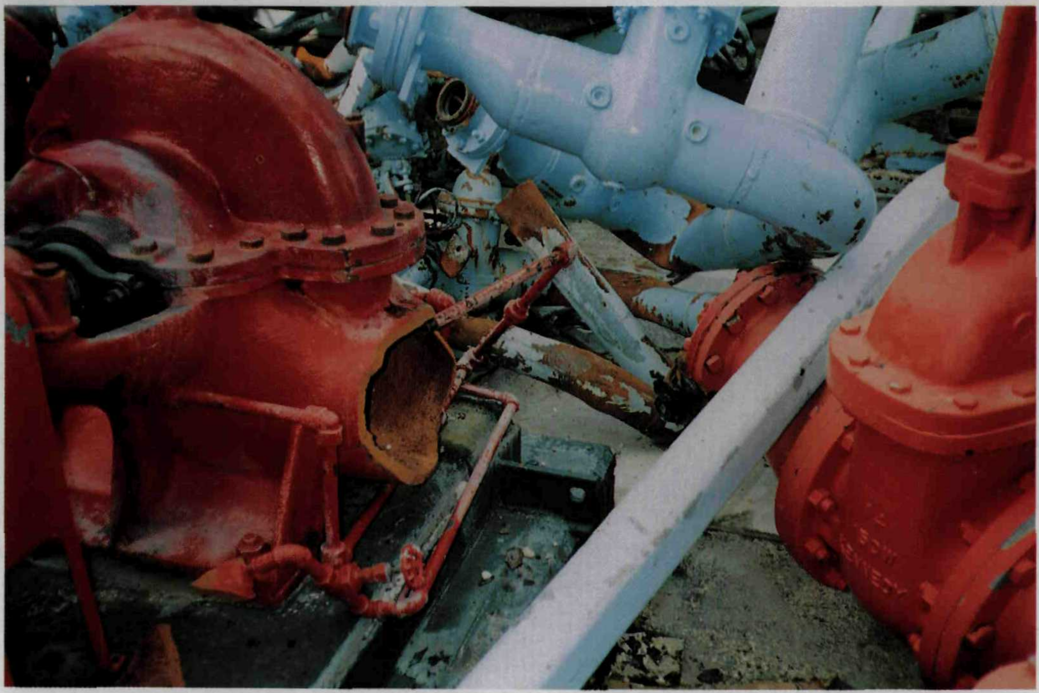

Figure J.2 Electric Fire Pump.

Figure J.3 Area Near Electric Fire Pump

and the National Fire Protection Association (NFPA). The fire water pump discharge is aligned to the water supply header.

To prepare the fire suppression systems for the hurricane, the following actions were taken:

- Diesel-powered pumps were staged for dewatering the plant if the plant experienced local flooding. These pumps were available as backup fire suppression pumps after the hurricane.

- Fire lockers and fire extinguishers were secured by lashing them to a permanent structure.

- Both RWSTs were filled to capacity.

At 2:45 a.m. on August 24, 10 CFR 50.54 (x) was invoked to allow fire watch and security personnel to go to a protected area for safety. Normal continuous watches and roving patrols were suspended such that the applicable action requirements of Technical Specification 3.7.9 could not be met.

When the high tower collapsed, it significantly damaged the fire suppression system, destroying RWT 1. In addition, a feeder header from the main water line was torn away from the RWT 2, causing RWT 2 to drain. The high water tower also damaged the fire protection electric pump beyond repair, the fire pump controller rendering the diesel pump inoperable, and the two jockey pumps used to continuously pressurize the header. At 9:16 a.m. on Monday morning, these failures were addressed by declaring the fire suppression system inoperable. Thus, the plant could not meet the appropriate action requirements in Technical Specifications 3.7.8.1 and 3.7.8.2, prompting the licensee to declare an Alert at 9:16 a.m., as required by procedure. At 3:56 p.m., the appropriate offsite agencies were notified upon establishing offsite communications. Roving watches were established because FPL was unable to conduct continuous fire watches in selected areas after declaring the Alert because a sufficient number of personnel was not available.

High priority was given to restoring the system. By 1:30 p.m. on August 24, a team had been formed to expedite repairs. At first the portable diesel-powered pumps were used as temporary fire pumps to pressurize the fire system. By 6:00 p.m. on August 27, the fire suppression system was restored to operation by re-energizing the screen wash pumps. At this time, the plant was in compliance with Action B of Technical Specification 3.7.8.1.b, which allows for the use of a backup fire suppression system.

By 7:45 p.m. on August 28, the diesel fire pump had been tested and placed in service. At 11:08 p.m. on August 30, continuous fire watches were restored in all required locations and the Alert terminated. By 2:00 a.m. on September 6, the fire system jockey pumps were returned to service, allowing the fire suppression header to remain pressurized, providing the automatic fire suppression capability.

Hurricane Andrew did not result in any fires that required the use of the automated fire detection and suppression system.

APPENDIX K

ELECTRICAL SYSTEM

APPENDIX K

ELECTRICAL SYSTEM

The storm caused extensive damage to the eight 240-kV transmission lines resulting in a loss of all power to the switchyard. This caused the four safety-related emergency diesel generators (EDGs) at Units 3 and 4 to automatically start and power safety-related loads. The EDGs successfully operated for 6-1/2 days after the hurricane to supply power for essential loads as required. On August 30, offsite power was restored, and the EDGs were returned to stand-by status.

Emergency Diesel Generators

The EDG installations for Units 3 and 4 at Turkey Point are typical of modern practice. Unit 3 has two 2850-kW EDGs and Unit 4 has two 3095-kW units. Both installations are Class 1E. Until 1991, the EDGs that now serve Unit 3 supported both nuclear units. The two EDGs that now serve Unit 4 were installed and brought on line in 1991.

The four Unit 3 and 4 EDGs are located in two separate Category I buildings. Two fuel oil tanks for the two EDGs for Unit 4 are located in special sections inside the EDG building, which protects these tanks against missiles. The single fuel oil tank for the Unit 3 EDGs is a Category I structure but is located outdoors. This tank has a Category I shell, which is the only means of protecting the tank against missiles. However, when the two EDGs were added in 1991, the fuel lines were designed so that the fuel oil tanks for the Unit 4 EDGs could also supply the Unit 3 EDGs. Therefore, loss of the fuel oil tank for the Unit 3 EDGs would not render the Unit 3 diesels inoperable.

To ensure that power will be available where needed, the EDGs and safety buses are configured so that any of the Unit 3 and Unit 4 EDGs can supply power to any of the safety buses for either unit.

During the hurricane, offsite power was lost, and the EDGs started and began powering site vital loads as designed. The loads on the EDGs were generally between 800 and 900 kW. The total load for the four EDGs was 3400 kW, which is about 29 percent of the EDGs' combined capacity.

The hurricane did not damage the Class 1E features of the Unit 3 and 4 EDG installations. However, it did damage the nonsafety-grade air conditioning units for the control room for each of the two Unit 4 EDGs. Two redundant refrigeration units are mounted on the roof of the EDG building to cool the control room. The damage to these units did not affect the operation of the EDGs.

When the first fuel oil trucks arrived at the plant 2 days after the storm, normal procedures were followed, and the driver waited while the acceptance analyses were made. Thus, the truck was held up about 6 hours. The fuel oil supply company immediately expressed concern because other customers such as hospitals had vital need for fuel oil, and the condition of the roads made delivery difficult and slow. On August 27, members of the corporate chemistry department solved this problem by taking samples of two of the supplier's main tanks at Ft. Lauderdale and sealing the tanks against further additions. Thereafter, quality assurance personnel boarded each truck in Ft. Lauderdale, witnessed the fill, and accompanied the truck to Turkey Point. This action enabled the supplier to avoid the long delay at the site for acceptance analyses.

Blackstart Diesel Generators

The five blackstart diesel generators (BDGs) at Turkey Point (also referred to as cranking diesels) were installed as part of the original design of the two fossil units before the nuclear units were built. The BDGs were installed in response to several events in the U.S. in which entire utility grids had become de-energized. The BDGs ensured that the fossil units could be started even if outside power was not available. The BDGs also supplied power during periods of peak consumption.

The BDGs were later connected to the two nuclear units. In the early 1970s, it was recognized that the two EDGs installed at Turkey Point to provide emergency power for the combination of Units 3 and 4 did not provide the redundancy desired by the utility. Therefore, a cable was installed that would allow the BDGs to power 4500 kW of plant loads for Units 3 and 4. The Units 3 and 4 technical specifications were modified to require that two of the five BDGs be available. The nuclear plant staff operates and maintains the BDGs, testing them once each month.

The BDGs no longer have as much significance to the two nuclear units. In 1991, the utility added two new Class 1E EDGs for Unit 4, configuring the existing two EDGs to serve Unit 3.

The five 2850-kW BDGs are located in a row of all-weather metal enclosures at the north end of the fossil units. These enclosures maintained their integrity and stayed water-tight throughout the hurricane. They sustained no significant damage but did require some clean-up and debris removal.

The power from the five BDGs passes through a BDG bus located in an all-weather, metal switchgear enclosure, next to the row of BDG enclosures. The switchgear enclosure includes space for personnel to enter the enclosure through doors at either end. The pressure and vibration from the hurricane winds blew these doors open, allowing the wind and rain to enter the walk-in area of the switchgear enclosure. Moisture passed behind the switchgear front panels and reduced the resistance of the insulation, causing the switchgear, and hence the BDGs to become unavailable.

A metering tank containing Bunker C fuel oil for Unit 1 is located about 300 feet (91 m) from the BDGs. A wind-generated missile penetrated the tank approximately 25 feet (7.6 m) above the ground. The contents above the slit, estimated to be about 105,000 gallons (397,000 L), were lost. Most of the spill accumulated at the intake for Units 1 and 2 (separate from the circulating water intake for Units 3 and 4). The winds also blew oil onto the BDGs and their associated switchgear enclosure, the Unit 4 Diesel Generator Building, and other tanks and buildings. The failure of the metering tank did not adversely affect the performance of the nuclear safety-related structures, systems, and components. The Bunker C fuel oil is not volatile under the ambient conditions experienced and did not pose a fire hazard.

The hurricane also damaged the all-weather, metal "C" bus enclosures for Units 3 and 4. These nonsafety auxiliary "C" buses are supplied from the BDG bus through the cable described previously. The "C" buses give additional capacity and redundancy for meeting the plant's internal loads. The Unit 3 and Unit 4 "C" buses are located in all-weather metal switchgear enclosures each having a walk-in area with doors at either end. The hurricane blew open both doors of the Unit 3 "C" bus enclosure and both doors of the Unit 4 "C" bus enclosure. The rain blew in and moisture rendered these buses inoperable.

This intruding water caused no major damage to the BDG switchgear on either of the "C" buses. A few days after the storm, plant personnel started two of the BDGs and verified they were operational but could not be used until the BDG switchgear bus and "C" buses had been dried. These buses were cleaned and dried, and became available after about a week.

The Switchyard and Offsite Lines

The 240-kV switchyard and offsite line capacity and arrangement at the site are typical of those found at most large nuclear plants (see Figure K.1). The switchyard is a junction for eight offsite lines and for distributing the output from fossil Units 1 and 2 and nuclear Units 3 and 4. The nuclear units can each deliver 760 MWe to the switchyard, while the fossil units are rated at 430 Mwe each.

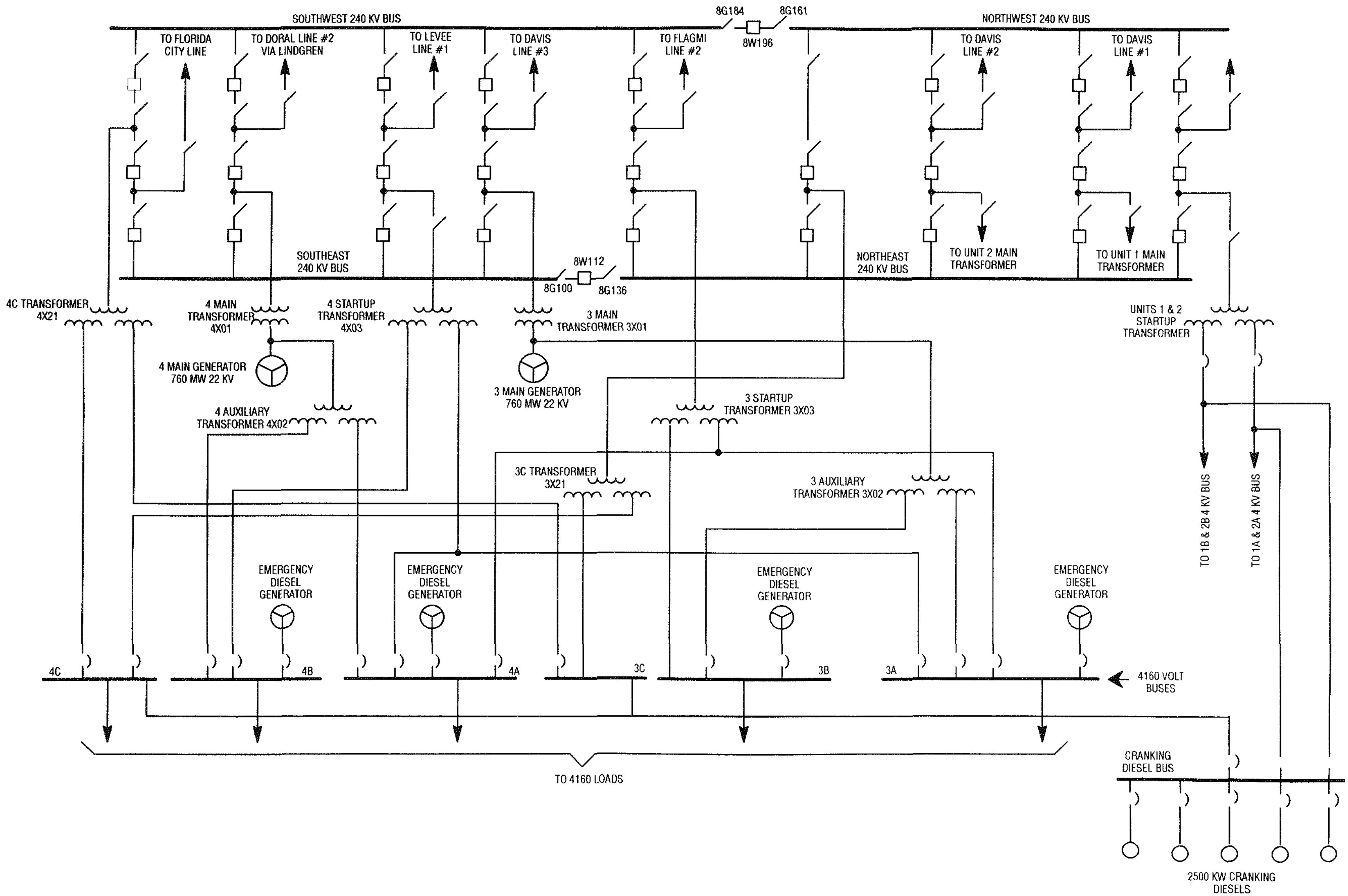

Figure K.1 Electrical Distribution System

The three 240-kV transformers for each of the nuclear units are located immediately next to the outdoor turbine generator. These transformers are the 22/240-kV main output transformer, the 240/4.16-kV startup transformers and the "C" auxiliary transformer. The 22/4.16-kV unit auxiliary transformer for each unit is also located next to the turbine generator.

The switchyard is located about 200 yards (183 m) away from the main transformers for Units 3 and 4. Overhead lines connect the main output from each nuclear unit with the switchyard and connect the startup transformer for each unit with the switchyard. The "C" auxiliary transformers are connected to the switchyard by 240-kV pipe cable.

The switchyard is a conventional configuration designed for sustained winds of 150 mph (262 km/h). Each circuit breaker is filled with gas. The FPL System Control Center in Miami controls all of the gas circuit breakers in the switchyard except for the 240-kV main output breakers for the fossil and nuclear generating units.

Seven of the offsite lines leaving the switchyard have H-frame constructions and are designed for a sustained wind load of 150 mph (241 km/h). An eighth line of lesser importance is constructed with single concrete poles. While the seven H-frame lines are designed for 150-mph (241-km/h) winds from the site to their terminal points, most of the utility's 240-kV system is of a design that can withstand winds up to 130 mph (209 km/h).

The principal activity in preparing the switchyard was to remove or tie down items that could become missiles. Loose debris was collected and disposed of. Cabinet and walk-in doors were wired closed if the existing latch was judged inadequate for the expected wind forces.

Table K.1 depicts the electrical power sequence of events during and after Hurricane Andrew. Unit 3 lost offsite power at 4:40 a.m. on Monday morning, and Unit 4 lost power at 5:22 a.m., 42 minutes later. Unit 4 did not lose offsite power when Unit 3 did because Unit 4 continued to receive power from fossil Unit 2. Fossil Unit 1 was taken off line about 12 hours before the storm so that operators could focus on operating a single unit. However, as the winds increased, the load and plant parameters began to fluctuate widely. At about 5:20 a.m., the decision was made to take Unit 2 off line. It was later determined that the tripping of Unit 2 and the loss of power to Unit 4 coincided. There is little doubt that Unit 2 had been supplying power to Unit 4 for about 40 minutes after all eight transmission lines had been de-energized by the hurricane.

Restoring Offsite Power

A high priority was placed on restoring offsite power to the site. The initial effort was focused on a particular line (Davis 1). The Davis line to the switchyard was energized

4-1/2 days after the storm. However, the line de-energized 2-1/2 hours later because a line span had inadequate phase-to-ground wire separation. The line was re-energized 4 hours later, and the Unit 3 startup transformers were energized 9 hours after that. However, the emergency buses remained powered by the EDGs. Eight hours later, the yard de-energized again because of relay problems. Nine minutes later, the line and switchyard were re-energized, but the Unit 3 startup transformer was intentionally left de-energized. The four Unit 3 and 4 EDGs were operating without problems. To ensure reliability, the Davis line and switchyard remained energized without a load.

Then, 6-1/2 days after the storm, the startup transformers for Units 3 and 4 were energized to restore power to the plant. The EDGs were then shut down and returned to standby status. A second offsite line became available about a day later.

Hurricane Andrew caused no major damage to the 240-kV switchyard or to the four major transformers associated with each nuclear unit. The absence of any damage to the gas circuit breakers or their porcelain is particularly impressive. The operating parts of these breakers are encased in porcelain and sit on vertical, 10-foot (3-m) tall stacks of insulators that are only about a foot in diameter.

Although there was no damage to major equipment, the hurricane did reveal a lesser but apparently generic failure mechanism. At many locations in the switchyard, a standoff insulator is used for mid-length support of flexible cable or copper bus tubing spans (see Figure K.2). These spans connect one piece of equipment, such as a 240-kV disconnect switch, to another, such as a circuit breaker or transformer bushing. These insulators are 7.5 feet (2.23 m) long and about 1 foot (0.3 m) in diameter. The total distance between the equipment connectors is typically 20-25 feet (6.1-7.6 m) with the standoff insulator providing support at about the midpoint. Figure K.3 is a photograph of a failed standoff insulator. Eighteen of these porcelain standoff insulators failed. Three insulators failed in the 240-kV connections to each of the Unit 3 and Unit 4 main transformers. Two insulators failed in the 240-kV connections to each of the startup transformers, and eight insulators in the switchyard also failed.

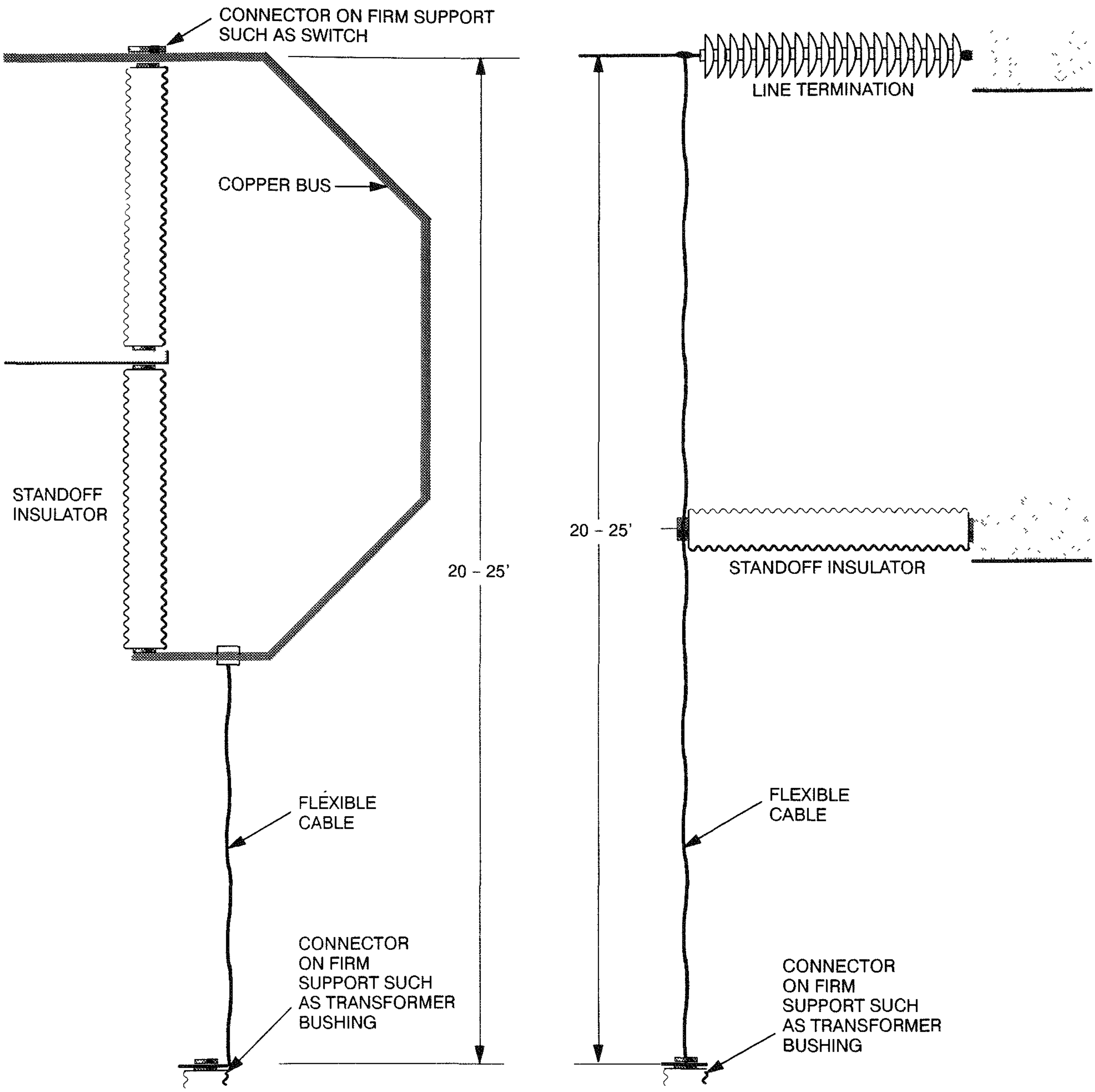

Figure K.2 Examples of Switchyard Connection Arrangements Where Standoff Insulators Failed

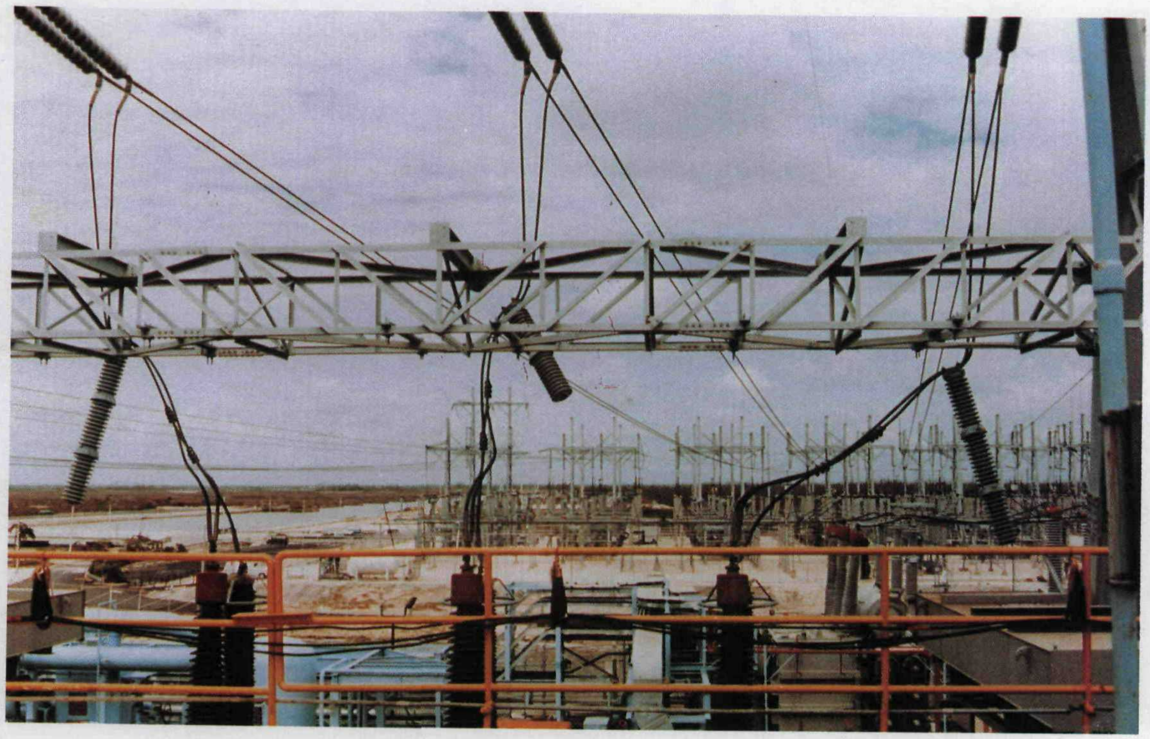

Figure K.3 Damaged Insulators

Table K.1 Electrical Power Sequence of Events

EVENT	UNIT 3	UNIT 4
	Date and Time	Date and Time
Unit off line	8/23/92 Sunday 7:32 p.m.	8/23/92 Sunday 10:15 p.m.
Loss-of-offsite power	8/24/92 Monday 4:40 a.m.	8/24/92 Monday 5:22 a.m.
Switchyard energized from Davis line	8/28/92 Friday 6:00 p.m.	
Davis line and switchyard de-energized	8/28/92 Friday 8:10 p.m.	
Davis line and switchyard re-energized	8/29/92 Saturday 12:10 a.m.	
Unit 3 startup transformer energized	8/29/92 Saturday 9:00 a.m.	
Davis line, switchyard and Unit 3 startup transformer de-energized	8/29/92 Saturday 5:01 p.m.	
Davis line & switchyard re-energized, startup transformers left de-energized while line soaks	8/29/92 Saturday 5:10 p.m.	
Return of offsite power	8/30/92 Sunday 2:27 p.m.	8/30/92 Sunday 6:44 p.m.
Second offsite line energized	8/31/92 Monday 11:36 p.m.	

Offsite Power Line Damage

Hurricane Andrew caused major damage to the eight 240-kV offsite lines and to FPL's transmission system. The eight offsite lines did not sustain damage immediately adjacent to the switchyard. However, the hurricane caused significant damage to the portion of these lines between the site and the termination on the opposite end. The following suggest the extent of the damage:

Davis 1 Line [18.3 miles (29.4 km) long]

34 percent of the structures sustained damage
1 concrete H-frame structure down
43 bent steel crossarms
1 mile (1.609 km) of conductor down

Flagami 1 and Davis 2 [18.3 miles (29.4 km) long, with shared towers]

53 percent of the structures sustained damage
10 concrete H-frame structures down
71 bent steel crossarms
1.3 miles (2.1 km) of conductor down

Davis 3 and Flagami 2 Lines [18.5 miles (29.8 km) long, with shared towers]

39 percent of the structures sustained damage
3 concrete H-frame structures down
61 bent steel crossarms
1.1 miles (1.8 km) of conductor down

Doral and Levee Lines [22.6 miles (36.4 km) long, with shared towers]

40 percent of the structures sustained damage
10 concrete H-frame structures down
64 bent steel crossarms
1.4 miles (2.3 km) of conductor down

Florida City Line [8.3 miles (13.4 km) long]

85 percent of the structures sustained damage
65 single pole concrete structures down
7.5 miles (12.1 km) of conductor down

In all, FPL lost 478 circuit miles (769 km) of transmission lines that de-energized 61 transmission lines serving 110 substations. Forty-three transmission lines serving 58 substations sustained damage that had to be repaired before these lines could be re-energized. Approximately 149 concrete structures, 526 wooden poles, and 3,845 insulators failed.

Damage to substation equipment was also severe. The storm damaged 114 substations and completely de-energized 58 substations. Dade County was hit the hardest with 8 transmission and 42 distribution substations out of service. Fortunately none of the power transformers incurred severe damage, and all could be put back in service. A significant part of the substation damage occurred to relay vaults. The high winds caused roof damage that let in water.

APPENDIX L

SECURITY SYSTEM

APPENDIX L

SECURITY SYSTEM

Security is maintained with a fully automated security system supported by security force personnel. The system consists of positive access control devices, intrusion detection devices, closed circuit televisions (with the capability to view fixed areas and to pan, tilt, and zoom), and physical barriers such as fences and thick metal gratings to prevent unauthorized persons from entering either the protected areas or vital plant areas. Many of these areas are outside structures and are susceptible to wind or missile damage, so the grating is also a barrier to missile hazards that could otherwise harm plant equipment. Areas protected by the security grating were not noticeably damaged by missiles.

The security system recently underwent a multi-million dollar upgrade. This effort included significantly improving the perimeter intrusion detection systems, erecting vital area gratings, building a new Entry Building, building a new central alarm station (CAS) and a new secondary alarm station (SAS), and installing a new computerized security system for access control and intrusion detection. The system is powered by an uninterruptable power supply.

The security system protects against unauthorized and undetected access into the protected and vital areas of the plant. Systems and components are designed to meet Review Guide 17 criteria and Part 73 to Title 10 of the Code of Federal Regulations (10 CFR Part 73) as defined in various regulatory guides. The security building superstructure and other structures were designed to withstand 120-mph (193-k/h) winds, which is a design requirement in the South Florida Building Code.

Before the storm, the following special storm preparations were taken:

- Parked all-terrain vehicles inside a building for protection. The building unfortunately sustained very heavy damage, and only a few vehicles survived for future use.

- Minimized patrols of the protected area as the storm increased, as allowed by the security force instructions. Maintained minimum security plan requirements until ceasing safeguards.

- Maintained accountability of all personnel at the site, accounting for all personnel once they were evacuated to the Class I facilities.

- Established access control points for the Technical Support Center (TSC), the Operations Support Center (OSC), the control room, and the personnel evacuation shelters.

- Directed contract security force personnel to ensure that all security force members remained in designated shelters until released by management.

- At 2:45 a.m., the senior site managers decided to suspend safeguards in accordance with 10 CFR 50.54(x) and Section 3.2.3 of the Physical Security Plan. This information was sent to the appropriate offsite agencies before electronic communications were lost.

- Before suspending safeguards at the site, the Security Department did not place the closed circuit television monitors in continuous recording mode to collect historical visual data. Visual documentation of the hurricane may have assisted in reconstructing damage that occurred during a hurricane.

The security system performed as expected. The perimeter area intrusion detection devices worked until they were either destroyed or the associated intrusion detection system (IDS) boxes were disrupted, largely by projectiles, excessive winds, or water intrusion (see Figure L.1). Most of the security lighting was also damaged or destroyed.

At 5:30 a.m. on Monday morning the security system lost power. The backup security diesel generator automatically started, but then shut down upon receiving a shutdown signal from smoke detection equipment inside the cubicle. The smoke detection equipment sent this signal upon detecting the diesel exhaust that was blown back by the high winds and differential pressures.

After the diesel shut down, the system operated using the emergency battery supply until the batteries were exhausted. At 10:30 a.m., power was restored after the system was inspected and the security diesel restarted. While computer controlled access to vital areas was lost for this brief period, vital area integrity remained intact. The capability remained to enter into these areas if necessary, and security roving personnel were making patrols as compensatory measures.

Compensatory actions were taken immediately to reestablish security conditions after the hurricane force winds subsided. Roving patrols were established to compensate for fences that were damaged. Within 48 hours after the storm, all fence fabric had been repaired except for the fences in the water treatment area. At 12:20 p.m. on September 22, full safeguards were restored.

Figure L.1 Damaged Security Building and Fence

Before the storm, a plan had been prepared for relieving personnel on site after the hurricane. This plan listed individuals by name and specified the time and day at which each was to report to the site. However, the devastation of the surrounding community prevented this plan from being implemented effectively. Therefore, personnel from the security forces at St. Lucie and the Beaver Valley nuclear plant in Pennsylvania were used to supplement the Turkey Point security force.

Personnel could not be badged at the site because the storm damaged the Entrance Building. Special badging procedures were established to allow authorized personnel unescorted access to the plant.

Fitness-for-duty testing was suspended at the site because the hurricane damaged the testing facility and support personnel could not be sent to the site for the testing process. However, security personnel, supervisors, and Human Resource Employee Assistance Program (EAP) personnel continued to observe personnel throughout the recovery process.

APPENDIX M

PLANT LIGHTING SYSTEM

One of the training scenarios practiced on the simulator immediately before the storm was of a loss of offsite power, which includes the loss of normal control room lighting.

The station battery supplying the control room and plant emergency lighting was supplied power from battery chargers powered from the emergency diesel generators. At 8:25 a.m. on Monday morning, power to the normal control room lighting was restored from the emergency diesel generators. The battery pack emergency lights illuminated with the loss of offsite power; however, the batteries were exhausted after 8 hours and were not available until power was restored.

APPENDIX N

SPENT FUEL POOL

APPENDIX N

SPENT FUEL POOL

Spent fuel is stored on site in Class I structures. The pools for Units 3 and 4 are constructed of steel reinforced concrete, each with a welded liner of stainless steel plate for added leak integrity. The spent fuel pools (SFPs) are located within seismic Class I buildings of steel reinforced concrete construction. The SFP cooling pumps, which provide circulation for a single SFP cooling loop for each SFP, are powered from safety-related power supplies which require manual operation of a breaker to resupply power from the emergency diesel generator (EDG). Any of the four onsite EDGs can supply emergency power to any one of the SFP cooling pumps to maintain SFP water circulation. The SFP pumps take suction from the SFP and discharge through the tube side of a heat exchanger that is cooled on the shell side by component cooling water.

On the morning of August 24, SFP cooling for each unit was lost when offsite power for the unit was lost. Unit 3 lost offsite power at 4:40 a.m., and Unit 4 lost it at 5:20 a.m. Power was restored to the SFP pumps by manually closing the breakers at 9:45 a.m. on August 24. The temperature in the SFPs increased very slowly [approximately 0.37 °F/hr (0.2 °C/hr)] . The temperature in the SFPs increased only about 1.5 °F (0.83 °C) and remained below 90 °F (32.2 °C). Hurricane Andrew did not cause damage to either the SFP structure or the SFP itself.

APPENDIX O

TURBINE CANOPIES

APPENDIX O

TURBINE CANOPIES

The canopies are used because the Turbine Building for Turkey Point Units 3 and 4 is not completely enclosed, and the turbines are located on the top level of the building in the open air. The canopy is a "general engineered type structure" that does not conform to a particular building code. The canopies shelter workers from the rain or sun while the turbine is being maintained or repaired. Three canopies protect each turbine. Each canopy consists of a tubular steel braced frame with a corrugated steel roof. The sides are open; the only enclosure is the roof. Wheels are attached to the four legs of each canopy so that it can move along a channel cast in the concrete turbine deck.

Appendix V, "Natural Emergencies," to Emergency Plan Implementing Procedure (EPIP) 20106 was followed. This consisted of securing all light material and structures such as the turbine canopies. Threaded inserts were installed in the turbine deck in a direction parallel to the channel that guides the canopies. Steel angles, approximately 3 by 3 inches (8 by 8 cm), were each secured to the turbine deck by a single bolt, one angle for each canopy leg. Each canopy was connected to the angle using wire.

Wind loads on the roof and frame caused each of the six turbine canopies to fail (see Figures O.1 and O.2). The structures tipped over and were further destroyed as they impacted other objects in the area. The wind loads caused the anchorages to fail by pulling the threaded inserts from the concrete or destroying the frame at attachment points. One of the anchors in the turbine deck was pulled from the concrete, and the concrete around another was severely cracked.

The canopy roofs became detached from the frames and became missiles that may have struck other canopies, structures, or equipment; however, the safety function of the nuclear plant was not effected.

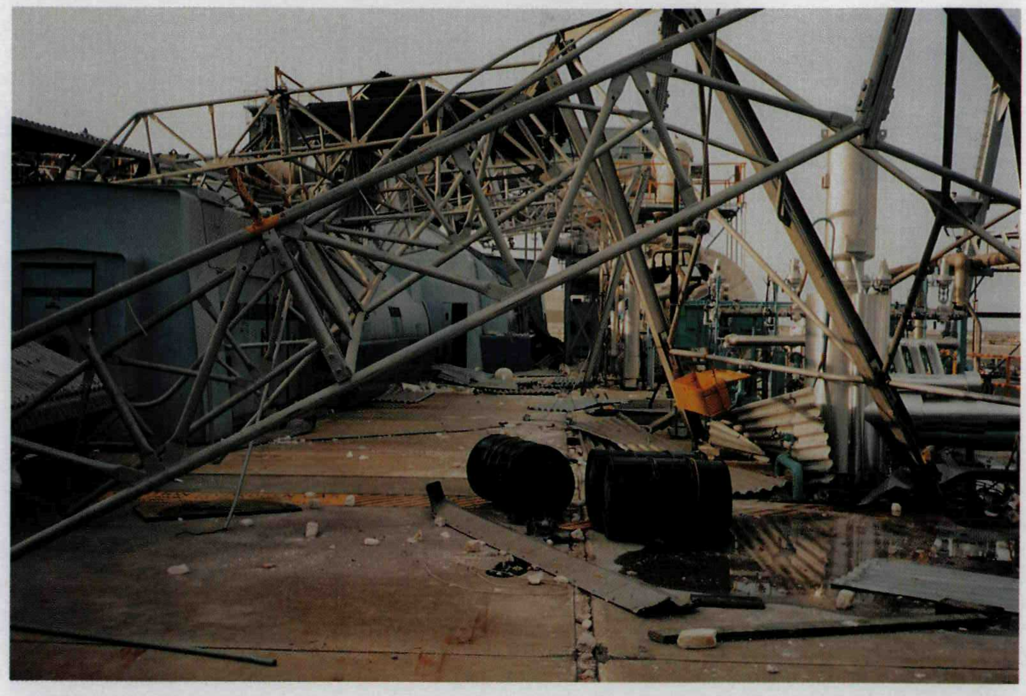

Figure O.1 Turbine Deck

Figure O.2 Parts of Turbine Canopy

APPENDIX P

CHIMNEYS

APPENDIX P

CHIMNEYS

The Turkey Point fossil plant, Units 1 and 2, had two chimneys located approximately 170 feet (52 m) apart. Each chimney consisted of a 400-foot (120 m) reinforced concrete tube that acts as a wind shield with a diameter ranging from approximately 40 feet (12 m) at the bottom to 23 feet (7 m) at the top. The thickness ranges from approximately 30 inches at the bottom to 9 inches (23 m) at the top. Inside of the wind shield was a free standing brick liner separated from the concrete tube by an annular air space in excess of 6 inches.

The chimney is a Class III structure. The force of wind on the chimney is treated as a uniform load of 45 psi (2.15 kPa) applied to the projected area for the full height. This loading is considered in conjunction with thermal loads resulting from the normal operating temperature [325 °F (162.8 °C)] and the maximum short duration temperature [750 °F (399 °C) for 15 minutes].

The chimney is also designed to withstand a 150-mph (241-km/h) hurricane wind equivalent to a uniform load of 55 psi (2.63 kPa) applied to the projected area for the full height. Only the thermal stresses associated with normal operating temperature are considered in conjunction with this condition. The wind design loadings are higher than the 37 psi (177 kPa) [120 mph (193 km/h)] wind speed equivalent with appropriate shape factors) stated in the final safety analysis report (FSAR) for nuclear plant Class III structures.

Although the Unit 1 chimney remained standing, the structure was significantly and visibly damaged. A detailed inspection indicated that the Unit 2 chimney, which is the closest chimney to the nuclear units, suffered minor cracking but without any significant structural damage.

The wind shield is reinforced with horizontal hoops and vertical rebar placed on the outer perimeter towards the exterior surface of the concrete. This reinforcement pattern enabled the vertical cracks to develop.

An older, lined chimney without a ventilation shaft or liner attached directly to the wind shield would experience higher temperature at the internal concrete wall than at the external wall resulting in horizontal tension over the external face. The outside surface was reinforced with steel to prevent thermal cracking.

Chimneys such as those for Units 1 and 2 are of newer designs in which the inspection and ventilation space between the liner and the wind shield creates the opposite temperature gradient. The radiation from the sun causes the outside surface of the shield wall to be hotter than the inside surface, creating horizontal tension over the internal face of the concrete. However, the hoop reinforcement for this new design is placed only near the external face. Therefore, a vertical crack could open and propagate freely from the interior face to the exterior surface of the reinforced concrete wall.

Visual inspections and analysis of the chimney indicated the vertical cracks observed at regular intervals existed before Hurricane Andrew. The cracking was caused by thermal gradients through the wind shield resulting from chimney operation. During the hurricane, the stress and movement from the extreme wind loads caused some of the pre-existing vertical cracks from approximately the 200-foot (61-m) elevation to the top of the chimney to increase in length, width, and depth.

This phenomena has been observed and documented at other similar chimneys. For example, a similar configuration of cracks formed in the utility's Cape Canaveral unit that went through Hurricane David (a Category 2 hurricane in 1979).

The extensive damage raised concern that the Unit 1 chimney might not survive another event with strong wind. The chimney could have failed in an uncontrolled manner, creating a hazard to personnel and equipment. Therefore, the chimney was demolished on September 4, 1992, using controlled explosive demolition techniques.

APPENDIX Q

CHRONOLOGY OF EVENTS FOR HURRICANE ANDREW

APPENDIX Q

CHRONOLOGY OF EVENTS FOR HURRICANE ANDREW

(provided by FPL)

Unit-3	Unit-4	Common
8-22-92	8-22-92	8-22-92 5:00 p.m. Entered ONOP-103.3. Severe Weather Hurricane Watch in effect from Titusville to Florida Keys.
8-23-92	8-23-92	8-23-92 7:11 a.m. Declared **Unusual Event** because of Hurricane Warning
6:00 p.m. **Began shutdown** in accordance with 3-GOP-103.		11:00 a.m. State reports hurricane now Cat. 4 with wind speeds of 135 mph (217 km/h).
7:32 p.m. Tripped turbine off line.		
7:40 p.m. Entered **Mode 3**.		
8:00 p.m. Opened reactor trip breakers.	8:00 p.m. **Began Shutdown** in accordance with 4-GOP-103.	

Unit-3	Unit-4	Common
8:48 p.m. Secured SFP vent as stated in EPIP-20106.		
9:15 p.m. Started 3-GOP-305.		
		10:00 p.m. Began to staff the TSC up in cable spreading room.
	10:15 p.m. Entered **Mode 2** and tripped turbine off line.	
		10:52 p.m. transferred RCA access to cable spreading room.
	10:45 p.m. Entered **Mode 3.**	10:55 p.m. TSC determined the staff requirements to be met with three exceptions: ENS Communicator by Cont Communicator assumed. TSC Reactor Engineer by EOF Personnel. TSC Electrical Supervisor by Electrical Maintenance staff engineer.
		11:21 p.m. Declared OSC operational.
11:40 p.m. Completed 3-GOP-103.		11:22 p.m. Declared TSC operational.
8-24-92	8-24-92 12:07 a.m. Started 4-GOP-305.	8-24-92 12:08 a.m. EOF staffed but not operational.

Unit-3	Unit-4	Common
	12:35 a.m. BAST level low as stated TS 3.1.2.5.a. returned to service 8/25.	
1:00 a.m. CV-3-200A TS 3.6.4		1:00 a.m. Plant vent SPING failed because of hurricane. TS Table 3.3-5
		1:15 a.m. Decided to suspend work at 3:00 a.m. and muster in cable spreading room.
		2:00 a.m. Began to search protected area to account for all personnel.
		2:45 a.m. Suspended safeguards TPPSP 3.2.3 and discontinued fire watches 10 CFR (50.54(x) TS 3.7.9).
3:12 a.m. Entered **Mode 4**.		
		3:55 a.m. Notified NRC of 50 mph winds. No continuous communications requested.
	4:05 a.m. Entered **Mode 4.**	
		4:15 a.m. Lost FTS 2000 capability.
		4:30 a.m. R-14 OOS TS Table 3.3-5, 19a

Unit-3	Unit-4	Common
		4:35 a.m. Notified State that NAWAS lost.
4:40 a.m. Lost off-site Power 3A and 3B EDGs start and load. TS 3.8.1.1 action a.		
4:41 a.m. Restored RHR.		
		4:50 a.m. Last credible indication of wind speed at approximately 70 mph for 10 minute average.
		5:15 a.m. Unit 1 and 2 informs that metering tank #1 (Bunker C) breached
	5:22 a.m. Lost off-site power and entered 4-ONOP-004 4A and 4B EDGs start and load. TS 3.8.1.1 action.	
	5:25 a.m. Restored RHR	
	5:30 a.m. 4A2 Battery charger lost due to water damage. returned 8/28 2400. TS 3.8.2.1.c.	
	5:30 a.m. Breaker for MOV 744A burned out (INOP for SI) TS 3.5.2.c	
	5:35 a.m. Reduced RHR flow because of RCS cooldown.	

Unit-3	Unit-4	Common
	5:40 a.m. CV-4-2831 AFW FCV failed at 235 gpm (no manual or auto control) TS 3.7.1.2.1	
	5:41 a.m. Restored RHR flow to 1000 gpm after cooldown stopped.	
		5:45 a.m. PTN lost all outside communications. Declared an **Unusual Event**.
		6:40 a.m. Notified NRC resident on site that Unit 3 & 4 S/U Tx de-energized. TS 3.8.1.1.e requires controlled shutdown in 30 hours if not re-energized.
		7:05 a.m. Damage report—U-3 S/U Tx wires and insulators ripped out. U-3 Main Tx wires and insulators ripped out. High tower fell on RWT. Exciter cubicle fell base of U-3 EDG. Turbine cover fell air ejector. 1A chiller gone. Security lights are down. Units 1 & 2 have severe damage and a large fuel oil spill. 2" of water in the power block area. Corrugated metal scattered about the plant.
		8:01 a.m. Damage assessment teams and HP teams assessed radiological conditions with micro-R meters.

Unit-3	Unit-4	Common
		8:25 a.m. Re-energized control room lights.
		8:25 a.m. Damage assessment team reported that RWT 1 is gone (TS 3.4.7.8.1.b).
		8:53 a.m. TSC used cellular phone in parking lot to report that the NRC has been notified of plant status.
	9:02 a.m. Isolated piping on TPCW Hx because of pipe break down stream.	
		9:16 a.m. Lost fire protection suppression (TS 3.7.8.1 & 2) **Declared an Alert.**
9:45 a.m. Verified Cooling in service.	9:45 a.m. Restored SFP cooling.	
		10:00 a.m. HP surveys completed. No increase in levels found.
	10:05 a.m. Placed OMS in service. Followed earlier 50.54(x) decision. Left primary block valve MOV-4-535 closed because of body/bonnet leak.	

Unit-3	Unit-4	Common
	10:07 a.m. 13 Closed MOVs-4-1403,4,& 5 to reduce cool down.	
		11:55 a.m. Transferred TSC to second floor of Security Building
	11:57 a.m. While attempting to ground, isolation 4A EDG output breaker opened.	
	12:00 p.m. Entered ONOP-004.2 and ONOP-050 to restart RHR. RCS heatup was about 5 °F.	
		12:03 p.m. Discovered NEB Class "C" fire.
		12:07 p.m. Put fire out.
		1:30 p.m. TSC noted that fire protection/spray suppression system out. Formed team to set up temporary fire protection system. TS 3.7.8.2.a, TS 3.7.8.1, 3, and 4 apply. (see entry for 5:20 p.m. on 8-27-92)
		2:30 p.m. Notified NRC of upgrade to Alert.
	2:53 p.m. Reestablished SFP cooling.	

Unit-3	Unit-4	Common
		3:36 p.m. Established communications with NRC and State warning point using cellular phone.
		4:28 p.m. Reestablished cellular phone communications with NRC.
		5:25 p.m. Tried numerous times to reestablish communications with EOF and NRCOC with no success.
7:00 p.m. 3D inverter failed to synchronize TS 3.8.3.2		
		7:50 p.m. updated NRC on plant status through St. Lucie.
9:00 p.m. MOV-3-1427 breaker tripping. TS 3.3.3.5 and 3.6.4		
		11:15 p.m. Updated NRC on plant status using EOF.
8-25-92 12:30 a.m. containment temp < 120 °F > 120 °F for approx. 16.5 hours.	8-25-92	8-25-92
		1:00 a.m. Dept. of Interior arrived with satellite communications system.
	1:20 a.m. PZR level decreased with charging pump speed increase.	

Unit-3	Unit-4	Common
		1:50 a.m. Fire Zone 21 locked in alarm. Returned to service at 11:50 p.m. on 8/30.
	2:30 a.m. Logged OMS as not in service since 4-OP-041.4 had not been performed to ensure N_2 backup bottle pressures not verified. Instrument air was in service to the valves (TS 3.4.9.3).	
		3:00 a.m. TSC discovered that continuous fire watches were "roving" watches. *continuous* watches Ordered.
4:10 a.m. Began OMS functional test 3-OSP-41.4 TS 3.4.9.3		
		5:15 a.m. Lost ERDADS.
6:02 a.m. OMS action statement not entered. Reported under 10 CFR 50.54(x) above.		
		6:15 a.m. "A" Aux Building fan tripped.
		6:40 a.m. Auxiliary Building fan restart was unsuccessful.
10:43 a.m. Completed 3-OSP-041.4		

Unit-3	Unit-4	Common
5:05 p.m. Entered **Mode 5** Entered without depressurizing and venting under 10 CFR 50.54(x) TS 3.8.1.2		5:05 p.m. Opened Canal Drive to Palm Drive to levee north-south.
		6:15 p.m. Confirmed Palm Drive open. TSC noted this issue at 4:48 p.m.
		6:45 p.m. Notified NRC of loss of all emergency siren capability.
		7:30 p.m. Exited 72-hour action statement TS 3.1.2.5 with boric acid storage tank level above TS minimum.
9:20 p.m. Discovered fire ball on A-MCC nonvital section during load break.		
9:45 p.m. Oil spill inside bowser berm approx 5 gallons outside berm. Less than 1 gallon to the drain.		
8-26-92	8-26-92	8-26-92 5:30 a.m. Began issuing special visitor badges because Security computer OOS.
	10:15 a.m. Entered **Mode 5** without depressurizing and venting under 10 CFR 50.54(x) TS 3.8.1.2	
		11:43 a.m. Allowed all FPL employees access to Turkey Point.

Unit-3	Unit-4	Common
		4:30 p.m. BSDs 1 and 3 started in dead bus mode. Attempted to energize black start bus unsuccessfully.
8-27-92	8-27-92 2:00 a.m. Established offsite communications using fiber optics.	8-27-92
		3:20 a.m. Submitted safety evaluation which allows operation of the intake with oil spill present.
7:05 a.m. 3A EDG lost because of lockout.		
9:38 a.m. 3A EDG started. 3A 4.16-kV bus restored.		
		5:20 p.m. 1935 energized 4C bus from 3C? and ran screen 4 wash pump to demonstrate operability of fire protection capability.
		6:00 p.m. Returned fire main system to functionality(Action B TS 3.7.8.1.b).
8-28-92 12:10 p.m. Returned NAWAS and hot ringdown system to service.	8-28-92	8-28-92
		1:00 p.m. Control room reported all major communications operational including FTS 2000.

Unit-3	Unit-4	Common
		1:45 p.m. Energized Davis substation from Levee. Attempted to close Davis 1 to Turkey Point.
		5:00 p.m. Verified Davis 1 good for 5 minutes.
		6:00 p.m. Energized NE switchyard.
		6:10 p.m. Notified EPA of asbestos release.
6:35 p.m. Energized U-3 S/U Tx high side.		
		6:58 p.m. Notified NRCOC of U-3 S/U Tx status.
		7:35 p.m. Started diesel-powered fire pump.
		8:15 p.m. Lost Davis line. Waited at least 12 hours with Davis 1 energized before powering vital buses from offsite power.
<u>8-29-92</u>	<u>8-29-92</u>	<u>8-29-92</u> 12:10 a.m. Re-energized Davis 1.
	6:00 a.m. "A" GammaMetrics OOS >.5 decades deviation from channel "B."	

Unit-3	Unit-4	Common
9:00 a.m. Energized Unit 3 S/U Tx high side.		
	9:15 a.m. Energized Unit 4 S/U Tx high side.	
		6:07 p.m. Lost FTS 2000 in control room. Established land line.
		6:35 p.m. Energized Units 1 & 2 S/U Tx.
8-30-92 12:02 a.m. Found 3-40-399 U-3 train 1 AFW FCV closed. Opened valve and restored train 1.	8-30-92	8-30-92
2:21 p.m. Energized 3A bus with off site power.		
	6:24 p.m. Energized U-4 S/U Tx from off site.	
	6:44 p.m. Energized 4A bus.	
8:00 p.m. Energized 3B bus from off site.		
8:01 p.m. Shut down 3A EDG		
9:50 p.m. Energized 3C bus.		

Unit-3	Unit-4	Common
10:08 p.m. Energized 4B bus from off site.		
		11:08 p.m. **Ended Alert.**

APPENDIX R

EMERGENCY PLAN IMPLEMENTING PROCEDURE 20106, "NATURAL EMERGENCIES"

1.0 Title:

NATURAL EMERGENCIES

This procedure may be affected by an O T S.C (On The Spot Change) verify information prior to use
Date verified__________ Initials________

2.0 Approval and List of Effective Pages

2.1 Approval:

Change dated 8/11/92 Reviewed by Plant Nuclear Safety Committee: 92-124

and Approved by Plant General Manager: 8/11/92

Periodic Review Due: 2/10/96

Page	Date	Page	Date	Page	Date	Page	Date
1	08/11/92	18	08/11/92	35	08/11/92	52	08/11/92
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5	08/11/92	22	08/11/92	39	08/11/92	56	08/11/92
6	08/11/92	23	08/11/92	40	08/11/92	57	08/11/92
7	08/11/92	24	08/11/92	41	08/11/92	58	08/11/92
8	08/11/92	25	08/11/92	42	08/11/92	59	08/11/92
9	08/11/92	26	08/11/92	43	08/11/92	60	08/11/92
10	08/11/92	27	08/11/92	44	08/11/92	61	08/11/92
11	08/11/92	28	08/11/92	45	08/11/92	62	08/11/92
12	08/11/92	29	08/11/92	46	08/11/92	63	08/11/92
13	08/11/92	30	08/11/92	47	08/11/92	64	08/11/92
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17	08/11/92	34	08/11/92	51	08/11/92		

3.0 Scope:

3.1 Purpose:

This procedure provides instructions and guidelines for preparing, controlling, and recovering the plant following activation of the Emergency Plan for a natural emergency.

3.2 Discussion:

3.2.1 This procedure addresses tornadoes and hurricanes, but is to be used for any severe weather disturbance which results in Emergency Plan activation. Specific guidance is provided for coping with possible flood conditions associated with more intense hurricanes.

RTSs 2037, 86-488P, 88-1614, 88-2709P, 89-1028, 89-2126, 89-2743, 89-3255, 89-3144,
RTSs 91-0293, 90-2452, 91-3460, 91-3680, 92-0777, 92-1344
PC/Ms 87-212, 89-124, 90-390, 90-449 OTSC 6497, 7599

3.2.2 Procedural guidance for weather disturbances not meeting the criteria for activating the Emergency Plan are found in 0-ONOP-103.3, Severe Weather Preparation.

3.2.3 Reliable information on approaching severe weather disturbances is expected to be available as follows:

1. The National Weather Service issues warnings received by the State of Florida Department of Emergency Management (DEM). The Florida DEM will issue an All Points Bulletin from the State Warning Point via NAWAS. The Bulletin will identify areas to be affected by the severe weather, and will be reliable for Control Room notification.

2. The National Oceanic and Atmospheric Administration (NOAA) issues warnings received by the FPL System Operations Power Coordinator's Office which relays the information to the Turkey Point Units 3 and 4 Control Room. The Control Room will receive this information through one of the normal or emergency communications channels described in 0-EPIP-20112, Communications Network.

3.2.4 The TSC Operations Manager and the TSC Maintenance Manager will report the status of hurricane preparations to the Emergency Coordinator. All other managers and supervisors will report the status of hurricane preparations to the Emergency Preparedness Supervisor, who will keep the Emergency Coordinator appraised.

3.2.5 Substantial portions of this procedure support commitments 6.2.1 and 6.2.2. Do not delete material from this procedure without a full review of these commitments.

3.3 Authority:

Turkey Point Plant Emergency Plan

3.4 Definitions:

The following terms are used throughout this procedure:

3.4.1 CATEGORY IV HURRICANE: Hurricane with wind speed between 131 and 155 miles per hour.

3.4.2 CATEGORY V HURRICANE: Hurricane with wind speed greater than 155 miles per hour.

3.4.3 EYE: The center of a hurricane where calm prevails, with winds of no more than 20 - 30 mph and little or no rain.

3.4.4 HURRICANE: Same as a tropical storm, but the winds are over 73 mph and a well defined low barometric pressure center, called the EYE of the storm, is present.

3.4.5 HURRICANE ADVISORY: This is an information release put out every six hours, usually at 12 o'clock and 6 o'clock both day and night whenever a hurricane exists; the advisory is continually updated and this information is issued in the form of HURRICANE BULLETINS which are issued every 3 hours, day and night.

3.4.6 HURRICANE WARNING: This is a communication from NOAA, issued whenever a hurricane is between 12 and 24 hours from, and approaching, the U. S. coast and applies to an area approximately 50 miles either side of the expected landfall. This warning gives the expected time and location of landfall, as well as the hurricane's size, maximum winds, direction and speed of travel. The warning may also describe the coastal areas where high water, floods or high waves may be expected.

3.4.7 HURRICANE WATCH: This is a communication from NOAA, issued whenever a hurricane is between 24 and 48 hours from, and approaching, the U.S. coast and comprises an area approximately 100 miles either side of the expected place where the storm could come inland. It also gives the size, maximum winds, direction and speed of travel.

3.4.8 OWNER CONTROLLED AREA: That portion of the FPL property surrounding and including Turkey Point Plant which is subject to limited access and control as deemed appropriate by FPL.

3.4.9 POWER BLOCK: Structures comprising all permanent nuclear, power generation, and cooling structures, systems, and components within the Protected Area and permanent Safety Related or Quality Related utilities (e.g., air, water, and electric) both inside and outside the Protected Area.

3.4.10 TORNADO: A violently rotating column of air in contact with the ground, usually developing from severe thunderstorms or hurricanes.

3.4.11 TORNADO WARNING: This condition is declared once the surveillance means have shown that a tornado has been sighted. The area for which this warning is issued is usually smaller than that for which a watch is declared.

3.4.12 TORNADO WATCH: Meteorological conditions in the area described as favorable to the formation of tornadoes.

3.4.13 TROPICAL STORM: A weather disturbance of large size with winds of 39 to 73 mph, rotating in a counterclockwise direction, accompanied by torrential rains and an area of low barometric pressure.

3.4.14 TROPICAL STORM WARNING: This is a communication from NOAA issued whenever a tropical storm is 12 to 24 hours from, and approaching, the U.S. coast.

4.0 Precautions:

4.1 Preparations for a hurricane are extensive. Start efforts early and take a conservative approach; pre-hurricane rain and winds may hamper preparation efforts.

4.2 All unnecessary personnel in the Protected Area and all visitors in the Owner Controlled Area shall be required to leave when a hurricane warning is issued for the area. Flooding may make later evacuation impossible.

4.3 If a hurricane passes directly over the plant area, do not assume the hurricane has passed when the winds subside and rain stops. This only means that the EYE of the hurricane is over the area, and within approximately one hour the winds will begin blowing again from the opposite direction as the second half of the hurricane passes.

4.4 When a hurricane is near the area and high winds are occurring, or if there is significant likelihood that a tornado will strike the immediate plant site, keep all activities outside of the plant buildings to a minimum.

4.5 The installation of drain plugs and portable dewatering pumps is intended for larger hurricanes where the storm surge might result in plant flooding (Category IV and above). Full or partial implementation, particularly the installation of dewatering pumps in the condenser pits, may be considered for lesser storms.

4.6 Do not assume the emergency to be over until the receipt of official word from NOAA through the System Operations Power Coordinator that there is no longer a threat to the area.

5.0 Responsibilities:

5.1 It shall be the responsibility of the Emergency Coordinator, Emergency Preparedness Supervisor, TSC Site Construction Supervisor, TSC Maintenance Manager, TSC Mechanical Supervisor, TSC I&C Supervisor, TSC Electrical Supervisor, TSC Operations Manager, TSC Chemistry Supervisor, TSC Health Physics Supervisor, and the TSC Fire Protection Supervisor to comply with the steps outlined in Section 8 of this procedure to protect personnel and the plant from the effects of the emergency.

6.0 References/Commitment Documents:

6.1 References:

6.1.1 Turkey Point Plant Radiological Emergency Plan

6.1.2 Turkey Point Plant, Units 1 and 2 Hurricane Plans

6.1.3 National Oceanic and Atmospheric Administration Information - information on area tornado and hurricane reports

6.1.4 FSAR, Section 2, and Figures 1.2-3 and 1.2-4

6.1.5 Plant Procedures

1. 0-ADM-215, Plant Surveillance Tracking Program
2. 3-ONOP-004.1, System Restoration Following Loss of Offsite Power
3. 4-ONOP-004.1, System Restoration following Loss of Offsite Power
4. 3-ONOP-004.2, Loss of 3A 4KV Bus
5. 4-ONOP-004.2, Loss of 4A 4KV Bus
6. 3-ONOP-004.3, Loss of 3B 4KV Bus
7. 4-ONOP-004.3, Loss of 4B 4KV Bus
8. 0-ONOP-103.3, Severe Weather Preparations
9. 0-OP-003.1, 125V Vital DC System
10. 0-OP-031, Black Start Diesel Operation
11. 3-OSP-023.1, Diesel Generator Operability Test
12. 4-OSP-023.1, Diesel Generator Operability Test
13. 0-OSP-102.1, Flood Protection Stoplog Inspection
14. 0-OSP-104.1, Record of Meteorological Forecasts
15. ASP-38, Control of Construction During Power Operations
16. EPIP-20101, Duties of Emergency Coordinator
17. EPIP-20110, Criteria for and Conduct of Owner Controlled Area Evacuation
18. 0-EPIP-20112, Communications Network

6.1.6 JPN-PTN-SECJ-88-079, Safety Evaluation Temporary External Flood Protection Barriers

6.1.7 PC/M 87-212, EDG Enhancement Site Preparation

6.1.8 PC/M 89-124, Repair/Replace Stoplogs On East Side of Auxiliary Building

6.1.9 5610-C-1695, Network of Barriers for Main Plant External Flood Protection

6.1.10 JPN-PTP-90-1902, External Flood Protection Enhancement Program - Plant Drainage Evaluation

6.1.11 PC/M 90-390, Plant Perimeter Floodwell Repair

6.1.12 PC/M 90-449, CCW Area Pipe Trench Floodwells

6.1.13 JPNS-PTN-90-0111, Turkey Point Units 3 and 4 RHR Pump Room Access Hatch Removals

6.1.14 Station Blackout:

1. NRC Reg. Guide 1.155, Station Blackout
2. NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors
3. L-89-144, Information to Resolve Station Blackout
4. JPN-PTP-89-3253, Turkey Point Units 3 and 4 Response to NRC on Station Blackout Open Items
5. Turkey Point Units 3 and 4 - Safety Evaluation For Proposed Implementation Of The Station Blackout Rule (10CFR 50.63) (TAC Nos. 68618 and 68619), dated June 15, 1990
6. L-90-275, Implementation Of The Station Blackout Rule
7. L-90-338, Comments on NRC's Safety Evaluation for Station Blackout
8. L-90-56, Information to Resolve Station Blackout, dated March 29, 1990

6.1.15 Security Force Instruction (SFI) 3002, Hurricane Preparedness

6.1.16 Technical Specification 3.4.1.3

6.2 Commitment Documents:

6.2.1 L-91-184, PRA Transmittal Letter to NRC, dated June 25, 1991

6.2.2 Turkey Point Plant Units 3 & 4 Probabilistic Risk Assessment Individual Plant Examination Final Report, dated June 21, 1991

7.0 Records and Notifications:

7.1 The Emergency Coordinator shall ensure notifications are performed per EPIP-20101 for natural emergencies meeting emergency action level criteria.

8.0 Instructions:

NOTES:
- This procedure shall be used when the natural emergency meets the criteria in Table 1 of EPIP-20101, Duties of Emergency Coordinator. Natural emergencies that do not meet the criteria of EPIP-20101 shall be handled in accordance with 0-ONOP-103.3, Severe Weather Preparations.
- Annotate in the left-hand margin those steps performed which should be tracked to aid in later restoration of the plant to a normal configuration.
- The Emergency Coordinator has the authority to perform, or not to perform, the steps of this procedure as he deems necessary.

8.1 Tornado:

8.1.1 For either a tornado that has been sighted in the Owner Controlled Area or a tornado striking any Power Block structure, the Emergency Coordinator should perform the following:

1. Instruct plant personnel to immediately seek safe shelter.
2. Consult EPIP-20101, Duties of Emergency Coordinator, for direction.
3. Ensure that plant structures and equipment are surveyed for damage after the occurrence, and take appropriate action to maintain the units in a safe condition.
4. Request additional support via the Duty Call Supervisor to repair damaged equipment and commence clean-up.

8.2 Hurricane Warning:

8.2.1 Emergency Coordinator responsibilities include the following:

1. Consult EPIP-20101, Duties of Emergency Coordinator, for direction.

2. Initiate 0-OSP-104.1, Record of Meteorological Forecasts.

3. Order all unnecessary work stopped.

4. Determine the need for additional staffing. Consider alternative means of transportation for callout personnel to minimize the number of personal vehicles on site.

   NOTE: All unnecessary personnel in the Protected Area and all visitors in the Owner Controlled Area shall be required to leave when a hurricane warning is issued for the area.

5. Release non-essential personnel in a phased, controlled manner as hurricane preparations are completed or as personal circumstances dictate. Ensure release is far in advance of severe weather to allow personnel to arrive safely at their homes and avoid any undue congestion with the public.

6. Instruct the Human Resources Manager to provide for the advanced evacuation, if desired, of families of the storm duty crews.

7. Investigate the need for relocation of the TSC and/or OSC.

8. Establish a shift schedule for response personnel to provide for continuous plant support.

9. Brief the NPS on the personnel available for emergency teams and the capabilities and limitations of support.

10. Brief emergency response personnel on the storm, safety precautions, expected duties, potential problems, contingencies, and communications systems.

11. Ensure adequate preparations are made by conferring with the TSC Operations Manager, TSC Maintenance Manager, and the Emergency Preparedness Supervisor.

12. Determine when it is safe for personnel to return to work and ensure appropriate notifications are made.

13. The following guidelines should be considered for a Category 5 Hurricane Warning, and may be considered for lesser category hurricanes:

    NOTE: The Auxiliary Building is the preferred location for the TSC, but if flood levels are expected above 18 foot elevation the Cable Spreading Room, 4160V/480V rooms, or the Unit 4 EDG building (upper floor) may be preferred.

    a. Direct the relocation of the TSC and OSC to suitable locations.

    NOTE: Emergency Coordinator responsibilities should remain with (or be transferred back to) the Nuclear Plant Supervisor (NPS) upon the relocation of the TSC/OSC due to the lack of communication, assessment and support capabilities available. The emergency response organization should remain at the relocated OSC and provide support resources, principally emergency teams, to the NPS during the storm.

    b. Brief the NPS upon initiating relocation of the TSC/OSC, and transfer Emergency Coordinator duties to him.

    c. Relocate the following emergency response personnel to the Control Room:

        TSC Dose Assessment Technician

        EOF Communicator

        TSC/ENS Communicator

        ERDADS Operator

    d. Evaluate the oncoming storm and select desired guidelines and contingency actions for implementation:

        1. Discuss with the TSC Operations Manager and determine if any of the guidelines from Appendix D should be implemented.

        2. Discuss with the TSC Maintenance Manager and select and prioritize desired guidelines from Section 8.2.4.

        CAUTION: Evacuation of a remote station during the hurricane presents great risk to personnel; adequate provisions must be made ahead of time to minimize this risk.

    e. Ensure that remote field stations (480V Load Center Rooms, Auxiliary Building, Cable Spreading Room, EDG buildings) are habitable and well equipped for local actions.

f. Establish prospective routes within the plant that personnel will use to minimize exposure to severe weather [Commitment Step 6.1.13]. Evacuation routes from remote stations should be equipped with safety lines.

8.2.2 Emergency Preparedness Supervisor responsibilities include the following:

NOTE: The Emergency Preparedness Supervisor has overall responsibility for storm preparedness.

1. Ensure the Emergency Coordinator is kept informed of the preparation status.

2. Ensure the instructions of this procedure are being properly and expeditiously implemented. Steps of the procedure may be only partially implemented based on management judgment.

3. Coordinate with the Human Resources Manager to make all plans necessary to evacuate the families of emergency crews, if desired, so that those individuals remaining can devote their full efforts to the plant.

4. Perform frequent walkdowns of the plant exterior and site with various key managers inspecting for and reducing potential missiles. [Commitment Step 6.1.13]

5. Coordinate activities of the various plant departments; resolve working level problems that may arise during storm preparations, including licensing issues.

6. Coordinate the following with the Nuclear Materials Management Superintendent:

   a. Purchase and properly store the necessary supplies for Operations, Maintenance, Security, and support personnel staying on site during the storm, including the following:

      (1) Food items

      (2) Water, beverages

      (3) Paper plates, cups

      (4) Plastic utensils

      (5) Paper towels

      (6) Soap

   b. Make arrangements for purchase of portable bedding as required by the Emergency Coordinator.

7. Coordinate the following with the Land Utilization Site Superintendent:

   a. Ensure that the U.S. Air Force Sea Survival School has removed their small boats and loose gear from the area.

   b. Make arrangements (including with any outside contractor within and Utilization responsibility) to remove, tie down, or otherwise secure equipment and material to keep it from blowing away.

   c. Ensure that equipment is available to clear Palm Drive following the hurricane.

8. Coordinate the following with the Safety Supervisor:

   a. Inspect the site for potential safety hazards.

   b. Inspect life lines for adequacy.

   c. Ensure medical support and adequate medical supplies are available.

   d. Investigate the relocation of the onsite medical facility.

9. Coordinate with the Supervisor - Contracts Management to make arrangements with all outside contractors within plant responsibility to remove, tie down, or otherwise secure equipment and material to keep it from blowing away.

10. Perform communications checks of all emergency communication systems in accordance with EPAD-007, Emergency Response Facilities and Equipment Surveillance.

11. Assist the Emergency Coordinator in determining the need for additional staffing.

12. Assist the Emergency Coordinator in investigating the need for relocation of the TSC and OSC.

13. Ensure the TSC and OSC, including supplies and emergency equipment, are fully prepared for possible activation in accordance with EPAD-007, Emergency Response Facilities and Equipment Surveillance.

14. Assign facility responsibility for Fab Shops/Trailers and other buildings per Section 8.2.13.

15. Perform the site facilities duties of Section 8.2.13.

16. The following guidelines should be considered for a Category 5 Hurricane Warning, and may be considered for lesser category hurricanes:

    a. Make preparations, as directed, to relocate the TSC and OSC:

        (1) Dismiss TSC/OSC staff that are not on the Emergency Response Teams and are not required to assure the effectiveness of the emergency response organization. Notify appropriate managers.

        (2) Coordinate with the TSC Maintenance Manager to move all portable emergency equipment and supplies to a location accessible from the new TSC/OSC location.

        (3) Coordinate with the TSC Maintenance Manager to relocate at least 5 desks and 60 chairs to the new TSC/OSC location, if space permits.

        (4) Establish dedicated phone lines to the Control Room from the relocated TSC/OSC. Ensure sufficient portable radios and cellular phones are available; contact the corporate radio shop to locate additional radio equipment.

        (5) Coordinate with the TSC Maintenance Manager to set up facilities for collecting human waste at a location accessible from the new TSC/OSC location.

        (6) Coordinate with the Nuclear Materials Management Superintendent to stage bedding, food, and water at a location accessible from the new TSC/OSC location.

        (7) Coordinate with the TSC Health Physics Supervisor to establish suitable work areas if the new TSC/OSC location is the Auxiliary Building. A berthing area and an area for eating and drinking should be established in the Cable Spreading Room or other designated location.

        (8) Coordinate with the TSC Health Physics Supervisor to establish a control point at the door from the Auxiliary Building to the New Electrical Equipment Room within two hours of the approach of the storm. Ensure a continuous path of access is set up from the Auxiliary Building to the New Electrical Equipment Room to the Cable Spreading Room.

    b. Consult with corporate officials on arranging for helicopters to bring support personnel and equipment to the site immediately after passage of the storm.

8.2.3 TSC Construction Services Manager responsibilities include the following:

1. Remove scaffolding that would be exposed to high winds.

2. Survey construction sites to ensure all light material is either tied down or placed indoors.

3. Tie down portable toilets, air compressors, and gangboxes; wire the gangboxes shut.

4. Secure electrical service to temporary facilities.

5. Survey site laydown areas to secure or remove loose objects.

6. Check tie downs on all temporary and portable buildings or structures that could be damaged by strong winds. Consult facility drawings to ensure all structures are checked.

7. Disassemble and remove temporary buildings not having tie-downs, such as the wooden buildings at the containment equipment hatches.

8. Move valuable equipment to high ground.

9. Ensure that PTF hurricane preparations are satisfactory so as not to impact the nuclear units. Coordinate walkdowns at the "island" laydown areas.

10. If winds greater than 120 mph are expected, tie down the water treatment plant ECOLOCHEM trailers.

8.2.4 TSC Maintenance Manager responsibilities include the following:

1. Ensure the Emergency Coordinator is kept informed of the preparation status.

   NOTE: Individuals appointed to emergency teams with personal considerations that can be addressed by the Company should be identified to the Human Resources Manager.

2. Solicit volunteers for emergency staffing; coordinate with the Emergency Preparedness Supervisor to attempt to resolve any personal considerations.

3. Contact additional Maintenance Department personnel that are necessary for hurricane preparations.

4. Establish emergency teams to meet the following criteria:

   a. Meet Emergency Plan minimum staffing in accordance with the PTN Radiological Emergency Plan Table 2-2a, and

   b. Provide for emergency maintenance, and

   c. Provide for round-the-clock coverage.

5. Establish backup crews for contingency support.

6. Ensure that adequate dewatering pumps and hoses, drain plugs, and sandbags are available and prestaged.

7. The following guidelines should be considered for a Category 5 Hurricane Warning, and may be considered for lesser category hurricanes:

   a. Assist the Emergency Coordinator in establishing a shift schedule for response personnel. Reliefs should be prepositioned to preclude the need to move personnel during the storm.

   b. Establish a tool and spare parts area in a secure location where a minimum but sufficient number of tools will be available for each maintenance discipline to use in an emergency.

   c. Request stores to wrap, elevate, relocate, or otherwise protect spare motors and other parts or tools that may be required for recovery.

   d. Ensure that the lifelines run by the Mechanical Supervisor include lines between appropriate remote stations described in Appendix D.

   e. Discuss with the Emergency Coordinator what additional protection may be required for the following areas:

      (1) 4kV Bus Rooms:

      - Seal all doors and penetrations on the 18 foot elevation. Consider at least sandbagging, possibly welding the doors.

      - Provide a means for measuring water level in the rooms.

(2) AFW Cage:

- Extend or plug the lube oil reservoir vents to prevent water intrusion.
- Bag the pump governors to protect against water intrusion.
- Bag the alternate shutdown communications headset and handset connections.

(3) Unit 4 EDG Building:

- Remove decking and install a ladder so access between the upper and lower levels is possible without travel outside.
- Seal and sandbag the ground floor doors.

  NOTE: Due to the exposed location of the Unit 3 EDG fuel oil transfer pumps, the Unit 3 EDGs may not be available in this storm. Priority should be placed on protecting the Unit 4 EDGs, then protecting Unit 3 EDGs as time permits.

(4) Unit 3 EDG Building:

- Provide as much flood protection as possible without impeding the ability of personnel to evacuate toward the turbine building.
- Create a sandbag and herculite floodwall to protect from flooding of the radiator compartment.

(5) Auxiliary Building:

- Bag alternate shutdown headset and handset connections.
- Provide a means for measuring water level in the building.
- Consider sandbags around MCCs so as to allow access but prevent flooding at low levels.
- Sandbag pipe trenches under the outer walls of the CCW rooms and the SI pump room as required.
- Seal outer doors (consider sandbags where appropriate).

(6) Auxiliary Building 10 ft elevation:

- Bag alternate shutdown headset and handset connections.

(7) Electrical Equipment Room:

- Provide a means for measuring water level in the room.
- Sandbag at the door to the Auxiliary Building so as to allow access but prevent flooding at low levels.

(8) Component Cooling Water Pump Rooms:

- Protect components from water and wave action as much as possible (e.g. via sandbagging).
- Check that area deckplates are bolted down and hurricane clips installed.

(9) A MCCs:

- When Operations no longer requires access, shield or wrap the MCCs in protective material to minimize water intrusion.
- Sandbag to allow access but prevent flooding at low levels.

(10) B MCC Rooms:

- Seal the doors when Operations no longer requires access.

(11) Computer Room:

- Seal the doors when Operations no longer requires access.

(12) Spent Fuel Pit pumps:

- Bag the non-running motors to protect against water intrusion.
- Sandbag and herculite the entrance to the heat exchanger rooms.

(13) Non-Vital DC battery and bus rooms:

- Seal the doors when Operations no longer requires access.

(14) Turbine Building:

- Walkdown and bag appropriate equipment (including alternate shutdown headset and handset connections) to protect against water intrusion.
- Verify deckplates are securely bolted down and hurricane clips installed.
- Verify any 18 foot elevation outer wall penetrations are securely plugged.

f. Provide support for the remote stations referenced in Appendix D:

CAUTION: Portable pumps and generators may be used in manned locations only if exhaust gases can be safely directed outside.

(1) Station maintenance personnel and equipment at remote stations that may require dewatering.

(2) Position electricians at remote stations where ground isolation may be required (Control Room, Cable Spreading Room, 480V load centers A-D rooms, Auxiliary Building) to measure grounds and voltages. Continuous voltage indication supporting early ground detection and isolation should be provided at remote station MCCs if possible.

(3) Deploy portable generators where needed.

(4) Provide materials at remote stations to allow sealing of leaking penetrations (such as door thresholds) and water collection and removal.

(5) Ensure adequate food and water is provided at remote stations for the duration of tropical storm force winds.

(6) Provide facilities for the collection of human waste at remote stations and the Control Room (since the sewage system may be out of service).

8.2.5 TSC Mechanical Supervisor responsibilities include the following:

NOTE: The combined capacity of pumps (a) through (f) below should equal or exceed 4900 GPM with pumps (a) and (b) making up the bulk of this capacity. The capacity of pumps (g) and (h) should equal or exceed 250 GPM each.

1. Install portable dewatering pumps, portable electric generators with fuel supplies, and associated suction and discharge hoses in the following areas:

   a. Unit 3 Condenser Pit Sump (locate at northeast corner near existing sump)

   b. Unit 4 Condenser Pit Sump (locate at northeast corner near existing sump)

   c. On the floor, just east of Unit 3 HDP

   d. On the floor, just east of Unit 4 HDP

   e. By Unit 3 Blowdown Flash Tank

   f. In Catch Basin #15 (in RCA west of Unit 4 West Electrical Penetration Room)

   g. Unit 3 CCW Pump Room north end

   h. Unit 4 CCW Pump Room south end

   i. Unit 3 RHR Room Sump

   j. Unit 4 RHR Room Sump

   k. Auxiliary Building Sump

   CAUTION: Portable pumps and generators may be used in manned locations only if exhaust gases can be safely directed outside.

   l. Unit 3 4KV A and B Bus Switchgear Room

   m. Unit 4 4KV A and B Bus Switchgear Room

NOTES:
- Drain plug installation shall not be initiated unless the approaching hurricane is judged to present imminent potential of external flooding.
- Early rains may cause standing water in some areas which obscures drains and hampers drain plug installation. Installation must start early, but should be worked after or concurrent with the deployment of portable dewatering pumps.

2. Install drain plugs per Appendix C after or during installing portable dewatering pumps.

NOTES:
- Sandbag dikes may be used to fortify either side of a stoplog.
- "*" indicates with Hold Down Pin installed.

3. Install stoplogs on plant flood protection walls as follows:

a. Stoplogs 1* and 2 - South of Unit 4 Steam Generator Feed Pump Room

b. Stoplog 3 - Southeast of Unit 4 Lube Oil Reservoir

c. Stoplog 4* - South Wall of Unit 4 Condenser Pit

d. Stoplog 5 - Entrance to Unit 4 Condenser Pit

e. Stoplogs 6 and 7 - East of Unit 4 Main Transformer

f. Stoplog 8 - Southeast of Unit 3 Lube Oil Reservoir

g. Stoplogs 9* and 10 - South Wall of Unit 3 Condenser Pit

h. Stoplog 11 - Entrance to Unit 3 Condenser Pit

i. Stoplogs 12 and 13 - East of Unit 3 Main Transformer

j. Stoplogs 14 and 15* - Between Unit 3 4160 Volt Switchgear Room and EDG Building

k. Stoplog 16* - Entrance to Unit 3 Spent Fuel Pit Heat Exchanger Room (sand bags as required at both lower corners)

l. Stoplog 17* - Entrance to Unit 3 New Fuel Storage Area

m. Stoplog 18* - Entrance to Auxiliary Building Chemical Storage Area (East door to BAST Room)

n. Stoplog 19* - Entrance to Unit 3 Component Cooling Water Pump Area

o. Stoplog 20* - Entrance to Unit 4 Component Cooling Water Pump Area

p. Stoplog 21* - Entrance to Unit 4 New Fuel Storage Area

q. Stoplog 22* - Entrance to Unit 4 Spent Fuel Pit Heat Exchanger Room

r. Radwaste Building Stoplogs

(1) Stoplog SL-1 - Northeast door to Radwaste Building

(2) Stoplog SL-2 - Southeast door to Radwaste Building

(3) Stoplog SL-4 - Top and Bottom - Overhead doorway Truck Ramp to Radwaste Building

4. Walkdown the floodwall. If the floodwall is breached or stop-log guides are displaced or damaged, install sandbags in the damaged area. The sandbag barrier should have a minimum height of two (2) feet and a minimum width of eighteen (18) inches.

5. Position sandbags in the following areas to control any potential flooding or inleakage that may develop (numbers are approximate):

NOTE: When constructing dikes use Appendix B, Sketch 1 for guidance.

a. 4KV A and B Bus Switchgear Rooms (50 each door)

b. Turbine Area 18 ft Elevation - North and South Ends (500 each)

c. Computer Room (60)

d. Auxiliary Building East - West Hallway/Laundry Room Door, SI Pump Room Doors (50 each door)

e. BAST Room Door (30)

f. Radwaste Building doors (50 each door)

g. HP Building, Maintenance Building, Nuclear Administration Building, Nuclear Entrance Building, Training Building doors (30 each)

h. CCW Rooms (200 Each)

i. Dry Storage Warehouse (100)

j. TSC (100)

k. If resources permit, the following areas may also be done:

   (1) Machine Shop

   (2) Nuclear Materials Issue Warehouse

   (3) Central Receiving Facility

   (4) Main Truck Gate Entry Building

   (5) Water Treatment Gate Entry Building

   (6) Security Emergency Diesel Generator Enclosure

CAUTION: Prior to sandbagging manhole covers, ensure no personnel are in the tendon galleries.

6. Ensure east tendon gallery manhole covers (one per unit) are installed and covered with sandbags.

7. Verify sufficient emergency supplies are available and staged:

   a. Portable radios and batteries

   b. Flashlights and batteries

   c. Lumber and nails

   d. Rope, cable, soft wire, tie wraps

   e. Tape

   f. Clamps, turnbuckles, screw anchors, stakes

   g. Banding material

   h. Plastic, tarps

   i. Rain gear, buckets

   j. Sandbags

8. Provide tarpaulins and ropes at various locations throughout the Auxiliary Building. Have an ample supply of plastic film (pliofilm) on hand in the Control Room, Cable Spreading Room, 4KV Switchgear Rooms and Computer Room.

9. Close the following outside doors, and roof hatches and inflate seals where applicable:

a. Outside doors:

(1) Cable Spreading Room (Doors 132-1, 132-2 and 104-3 to roof)

(2) Unit 3 New Fuel Storage Room (rollup door)

(3) Unit 4 New Fuel Storage Room (rollup door)

(4) Unit 3 Spent Fuel Pit

(5) Unit 4 Spent Fuel Pit

(6) Unit 3 CCW Surge Tank Room

(7) Unit 4 CCW Surge Tank Room

(8) West Auxiliary Building Main Passageway to Turbine Building (Door 58-2)

(9) Unit 3 480V Load Center Room (Door 96-1)

(10) Unit 4 480V Load Center Room (Door 94-1)

(11) Unit 3 4160V Switchgear Room (Doors 70-1, 70-2, 71-1)

(12) Unit 4 4160V Switchgear Room (Doors 67-1, 67-2, 68-1)

(13) CVCS Holdup Tank Enclosures (2)

(14) 3A EDG Room (Doors 73-1, 75-1)

(15) 3B EDG Room (Doors 72-1, 74-1)

(16) East Auxiliary Building Main Passageway to Unit 4 CCW Room (Door 58-1)

(17) Control Building Elevator Vestibule (4)

(18) Containment Purge Supply Fan Room

(19) Auxiliary Building Laundry Room (Door 46-2)

(20) Intake Storage Room (1)

(21) Unit 3 B MCC Room (Doors 63-1, 63-2)

(22) Unit 4 B MCC Room (Doors 61-1, 61-2)

(23) Unit 3 Electrical Penetration Rooms (Doors 20-1 South, 19-1 West)

(24) Unit 4 Electrical Penetration Rooms (Doors 26-1 North, 27-1 West)

(25) Generator Exciter Switchgear Enclosures (2)

(26) Radwaste Building Doors (East, North, Loading Ramp, Elevator)

(27) Condensate Polisher/E Load Center/B43 MCC Building

(28) Computer Room (Doors 62-1, 62-2)

(29) DC Enclosure Building

(30) Boric Acid Storage Room (Door 41-1)

(31) Safety Injection Pump Rooms (2)

(32) Amertap Control Center/4G MCC Enclosure (2)

(33) C Bus - 4160 Volt Switchgear Enclosure (2)

(34) Nuclear Gas House (1)

(35) Control Room to Auxiliary Building Roof (Door 108 A-2)

(36) Control Room to Fan Room (Doors 108 A-3, 108 A-4)

(37) Load Center F & G Enclosures (2)

(38) Unit 4 EDG Building (Doors 133-1, 133-3, 138-1, 138-2, 136-1, 141-1)

b. Roof hatches:

(1) Auxiliary Building - Stairwell to 10 ft. elevation

(2) Auxiliary Building - RHR Pump and Hx Rooms

(3) Auxiliary Building - Monitor Tank Room

(4) Auxiliary Building - Demin Cubicles

(5) Auxiliary Building - BA Evaporator Rooms

(6) Radwaste Building

10. Verify that hatch covers and grating above each Heater Drain Pump, Condensate Pump, Steam Generator Feed Pump, and Auxiliary Transformer is secured.

11. Ensure main passageways are cleared.

12. Remove items from areas subject to high winds, for example:

    a. Loose trash and debris

    b. Tools

    c. Sheet metal

    d. Empty containers, trash cans, drums

    e. Unnecessary hoses, electrical cords, welding cable

    f. Temporary power panels

    g. Lumber, pallets, platforms, work stations

    h. Cleaning equipment

    i. Portable resin funnels on Auxiliary Building roof

13. Tie down or secure the following loose equipment:

    a. Gas trailers

    b. Portable dewars

    c. Ladders

    d. Needed hoses, electrical cords

    e. Gang boxes

    f. Signs

14. Install life lines between important operating areas of the plant in case personnel must be sent to these areas during high winds.

NOTE: Chemicals/oil should be stored securely above any expected flood level and in locations which will withstand expected winds.

15. Store all chemical drums in the chemical warehouse, and oil drums in the oil house and/or chemical warehouse.

NOTES:
- Before locking dampers closed or installing protective covers, ensure Operations will not require use of the blocked fans.
- When the vent fans listed in Substep 8.2.8 are stopped, the following air intake, exhaust, or vent openings should be closed off.

16. Verify that the dampers of those openings equipped with dampers are locked in the closed position. Install the following protective covers where required:

    a. Spent Fuel Pit Inlet Air Vents

    b. New Fuel Storage Room Fan Inlet Vent

    c. Spent Fuel Pit Heat Exchanger Room Fan Inlet Vent

    d. Spent Fuel Pit Heat Exchanger Room Exhaust Vent

    e. Containment Purge Supply Fan Air Intake

17. Fuel and tie down the diesel instrument air compressors; stage and secure additional fuel drums/tanks adjacent to the compressors.

18. Ensure nitrogen bottles for MSIVs, steam dump to atmosphere valves, and AFW flow control valves are filled and properly secured.

19. Verify that the gas cylinders in both gas cylinder storage houses are properly secured.

20. Consult Engineering for additional preparation requirements for empty tanks (i.e., installing temporary tie down anchors). Engineering will provide such additional requirements on a case by case basis.

21. Check and clean fuel oil tank roof vents to assure adequate pressure relief if necessary.

22. Bolt or otherwise secure the hatches on the chemical feed tanks.

23. If the Unit 3 or Unit 4 Hydrogen Recombiner is in operation the Hydrogen Recombiner shall be secured from service and the attached hoses isolated and disconnected from the permanently installed piping flanges.

24. Clean the intake trash pit.

25. Tie down intake trash rakes and hoists in such a manner that they are secure, yet readily available if needed.

26. Dog the intake area gantry crane, the cask crane and the turbine deck gantry crane. Ensure hooks are fully raised.

27. Designate storm duty vehicles. Establish a designated location for storm duty vehicles inside the Protected Area and RCA. Ensure these vehicles are serviced and fueled. Move unnecessary vehicles outside the Protected Area.

28. Perform the site facilities duties of Section 8.2.13.

8.2.6 TSC I&C Supervisor responsibilities include the following:

1. Check that all instruments located outdoors are in weatherproof condition by inspecting cases, gaskets, and so forth. Weatherproof those that need it with plastic film.

2. Tape up or protect glass gage face covers as necessary.

8.2.7 TSC Electrical Supervisor responsibilities include the following:

1. Ensure all doors to plant transformer control panels, outdoor electrical cabinets, and so forth are securely closed.

2. Coordinate with System Protection to ensure the switchyard is prepared for severe weather.

3. Perform the site facilities duties of Section 8.2.13.

8.2.8 TSC Operations Manager responsibilities include the following:

1. Ensure the Emergency Coordinator is kept informed of the preparation status.

<u>NOTE:</u> Individuals appointed to emergency teams with personal considerations that can be addressed by the Company should be identified to the Human Resources Manager.

2. Solicit volunteers for emergency staffing to resolve any personal conflicts. Coordinate staffing with the Emergency Preparedness Supervisor.

3. Establish emergency teams to meet the following criteria:

   a. Meet Emergency Plan minimum staffing in accordance with the PTN Radiological Emergency Plan Table 2-2a, and

   b. Provide for round-the-clock coverage.

   <u>NOTE:</u> Substeps 4 through 15 are commitments: Commitment Step 6.1.12.

4. Make arrangements for sufficient operating personnel to be at the plant during the hurricane in order to provide the necessary coverage for several days during which the plant may be inaccessible.

5. Shutdown/cooldown both units to at least Mode 4 within two hours prior to the projected onset of sustained hurricane force winds at the site. Units shall then remain in Mode 4 or below for the duration of the hurricane and/or until offsite power has been stabilized.

6. Perform a review of the EOOSL for equipment out of service for maintenance or testing to identify those whose redundancy is desired to support reliable plant operation during the storm. Ensure work is prioritized to promptly restore such equipment to an operable status.

7. Perform an operability check of the Black Start Diesels per 0-OP-031. If any equipment is inoperable, ensure work is properly prioritized to restore such equipment to an operable status. Ensure an adequate supply of fuel oil is available.

8. Review OSP-200.1 and 0-ADM-215 for Technical Specification surveillance requirements. Conduct all surveillances, if possible, that will come due during the storm.

9. Determine if and when operator rounds on outside equipment are to be temporarily suspended during the storm. Document instructions in the Night Orders.

10. Perform an operability run of each EDG per 3/4-OSP-023.1 and return the diesel generator to standby service within 24 hours prior to projected onset of sustained hurricane force winds at the site.

11. Fill Condensate Storage Tanks, Raw Water Tanks, the Demineralized Water Storage Tank, Primary Water Tanks and Refueling Water Storage Tanks.

12. Verify battery chargers and applicable station vital batteries are operational per 0-OP-003.1.

13. Ensure that adequate inventories of hydrogen, nitrogen, and carbon dioxide are available to accommodate a unit shutdown and subsequent startup.

14. Review 3/4-ONOP-004.XX series procedures and 3/4-EOP-ECA-0.0 in preparation for a Station Blackout.

15. Remind FPL System Operations of the importance of expeditiously re-establishing power to the site if a Loss of Offsite Power or Station Blackout occurs.

16. Perform a test run of the Security diesel in accordance with 0-OP-026, Cat 400 Operation.

17. Make maximum permissible liquid and gaseous releases before the hurricane is within two hours of the plant; waste water and waste gas inventories should be at a minimum.

18. Open redundant outdoor 480V receptacle circuit breakers per Appendix A. Issue a clearance to the NPS on all breakers opened.

    NOTE: Fans may be operated on a selected basis as operating conditions dictate; do not allow Maintenance to secure dampers on fans which may be needed.

19. Stop the vent fans listed below so the TSC Mechanical Supervisor can lock close dampers and install protective covers:

    a. Spent fuel pit ventilation fan

    b. New fuel storage room vent fan

    c. Spent fuel pit heat exchanger room vent fan

    d. Containment purge supply and exhaust fans

    e. Auxiliary building supply vent fans

    f. Containment penetration cooling fans if not required

    g. Diesel generator room vent fans - verify in automatic

20. Consult Engineering for additional preparation requirements for empty tanks (i.e., filling of tank); Engineering will provide such additional requirements on a case by case basis. Tanks should be vented to atmosphere where practicable.

21. Ensure adequate inventories of chemicals (such as boric acid, ammonia, hydrazine) are available and staged.

22. Isolate the Miami Dade Water and Sewer Authority water supply by closing Raw Water Storage Tank inlet isolation valves RXU-1 and 885.

23. Verify Unit 3 and Unit 4 cask washdown area drains are closed by having drain covers installed and bolted.

24. Shutdown Amertap Systems and open and tag power supply breakers to all pumps and valves. Issue a clearance to the NPS.

25. Suspend all fuel movement, if applicable; place all refueling equipment in a safe condition.

26. Arrange to have portable bedding brought to the Control Room and other suitable locations when the hurricane is less than six (6) hours from the plant.

27. Start all traveling screens at the approach of the storm.

28. Restore the plant to a normal configuration upon discontinuation of the emergency. Annotated steps of this procedure and applicable plant procedures may be used.

29. The following guidelines should be considered for a Category 5 Hurricane Warning, and may be considered for lesser category hurricanes:

    a. Assist the Emergency Coordinator in establishing a shift schedule for response personnel. Reliefs should be prepositioned to preclude the need to move personnel during the storm.

    b. Determine with the Emergency Coordinator and/or NPS if any of the guidelines from Appendix D should be implemented.

8.2.9 TSC Chemistry Supervisor responsibilities include the following:

1. Arrange to have the fuel oil storage tanks for the Black Start Diesels and the Emergency Diesel Generators topped off.

2. Ensure that adequate inventories of acid and caustic are available, then isolate acid and caustic sources.

3. Ensure the NPS has terminated all radioactive release permits when the hurricane is less than two hours from the plant.

4. Perform the site facilities duties of Section 8.2.13.

8.2.10 TSC Health Physics Supervisor responsibilities include the following:

1. Instruct Health Physics personnel to inspect outside areas for radioactive materials that need to be stored inside or protected from severe weather.

2. Instruct Health Physics personnel to inspect the low level radwaste storage warehouse and radwaste building. Consider moving highly contaminated components stored at ground level to a higher elevation.

3. Temporarily store all contaminated waste at the RCA waste segregation building in a C-van.

4. Perform the site facilities duties of Section 8.2.13.

5. The following guidelines should be considered for a Category 5 Hurricane Warning, and may be considered for lesser category hurricanes:

   a. Perform detailed surveys of the main passageways and establish suitable work areas if the TSC/OSC is relocated to the Auxiliary Building.

   b. Locate sufficient HP supplies and equipment, (including monitoring instrumentation), in the Auxiliary Building to support the emergency teams.

   c. Temporarily relocate the RCA control point to the door between the New Electrical Equipment Room and the Auxiliary Building within two hours of the approach of the storm. Secure the normal entrance to the RCA.

8.2.11 TSC Security Supervisor responsibilities include the following:

1. Ensure that all visitors have been evacuated in an orderly manner from the Owner Controlled Area in accordance with EPIP-20110, Criteria for and Conduct of Owner Controlled Area Evacuation.

2. Maintain an accurate list of personnel who are to remain on site. Verify this list against a Security printout of personnel on site.

3. Coordinate the deployment of Security personnel during the severe weather.

4. Implement Security Force Instruction (SFI) 3002, Hurricane Preparedness.

5. Perform the site facilities duties of Section 8.2.13.

8.2.12 TSC Fire Protection Supervisor responsibilities include the following:

1. Fuel all fire protection equipment.

2. Relieve personnel as directed.

(6) Contracts, invoices, budget information

(7) Maintenance documents

(8) FSAR, Tech Specs, Vendor Manuals

c. Verify that sandbags required per Step 8.2.5.5 have been or are being installed satisfactory.

d. Nonessential equipment is deenergized.

e. Windows and glass doors are taped and boarded over, as time permits.

f. Window blinds are closed.

g. Doors to rooms having windows are closed.

h. Outside doors are shut securely.

i. Grounds around the facility are free of potential hazards.

APPENDIX A
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480 VOLT RECEPTACLE LIST

NOTE: The following breakers are to be verified tagged and opened per Step 8.2.8 of this procedure. The TSC Operations Manager has responsibility to ensure this is completed.

BREAKER NO.	RECEPTACLE NO./LOCATION
30513	4 and 4A, Turbine Area East
30653	17 and 17a, Unit 3 Containment
30661	5, West End, Aux. Building E/W Passageway
30674	6, 6A and 6B East End and Exterior East Wall of Aux. Building
30736	7, North End, Aux. Building N/S Passageway
30905	11 and 12, North End of Intake Area
30760	8, Unit 3 Cask Wash Area (See Note 1)
34341	U3 Condensate Polisher Area Receptacles
40653	17 and 17a, Unit 4 Containment
40903	15 and 16, Intake Area (at Traveling Screens)
44341	U4 Condensate Polisher Area Receptacles
0870	9, South End of Aux. Building N/S Passageway
0871	10, Unit 4 Cask Wash Area (See Note 1)
1023	13, Water Treatment Plant Area
B1605	01 and 02 Radwaste Control Area, West Wall
B1704	03, Radwaste N/S Passageway, North End
B2028	Radwaste N/S Passageway, South End and Outside Receptacles
Panel 3P14, Bkr 1	Two receptacles outside north wall and two outside east wall of No. 3 4160 Switchgear Room
Panel 3P14, Bkr 2	One receptacle at SE corner No. 3 Aux. Trans.
Panel 3P14, Bkr 3	One receptacle at No. 3 Bowser Filter One receptacle west of 3A MSRH One receptacle at SW corner of Cond. Retubing Pit, ground level (See Note 2)
Panel 3P14, Bkr 4	One receptacle in Aux. Feedwater Pump Area One receptacle east of 3D MSRH
Panel 3P14, Bkr 5	One receptacle, Turbine Deck, west side between Units 3 and 4 One receptacle under south end of steam platform
Panel 3P14, Bkr 6	One receptacle on Mezz. Level at Panel 3P14 One receptacle at NE corner of Turbine Deck
Panel 3P14, Bkr 7	One receptacle at NW corner of Turbine Deck
Panel 4P14, Bkr 1	One receptacle at east wall No. 4 4160 Room
Panel 4P14, Bkr 2	One receptacle at SE corner No. 4 Aux. Transformer
Panel 4P14, Bkr 3	One receptacle at south side of Cond. Retubing Pit, ground level One receptacle east of Bowser Filter One receptacle west of 4A MSRH
Panel 4P14, Bkr 4	One receptacle east of 4D MSRH One receptacle east of No. 4 SGFW Pump Room
Panel 4P14, Bkr 5	One receptacle at SW corner of Turbine Deck One receptacle under south edge of steam platform

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480 VOLT RECEPTACLE LIST

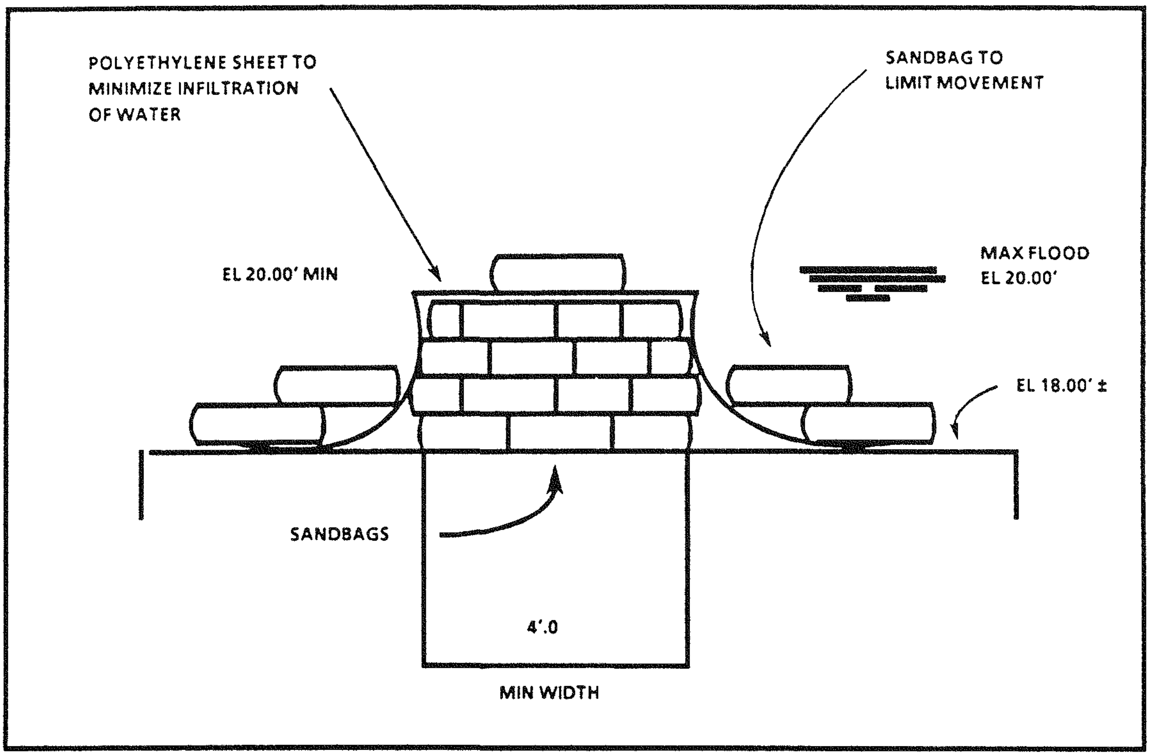
Panel 4P14, Bkr 6	One receptacle on Mezz. Level at Panel 4P14 One receptacle on Turbine Deck, south of Control Room door
DP10-5	Fan Room area receptacles
DP10-6	Fan Room area receptacles and DP441

NOTE 1: Power supply to Emergency Spent Fuel Pit Cooling Water Pumps

NOTE 2: Power supply to L.O. Reservoir Oil Renovators (DeLaval)

APPENDIX B
(Page 1 of 1)

DETAILS FOR FLOOD PROTECTION DIKE



SKETCH 1

SIDE VIEW OF TYPICAL SANDBAG DIKE

NOTES:

1. The location of dikes placed along walls shall be chosen to limit obstructions with the mounted items to walls. Care shall be used when placing dikes to insure equipment/components are not obstructed.

2. Polyethylene sheets should have a minimum thickness of 4 mils.

3. Sandbag size and placement should be determined by field personnel based on availability and positioned to provide dike dimensions similar to those shown above.

4. Position sandbags used to protect doors on the side of the door that will allow opening the door and maintaining access.

APPENDIX C
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DRAIN PLUGS

NOTE: If a drain plug cannot be properly installed in a drain, install a sandbag dike at least two feet high around the drain.

DRAIN ID	SIZE	DESCRIPTION	LOCATION	NOTES
2	2"	Equipment Drain	South of No. 4 Instrument Air Compressor	Remove pipe clamps and relocate equip drain lines
3	2"	Equipment Drain	On the east side of the Unit 4 Instrument Air Receiver	Loosen threaded drain pipe and loosen clamp on half-inch drain pipe
5	4"	Floor Drain	West of 4B Heater Drain Pump	Cut off the TPCW drain; unthread and remove the Heater Drain Pump drain pipe
6	4"	Hub Drain	East of 4S Instrument Air Compressor	Cut Instrument Air drains; relocate small drain tube
9	4"	Floor Drain	East of CV-4-1515 (by FI-4-5120)	None
11	4"	Hub Drain	Under 4-30-788 (South of 4A RHDT)	Inflatable plug
12	4"	Floor Drain	Under B Breathing Air Compressor	Inflatable plug
13	4"	Hub Drain	South side of 4B RHDT	None
14	4"	Floor Drain	By CV-4-1504	None
15	2"	Equipment Drain	Inside Unit 4 Silica Analyzer cabinet	None
16	4"	Floor Drain	West of Unit 4 Silica Analyzer cabinet	None
18	4"	Floor Drain	By column J-35 in the walkway outside of the Unit 4 SGFW Pump Room	None
19	4"	Hub Drain	Under valve 4-60-212 (CV-4-2203 bypass valve)	None

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DRAIN PLUGS

DRAIN ID	SIZE	DESCRIPTION	LOCATION	NOTES
20	4"	Floor Drain	South of Unit 4 Generator Hydrogen Gas Dryer	None
21	4"	Hub Drain	South of 4A MCC by the corner of the wall	None
22	4"	Floor Drain	North of 4A Isophase Bus Fan	None
23	4"	Equipment Drain	South of #3 Instrument Air Compressor	Cut drain pipes or loosen clamps; turn threaded drains out of the way; inflatable plug needed
24	4"	Floor Drain	By valve 3-50-562 (3B HDP suction valve)	None
25	2"	Equipment Drain	On the northeast corner of the Unit 3 Instrument Air Dryer	Loosen clamp and move threaded drain out of the way; inflatable plug needed
26	2"	Equipment Drain	On the west side of the Unit 3 Heater Drain Pump foundation	Move threaded drains out of the way
27	4"	Floor Drain	East of CV-3-1515	None
29	4"	Hub Drain	Under valve 3-30-788 (south of 3A RHDT)	Inflatable plug
30	4"	Floor Drain	West of the Chemical Addition Pumps	None
32	2"	Hub Drain	East of the Chemical Addition Tanks	None
33	2"	Hub Drain	East of the Chemical Addition Tanks	None
34	4"	Hub Drain	South of 3B RHDT	None
35	4"	Floor Drain	By CV-3-1504	None
38	4"	Floor Drain	Outside the entrance to 4B 4160 Volt Switchgear Room	None
39	2"	Equipment Drain	Inside the Unit 3 Silica Analyzer cabinet	None
40	4"	Floor Drain	In the walkway by Firelocker Number 1	None

APPENDIX C
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DRAIN PLUGS

DRAIN ID	SIZE	DESCRIPTION	LOCATION	NOTES
41	4"	Floor Drain	West of C AFW Pump in the walkway	None
44	2"	Equipment Drain	At the south end of the Unit 4 Gland Steam Condenser	Loosen clamp and move drain pipe
45	4"	Floor Drain	By the Unit 3 Generator Hydrogen Alarm Panel	None
46	4"	Hub Drain	Behind valve 3-60-212 (CV-3-2203 Bypass Valve)	None
47	4"	Floor Drain	South of the Unit 3 Generator Hydrogen Gas Dryer	None
48	4"	Floor Drain	North of the 3A Isophase Bus Fan	None
49	4"	Hub Drain	South of the 3A MCC non-vital side	None
52	4"	Floor Drain	Outside the entrance to 3A 4160 Volt Switchgear Room	None
63	8"	Outlet pipe of Catch Basin 15	In the RCA, west of the Unit 4 West Electrical Penetration Room	Install temporary pump in the catch basin with discharge routed to outside the Flood Protection Barrier concurrent with plug installation
68	4"	Floor Drain	North end of Unit 3 CCW Room in the valve pit	None
69	4"	Floor Drain	By the north pedestal of 3B CCW Heat Exchanger	None
70	4"	Floor Drain	Just south of 3B CCW Heat Exchanger	None
71	4"	Floor Drain	Unit 3 CCW Room by 3B CCW Pump	None
72	4"	Floor Drain	Unit 4 CCW Room just east of the Aux Building doors	None

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DRAIN PLUGS

DRAIN ID	SIZE	DESCRIPTION	LOCATION	NOTES
73	4"	Floor Drain	Unit 4 CCW Room in the pump area	None
74	4"	Floor Drain	Unit 4 CCW Room just north of 4B CCW Heat Exchanger	None
75	4"	Floor Drain	By the south pedestal of 4B CCW Heat Exchanger	None
76	4"	Floor Drain	South end of Unit 4 CCW Room in the val pit	None
77	3"	Floor Drain	Unit 4 Bowser Lube Oil Conditioner under valve 4-40-020 in the southeast corner	None
78	3"	Floor Drain	Unit 4 Bowser Lube Oil Conditioner on the north side of the conditioner under FG-4-3401	None
79	3"	Hub Drain	Unit 4 Bowser Lube Oil Conditioner to the east of the Unit 4 Lube Oil Transfer Pump	None
80	3"	Hub Drain	Outside the northeast corner of the Unit 4 Bowser Lube Oil Conditioner pit	Cut drain line
83	3"	Floor Drain	In the Unit 4 SGFW Pump Room on the south end between the motors	None
84	3"	Equipment Drain	Just north of 4A SGFW Pump	Unthreaded drain pipe; use inflatable plug
85	3"	Floor Drain	In the Unit 4 SGFW Pump Room just west of valve 4-20-218 (4B SGFW Pump discharge check valve) under the deck plate	None
86	2"	Equipment Drain	Just north of 4B SGFW Pump	Unthreaded drain pipe; use inflatable plug

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DRAIN PLUGS

DRAIN ID	SIZE	DESCRIPTION	LOCATION	NOTES
87	2"	Equipment Drain	In the southwest corner of the Unit 4 Generator Seal Oil pit	Loosen clamps to move drain pipe; use inflatable plug
88	3"	Floor Drain	In the northwest corner of the Unit 4 Auxiliary Transformer Pit	None
89	3"	Floor Drain	Just north of the Unit 4 Auxiliary Transformer Pit	None
90	3"	Hub Drain	In the southeast corner of the Unit 3 Bowser Lube Oil Conditioner pit under valve 3-40-025	Inflatable plug
91	3"	Floor Drain	In the Unit 3 Bowser Lube Oil Conditioner pit just north of the conditioner under FG-3-3401	None
92	3"	Hub Drain	In the Unit 3 Bowser Lube Oil Conditioner pit just east of the Unit 3 Lube Oil Transfer Pump	None
93	3"	Hub Drain	In the northeast corner of the Unit 3 Bowser Lube Oil Conditioner pit	Cut pipe
96	3"	Floor Drain	In the Unit 3 SGFW Pump Room on the south end between the motors	None
97	3"	Equipment Drain	Just north of 3A SGFW Pump	Loosen unions and threaded drain pipe if required; use inflatable plug
98	3"	Floor Drain	In the Unit 3 SGFW Pump Room just west of valve 3-20-218 (3B SGFW Pump discharge check valve) under the deck grating	None
99	2"	Equipment Drain	Just north of 3B SGFW Pump	Loosen unions to move drain pipe out of the way

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DRAIN PLUGS

DRAIN ID	SIZE	DESCRIPTION	LOCATION	NOTES
100	3"	Equipment Drain	In the southwest corner of the Unit 3 Generator Seal Oil enclosure	None
101	3"	Floor Drain	In the northwest corner of the Unit 3 Auxiliary Transformer pit	None
102	3"	Floor Drain	Just north of the Unit 4 Auxiliary Transformer pit	None
103	2"	Hub Drain	In the 3A EDG Room under C air receiver	Move threaded drains out of the way; use inflatable plug
106	2"	Hub Drain	In the 3B EDG Room under C air receiver	Inflatable plug
107	3"	Floor Drain	In the 3B EDG Room just east of the electrical control panel	None
108	4"	Floor Drain	In the 3A EDG Room just east of the electrical control panel	None
109	2"	Hub Drain	In the 3A EDG Radiator Room on the southeast side of the radiator	None
110	2"	Hub Drain	In the 3B EDG Radiator Room on the southeast side of the radiator	None
111	4"	Floor Drain	In the 3B EDG Room under the air dryer skid	None
112	4"	Floor Drain	In the 3A EDG Room under the air dryer skid	None
114	2"	Equipment Drain	Between the 4A and 4B Heater Drain Pumps on the west side of the foundation	None
115	4"	Floor Drain	To the northeast of the Unit 4 Generator Hydrogen Alarm Panel	None
NNA	12"	Manhole #3B Inlet Pipe	West of the New Unit 4 EDG Building	Buried Plug inlet pipe on west side of the manhole

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DRAIN PLUGS

DRAIN ID	SIZE	DESCRIPTION	LOCATION	NOTES
NNA	2"	Floodwell Drain	Unit 3 CCW Pipe Trench	Plug 2" drain line in bottom of trench floodwell. Drain line is North of centerline in floodwell. Coordinate removing deckplates with Mechanical Maintenance or Construction Services. Contact Health Physics prior to entering trench. This is a Contaminated Area.
NNA	2"	Floodwell Drain	Unit 4 CCW Pipe Trench	Plug 2" drain line in bottom of trench floodwell. Drain line is South of centerline in floodwell. Coordinate removing deckplates with Mechanical Maintenance or Construction Services. Contact Health Physics prior to entering trench. This is a Contaminated Area.
NNA	8"	Catch Basin #15 Outlet Pipe	West of Unit 4 West Electrical Penetration Room near column line K-33.9	Plug 8" Outlet Pipe in Catch Basin

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NATURAL EMERGENCIES

APPENDIX C
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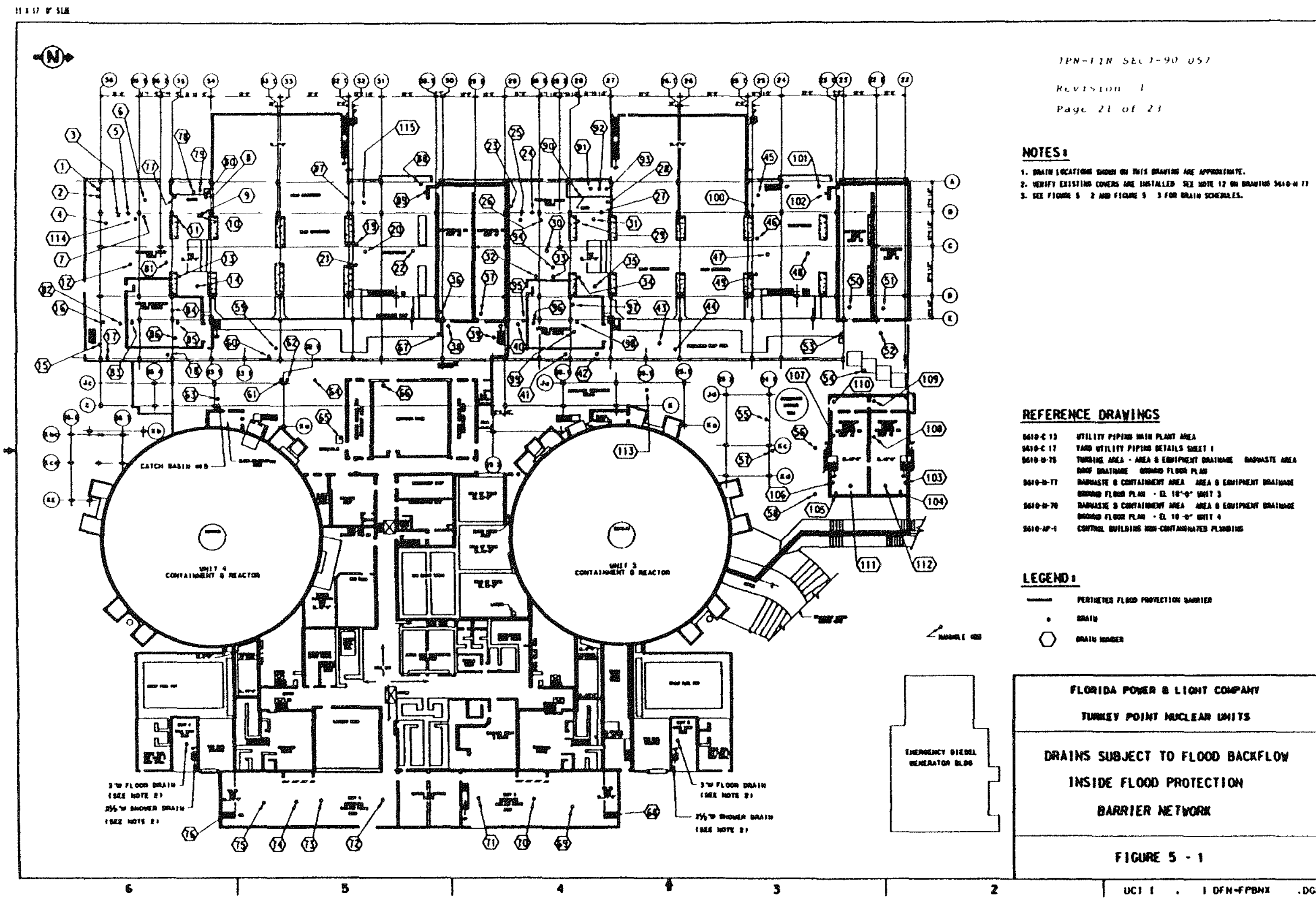
DRAIN PLUG LOCATIONS



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DRAIN PLUG INSTALLATION

FIGURE 1
DETAIL FOR PLUGGING FLOOR DRAINS

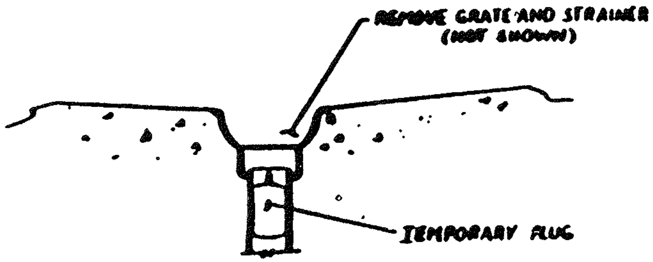


FIGURE 2
DETAIL FOR PLUGGING HUB DRAINS
AND EQUIPMENT DRAINS

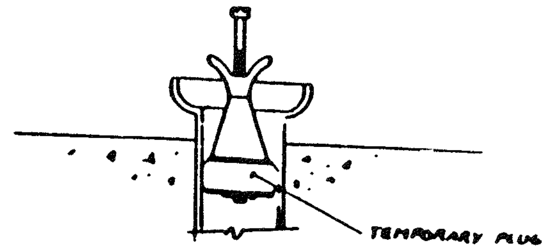


FIGURE 3
DETAIL FOR PLUGGING CATCH BASIN
OR MANHOLE DRAIN PIPE

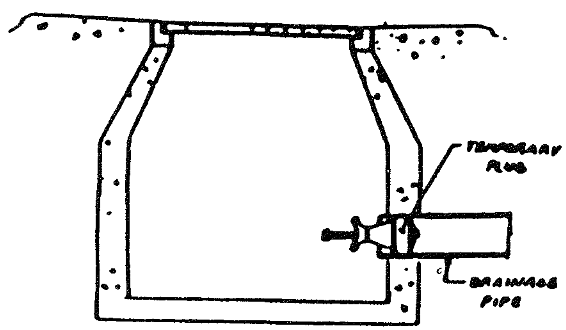
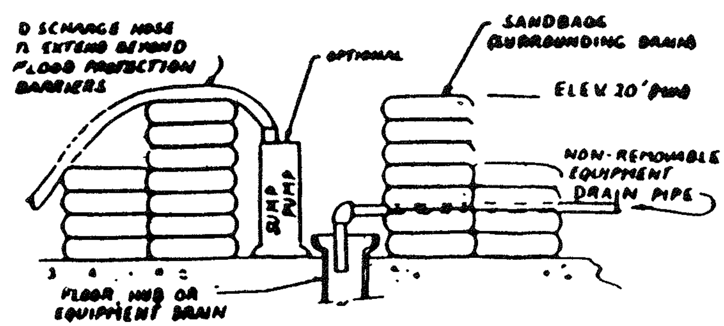


FIGURE 4
DETAILS FOR FLOOD PROTECTION
IN WHICH
DRAIN CANNOT BE PLUGGED



APPENDIX D
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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

1. Discussion

This appendix provides guidelines for plant operations before, during, and after a Category 5 hurricane. The degree to which these guidelines are used is per NPS discretion after consultation with the Emergency Coordinator.

The guidelines address plant damage - particularly from flooding - outside of the plant design basis. The focus is on personnel safety and maintaining the RCS below 350°F to minimize RCP seal degradation. The following core cooling contingencies are addressed for the units initially in Mode 5:

1. RHR Loops
2. AFW Train 2
3. AFW Train 1 (pre-throttled)
4. Bleed and Feed

In addition, measures are presented for maintaining essential equipment and instrumentation and safely deploying personnel at remote stations.

2. Preparation

A. Modes 1-4

1. Shutdown/cooldown to approximately 300°F in accordance with *-GOP-103/*-GOP-305:

   a. Do not open the main generator disconnects in the switchyard; do open the main generator links in case backfeed is required later.

   b. Purge the generator with carbon dioxide; shutdown seal oil and lube oil systems.

   c. Isolate steam generator blowdown.

   d. Maintain steam generators at approximately 70 percent narrow range level.

   NOTE: The following evolution throttles auxiliary feedwater and steam flows under natural circulation conditions with the RCS at approximately 300°F. The purpose is to prepare for a beyond-design scenario where neither RHR cooling nor AFW flow control valve operation are possible. The objective is to throttle flows to maintain RCS temperature and steam generator levels at near-equilibrium.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

2. Throttle steam flow and AFW train 1 flow for natural circulation conditions with the RCS at approximately 300°F. If both units were initially in Modes 1-4, coordinate between units to perform this evolution simultaneously:

   a. Place AFW train 1 flow control valves in manual with zero demand.

   b. Start AFP "A" in accordance with *-OP-075.

   c. Open all MSIV Bypass MOVs.

   d. Open *-043 and *-044, hogger jet ejector main steam isolation valves.

   e. Stop all running NCC and CRDM fans.

   f. Stop all running RHR pumps and RCPs for up to one hour per T.S. 3.4.1.3.

   g. Verify natural circulation:

      * RCS subcooling based on core exit TCs - GREATER THAN 30°F

      * S/G pressures - STABLE OR DECREASING

      * RCS hot leg temperatures - STABLE OR DECREASING

      * Core exit TCs - STABLE OR DECREASING

      * RCS cold leg temperatures - WITHIN 35°F OF SATURATION TEMPERATURE FOR S/G PRESSURE

   h. Make the following adjustments until steam generator levels and RCS average temperature are as close as possible to equilibrium:

      (1) Close the steam dump to atmosphere valves.

      (2) Throttle open *-072, hogger jet ejector main steam isolation valve. If needed, add other dummy steam loads (such as waterbox air ejectors or steam trap drains) to allow throttling of *-072.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

(3) Take local control of CV-*-2816, CV-*-2817, and CV-*-2818, AFW train 1 flow control valves, and throttle them open while closing the main feedwater bypass valves.

(4) Continue steps 2 and 3 until steam generator levels are maintained at approximately 70 percent and RCS average temperature is maintained at approximately 300°F with steam dump to atmosphere valves and main feedwater bypass valves closed.

(5) Lock the train 1 AFW flow control valves in the throttled position.

i. Stop AFP "A" in accordance with *-OP-075 and maintain steam generator levels with the main feedwater bypass valves.

j. Return AFW to standby in accordance with *-OP-075, leaving the train 1 AFW flow control valves locked in the throttled position.

k. Start desired RHR pump.

l. Start desired NCC and CRDM fans.

3. Continue plant cooldown to Mode 5 in accordance with *-GOP-305:

a. Fill the pressurizer to 90 percent narrow range level.

CAUTIONS:
- **DO NOT** make up to the RCS during the cooldown (except to compensate for known leakage) or an overfill situation may result upon plant heatup.
- Maintain pressurizer temperature as high as possible above RCS temperature without challenging the OMS setpoint or exceeding a 320° differential.

b. Cooldown on RHR until pressurizer level drops to 22 percent.

c. Maintain the plant on RHR in Mode 5; do not heat up.

4. See Section 2.D for further preparatory guidelines.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

B. Mode 5

1. If the RCS is not filled and vented:

   CAUTION: Drain down condition with steam generators unavailable and RCS integrity breached is the most dangerous plant configuration during the storm. The following actions should begin early and be given high priority:

   a. Commence immediate action to restore steam generator operability (replace manways, etc.).

   b. Simultaneously commence action to restore RCS integrity (if breached).

   c. When RCS integrity is achieved, commence fill and vent per *-OP-041.8.

2. If the RCS is filled and vented:

   a. Establish containment integrity as soon as possible.

   b. Maintain RCS temperature as low as possible.

   c. Draw a pressurizer bubble per *-OP-041.2.

   d. Maintain pressurizer temperature as high as possible above RCS temperature without challenging the OMS setpoint or exceeding a 320° differential.

   e. Secure steam generators from wet layup, if applicable.

   f. Maintain steam generators at approximately 70 percent narrow range level.

   g. Line up AFW and place it in standby per *-OP-075.

   h. See Section 2.D for further preparatory guidelines.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

C. Mode 6

1. If the reactor is not defueled:

   a. Terminate all fuel transfer operations and secure fuel transfer equipment.

   b. Transfer the conveyor cart to the spent fuel pit.

   c. Close the tube gate valve.

   d. Establish containment integrity.

   e. Maintain RCS temperature as low as possible.

   f. Fill the cavity to normal band.

   g. Select further preparatory actions as applicable from Section 2.D.

2. If the reactor is defueled:

   a. Maintain the spent fuel pit temperature as low as possible.

   b. Verify the spent fuel pit level is in the normal band.

   c. Verify the transfer canal is filled (at least on the spent fuel pit side with the transfer tube gate valve closed).

   d. Select further preparatory actions as applicable from Section 2.D.

D. Prepare equipment and station personnel on each unit:

1. Determine whether splitting the CCW headers is necessary to minimize missile vulnerability of exposed piping and/or splitting CCW to the Safety Injection Pumps so that each unit supplies its own Safety Injection Pumps.

2. Observing *-OP-30 precautions, isolate CCW to selected non-essential de-energized equipment.

3. Isolate containment to the extent practical.

4. Verify the spent fuel pit level and temperature are satisfactory.

5. Valve in service water backup from the elevated storage tank by opening valve 10-1019.

6. To allow pressurizer backup heater operation, place the keylock switch on the back of 3D/4D load center in bypass and reset the lockout relay in the appropriate electrical penetration room.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

7. Personnel should be positioned at the following remote stations to perform local actions:

   - Auxiliary Building (if tenable)-1 SRCO/SRO, 4 SNPO/NOs
   - Each unit's 480V Vital Load Center Room (also includes 4kV rooms)-1 SRCO/SRO, 2 SNPO/NPO/TOs
   - Unit 3 EDG Building-2 SNPO/NPO/TOs
   - Unit 4 EDG Building-4 SNPO/NPO/TOs
   - Cable Spreading Room-1 SRCO/SRO, 4 SNPO/NPO/TOs
   - Inverter Room-2 NWE/SRCO/RCOs not involved in Control Room duties

   a. Determine whether assigning experienced supervisory operators to the remote stations is necessary.

   b. Ensure these personnel are in position prior to the arrival of the storm and have appropriate safety equipment, materials to stop flooding or make minor repairs, and needed keys (such as ICCS, vital area).

   c. Ensure remote station personnel responsible for ground isolation have a copy of the breaker list and relevant ONOPs.

      NOTE: Attachment 1 provides guidance for personnel at remote stations in case all communications with the control room are lost. Each station should have a full copy so that each knows what the others plan to do if communications are lost.

   d. Instruct remote station personnel to continuously monitor local conditions and equipment status; Attachment 1 is to be used if (and only if) all communication between the control room and remote stations is lost.

8. Turn off selected non-essential loads to minimize the potential for bus grounding in accordance with Technical Specification requirements.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

3. **Mitigation**

CAUTION: As the hurricane passes, no personnel should be allowed to leave tenable stations. Exceptions should be conducted using applicable guidance contained in EPIP-20111, Re-Entry.

NOTES:
- EOPs and ONOPs should be carefully evaluated during a Category 5 hurricane since these procedures assume that most areas of the plant are accessible. Deviations from procedures shall comply with approved administrative procedures.
- Control room personnel should constantly monitor their equipment in case it grounds or is secured by an operator performing ground isolation from a remote station.

A. If Offsite Power is lost:

1. Consult *-ONOP-004.
2. Locally open *-358 and close LCV-*-115C since LCV-*-115C will fail as is.

B. If all AC is lost:

1. Consult *-ONOP-004, *-EOP-ECA-0.0 (for guidance until in Mode 4), and *-ONOP-050.
2. If RHR was in service, see loss of RHR guidance below.
3. Determine the need to save sufficient capacity to start an EDG prior to using the spare battery for DC loads.

C. If all DC power is lost in addition to loss of all AC:

1. Consult the TSC about the possibility of having I&C obtain instrumentation readings from the Hagan racks and other locations using portable generators/power packs.
2. Consult the TSC about the possibility of having Electrical operate MOVs from dead breakers using portable generators/transformers.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

D. If RHR is lost:

NOTE: If RCS temperature rises above the value initially established in Section 2 of Appendix D, pressurizer level should be allowed to rise. The plant should stabilize at approximately the conditions established during the natural circulation evolution performed in Section 2.

1. Consult *-ONOP-050.

2. If use of AFW becomes necessary, then train 2 should be used as long as possible.

3. Determine whether using other available control valves or the manual isolation valves to the hogger jet ejector are necessary if steam dump to atmosphere valves cannot be used to throttle steam.

4. Maintain steam generators between 40 percent and 70 percent narrow range level and RCS average temperature less than 350°F.

5. If AFW train 2 is lost:

   a. Consult ONOP-7308.1.

   b. Open MOV-*-1403.

   c. Close MOV-*-1405.

   d. Maintain steam generators between 40 percent and 70 percent narrow range level and RCS average temperature less than 350°F.

      NOTE: After running an auxiliary feedwater pump, approximately three hours is required for the governor oil pressure to completely bleed down. While less than three hours bleed-down time may be adequate to prevent overspeed upon restart, the risk of losing the pump or having to perform a local reset of the overspeed trip must be weighed against the benefit gained and the alternatives available.

   e. Cycle MOV-*-1403 for steam generator level control if necessary.

   f. If local actions appear necessary, consult the Emergency Coordinator.

   g. Request the TSC to begin researching bleed and feed contingencies.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

E. If CCW is lost:

1. Stop any running RHR pump.
2. Consult *-ONOP-030.
3. If CCW is lost on one unit, determine whether cross-tying CCW systems is necessary.
4. If CCW is lost on both units, connect service water to the charging pumps. If service water is not available and charging pump operation is required, alternate charging pumps to minimize pump heatup.
5. Review loss of RHR and loss of spent fuel pit cooling guidance.

F. If ICW is lost:

1. Stop any running RHR pump.
2. Consult *-ONOP-019.
3. Review loss of CCW guidance.

G. If Instrument Air is lost:

1. Consult 0-ONOP-013.
2. After verifying letdown isolates and any running charging pump go to maximum speed:
   a. Stop any running charging pump.
   b. Open *-358, manual bypass around LCV-*-115B.
   c. Close LCV-*-115C.
3. After verifying HCV-*-758 failed open resulting in RCS cooldown and pressurizer level drop:
   a. Throttle CCW to the RHR heat exchangers to return RCS temperature and pressurizer level to the values initially established in Section 2 of Appendix D.
4. Cycle charging pumps as needed to maintain the desired pressurizer level.

<u>NOTE:</u> AFW flow control valves, PORVs, and steam dump to atmosphere valves will go to backup nitrogen upon a loss of Instrument air.

5. Place AFW Train 2 flow controllers in manual to conserve nitrogen.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

H. If Spent Fuel Pit cooling is lost and boiling occurs, possible sources of makeup include RWST purification pumps, primary water pumps, CVCS holdup tank pumps, the water treatment plant, service water, fire water, and portable pumps.

NOTE: 0-ONOP-16.10 contains valuable information on equipment in rooms and their power supplies. This information may be useful if a room is flooding and equipment in it needs to be de-energized.

I. If plant flooding is imminent:

1. For Auxiliary building flooding:

   a. De-energize the remaining MCCs.

   b. Open *-358 and close LCV-*-115C on both units.

   c. Evacuate through the New Electrical Equipment Room to the Cable Spreading Room.

2. For Turbine Building flooding, start the 3A EDG and run it in idle in case the 3A MCC floods.

3. For Computer Room flooding, de-energize ERDADS.

J. Refer to Attachment 1, Loss of Communications - Remote Station Guidelines if all onsite communications are lost.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

4. Recovery

CAUTION: The site is likely to present unforeseen hazards to recovery teams, such as weakened structures, faulted piping, electrical hazards, dispersed hazardous chemicals, and an absence of fire fighting capability. Recovery teams and general access must be controlled to minimize risk.

A. Dispatch, as necessary, teams to search for missing personnel, assess damage, and perform repairs on critical systems once tropical storm force winds recede.

B. Determine which of the following guidelines are applicable before energizing plant equipment:

NOTE: If electrical equipment is needed for plant or public safety before a full operability assessment can be completed.

1. No electrical equipment should be re-energized until it is checked by an electrician.

2. If reactor safety is challenged and time does not permit equipment recovery actions (such as rinse and dry, megger), energize the minimum equipment necessary to meet the challenge. If possible, station a watch at a safe distance from the equipment.

3. Spare motors may be available from the nuclear units, fossil units, or stores. If time permits, install spares to allow wetted motors to be recovered.

4. For electrical components wetted by the storm surge or wave action, have Electrical perform a fresh water rinse, dry, and megger as necessary. After successful meggering, energize any installed heaters.

5. For electrical components wetted by rain, have Electrical dry and megger the equipment as necessary. After successful meggering, energize any installed heaters.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

C. Remove all stop logs and drain plugs to allow any trapped water to drain out as soon as practical.

NOTE: Federal, state, or local assistance may be required in the wake of the storm due to damage to plant systems and impaired site access.

D. Make required reports and transmit a prioritized list of needs to outside agencies as soon as communications are re-established.

NOTE: Priority must be placed on the restoration of electrical power and establishing or maintaining RCS or spent fuel pit cooling support systems (depending on where the fuel is).

E. Restore the plant to a normal configuration upon discontinuation of the emergency, using annotated steps of this procedure and applicable plant procedures.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

Attachment 1: Loss of Communications - Remote Station Guidelines

A. 480V LOAD CENTER ROOM OPERATOR (Page 1 of 2)

NOTE: These instructions are provided in case all communications are lost between the Control Room and your station. Before resorting to these default instructions, attempt to contact the Control Room on all communications circuits. Use of these instructions must be tempered by your understanding of the current situation and good judgement.

1. Monitor the 4kV Bus Rooms for flooding and the 480V Load Center Rooms for water intrusion. Attempt to contain or divert minor flooding to keep it away from the buses.

   CAUTION: Even if a 4kV bus feeder breaker is tripped, breaker control power is normally present and presents an electrical safety hazard.

2. If flooding of a bus is imminent, trip the feeder breaker for that bus and remain out of that bus's room.

3. Continually check the 4kV buses for grounds, and if a ground is detected, perform ground isolation:

   a. If the 4kV ground is isolated to a non-load center load, leave the breaker open.

      NOTES:
      - If a remote station operator observes that a load center or MCC is deenergized, he will locally perform ground isolation. He will expect the 480V Load Center Room operator to reenergize the load center or MCC as discussed below.
      - If a ground is localized to H load center, open both feeder breakers. When re-energizing the load center, close in one feeder and wait five minutes. If no ground is detected, close the other breaker.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

Attachment 1: Loss of Communications - Remote Station Guidelines

A. 480V LOAD CENTER ROOM OPERATOR (Page 2 of 2)

b. If the 4kV ground is isolated to a load center, then perform the following:

(1) If the 480V ground is isolated to a non-MCC load, leave the breaker open.

(2) If the ground is isolated to an MCC, then perform the following:

(a) Open the MCC's feeder breaker for ten minutes.

(b) Attempt to reclose the breaker after the ten minutes.

(c) If the ground is not present, then leave the breaker closed. If the ground is still present, then reopen the breaker for another ten minutes.

(d) Repeat until the ground disappears or until communications are re-established.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

Attachment 1: Loss of Communications - Remote Station Guidelines

B. AUXILIARY BUILDING OPERATOR (Page 1 of 2)

NOTE: These instructions are provided in case all communications are lost between the Control Room and your station. Before resorting to these default instructions, attempt to contact the Control Room on all communications circuits. Use of these instructions must be tempered by your understanding of the current situation and good judgement.

1. Monitor the Auxiliary Building for flooding. Attempt to contain or divert minor flooding away from the MCCs and the charging pumps.

   CAUTION: MCC local feeder breakers are actually disconnect switches; do not interrupt load with them.

2. If flooding of an MCC is imminent, shed all loads on the MCC and then open the local feeder breaker for that MCC.

3. If water level throughout the Auxiliary Building is rising and all MCCs and charging pumps are threatened, perform the following:

   a. Shed all loads on the MCCs

   b. Open the MCCs' local feeder breakers

   c. Open *-358 and close LCV-*-115C on both units

   d. Evacuate to the Cable Spreading Room via the New Electrical Equipment Room.

   NOTES:
   - If a Load Center Room Operator observes that an MCC is grounded, he will open the load center breaker for that MCC. After ten minutes, the operator will reclose the breaker. He will repeat this until the ground is isolated by the Auxiliary Building Operator or until communications are re-established.
   - Coordinate any ground isolation efforts on the 3D MCC with the Cable Spreading Room Operator.

   CAUTIONS:
   - Ensure the MCC local feeder breaker (disconnect) is open when ground isolation is being performed.
   - All applicable safety precautions for working with energized equipment must be followed. Electricians troubleshooting grounds and measuring voltages need to be very careful to prevent injury. Emergency medical response may be delayed and will be limited by the hurricane.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

Attachment 1: Loss of Communications - Remote Station Guidelines

B. AUXILIARY BUILDING OPERATOR (Page 2 of 2)

4. If an MCC voltage suddenly goes to zero, perform the following:

   a. Open the local feeder breaker for that MCC.

   b. Have an electrician check whether the MCC is grounded.

   c. If the MCC is grounded, have an electrician determine which load is grounded.

   d. Open that load's breaker.

   e. If the voltage to the MCC is still zero, close the MCC local feeder breaker. Otherwise, perform the following:

      (1) Recording all changes made, shed all loads on the MCC

      (2) Close the MCC's local feeder breaker

      (3) Restore previous MCC loads except for the grounded one

   f. If the ground is not isolable, leave the local feeder breaker open.

5. If no ground is found on a de-energized MCC, then close the local feeder breaker. The associated EDG may be inoperable. If the MCC remains de-energized for ten minutes, then repeat step 4 every 30 minutes until the MCC is re-energized or until communications are re-established.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

Attachment 1: Loss of Communications - Remote Station Guidelines

C. CABLE SPREADING ROOM OPERATOR (Page 1 of 2)

NOTE: These instructions are provided in case all communications are lost between the Control Room and your station. Before resorting to these default instructions, attempt to contact the Control Room on all communications circuits. Use of these instructions must be tempered by your understanding of the current situation and good judgement.

1. Monitor the Cable Spreading Room for water intrusion. Periodically open all DC bus and MCC enclosures in the Cable Spreading and Electrical Equipment Rooms to check for water.

2. Continuously monitor DC bus voltage and ground indication. If a DC ground is detected, perform ground isolation as appropriate. Timely ground isolation is required to protect against double grounds which are much harder to locate.

3. Continuously monitor voltage in the Electrical Equipment Room:

   NOTE: If a Load Center Room Operator observes that a load center or MCC is grounded, he will open the breaker for that load center or MCC. After ten minutes, the operator will reclose the breaker. He will repeat this until the ground is isolated by the Cable Spreading Room Operator or until communications are reestablished.

   a. If voltage is lost to an H load center, then open both local feeder breakers and have an electrician determine which load is grounded:

      (1) If the 480V ground is isolated to a non-MCC load, then leave that load's breaker open.

      NOTE: If the ground is isolated to 3D vital MCC, coordinate ground isolation efforts with the Auxiliary Building Operator.

      (2) If the ground is isolated to a D vital MCC, then perform the following:

         (a) Recording all changes made, shed all loads on the MCC.

         (b) Open the MCC's local feeder breaker.

         (c) Reclose the H Load Center local feeder breakers.

         (d) Instruct an electrician to determine which D vital MCC load is grounded.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

Attachment 1: Loss of Communications - Remote Station Guidelines

C. CABLE SPREADING ROOM OPERATOR (Page 2 of 2)

(e) Verify that load's breaker is open.

(f) If the ground is isolated, then reclose the MCC local feeder breaker and then restore previous MCC loads except for the grounded one.

(g) If the ground is not isolable, then leave the MCC local feeder breaker open.

b. Frequently check 120V AC panels. If a 120V vital AC panel is de-energized, grounding is likely. Open the local feeder breaker. Have an electrician determine which load is grounded. Open that load's breaker and reclose the local feeder breaker.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

Attachment 1: Loss of Communications - Remote Station Guidelines

D. UNIT 3 EDG OPERATOR

NOTE: These instructions are provided in case all communications are lost between the Control Room and your station. Before resorting to these default instructions, attempt to contact the Control Room on all communications circuits. Use of these instructions must be tempered by your understanding of the current situation and good judgement.

CAUTION: Stand clear of the EDGs since they may start at any time.

1. Monitor the rooms for water intrusion and attempt to contain or divert minor flooding that threatens the safe operation of an EDG.
2. If flooding in a room threatens energized electrical equipment, then open appropriate local breakers. If the electrical equipment cannot be isolated, then consider stopping the EDG and remain on elevated platforms above the flooding.
3. If the room becomes untenable, then evacuate to the Cable Spreading Room or Load Center Room.
4. Continuously monitor running EDGs. If trouble is noted, then consult 3-ONOP-023.2 for guidance and attempt to rectify the problem.
5. If EDG load suddenly drops to zero, then check the EDG output breaker. If open, the bus is probably grounded.
6. If an EDG runs unloaded for four hours, and no communications from the Control Room or Load Center Room are received, then stop the EDG and place it in standby.

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CATEGORY 5 HURRICANE OPERATIONS GUIDELINES

Attachment 1: Loss of Communications - Remote Station Guidelines

E. UNIT 4 EDG OPERATOR

NOTE: These instructions are provided in case all communications are lost between the Control Room and your station. Before resorting to these default instructions, attempt to contact the Control Room on all communications circuits. Use of these instructions must be tempered by your understanding of the current situation and good judgement.

CAUTION: Stand clear of the EDGs since they may start at any time.

1. Monitor the rooms for water intrusion and attempt to contain or divert minor flooding that threatens the safe operation of an EDG.

2. If flooding in a room threatens energized electrical equipment, then open appropriate local breakers. If the electrical equipment cannot be isolated, then consider stopping the EDG and remain out of the room.

3. Continuously monitor running EDGs. If trouble is noted, then consult 4-ONOP-023.2 for guidance and attempt to rectify the problem.

4. If EDG load suddenly drops to zero, then check the EDG output breaker. If open, the bus is probably grounded. If an EDG runs unloaded for four hours, and no communications from the Control Room or Load Center Room are received, then stop the EDG and place it in standby.

5. Continually check the D 4kV buses for signs of grounds. If any grounded equipment is discovered, then secure that load immediately.

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On August 24, 1992, Hurricane Andrew, a Category 4 hurricane, struck the Turkey Point Electrical Generating Station with sustained winds of 145 mph (233 km/h). This is the report of the team that the U.S. Nuclear Regulatory Commission and the Institute of Nuclear Power Operations jointly sponsored (1) to review the damage that the hurricane caused the nuclear units and the utility's actions to prepare for the storm and recover from it, and (2) to compile lessons that might benefit other nuclear reactor facilities.

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