

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION  
WASHINGTON, D.C. 20555

April 29, 1994

NRC INFORMATION NOTICE 93-53, SUPPLEMENT 1: EFFECT OF HURRICANE ANDREW ON  
TURKEY POINT NUCLEAR GENERATING  
STATION AND LESSONS LEARNED

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice (IN) supplement to inform addressees of further lessons learned as a result of the investigations undertaken to assess the effects of Hurricane Andrew on the Turkey Point Nuclear Generating Station (Turkey Point); to expand the scope of the lessons learned to other external events, as appropriate; and to discuss existing regulatory guidance for various external events. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

In IN 93-53, "Effect of Hurricane Andrew on Turkey Point Nuclear Generating Station and Lessons Learned," the NRC provided a description of the impact of Hurricane Andrew on Turkey Point on August 24, 1992. The notice described several lessons reinforced and lessons learned based on a joint NRC/industry team review.

Discussion

NRC NUREG-1474, "Effect of Hurricane Andrew on the Turkey Point Nuclear Generating Station from August 20-30," indicates that two Category 5 hurricane storms, (wind speed > 249 km/h [155 mph]), and four Category 4 hurricane storms, (wind speed between 210 and 249 km/h [130 and 155 mph]), have hit the eastern coast of the United States in the last 60 years. The wind speeds used in the design of safety-related structures of east-coast plants vary from 177 to 210 km/h [110 to 130 mph]. As the load factor used with the design wind loading is 1.7, when compared with the code established limit states of the structures, these structures can withstand Category 4 and low intensity Category 5 hurricanes (which have a range from 249 to 290 km/h [155 to 180 mph]). Moreover, design against tornado generated loadings (in accordance

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with Regulatory Guide 1.76, "Design Basis Tornado for Nuclear Power Plants," and NUREG 0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Sections 3.3.1 and 3.5.1.4, or other provisions accepted by the staff) provides margin against failure of safety-related structures during hurricanes.

Based on NRC and industry experience with plant-specific probabilistic risk assessments (PRAs), NRC recognized that systematic examinations are beneficial in identifying plant-specific vulnerabilities. Thus, on November 23, 1988, NRC issued to all licensees a request to conduct systematic examinations of their plants for internally initiated event vulnerabilities (Generic Letter 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities" and on June 28, 1991, expanded the request to include externally initiated event vulnerabilities (Generic Letter 88-20, Supplement 4, "Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities"). NUREG-1407, "Procedural and Submittal Guidance for the Individual Plant Examination of External Events," provides procedural guidelines for assessing the adequacy of plant safety systems against external events, such as earthquakes, tornadoes, external floods, transportation and nearby facility accidents. Following these guidelines in the implementation of the IPEEE program will enable licensees to look for vulnerabilities to severe accidents resulting from such events and identify cost-effective improvements.

It is not clear whether adequate consideration has been given to the failure (or malfunction) of nonsafety-related structures and equipment in the vicinity of a nuclear reactor which could jeopardize the proper functioning of safety-related structures, systems and components. As noted in IN 93-53 and in NRC NUREG-1474, at Turkey Point, Hurricane Andrew caused damage to a number of nonsafety structures and equipment:

- all (six) steel-framed turbine canopies collapsed,
- one of the two chimneys (associated with the two fossil units at the site) was severely damaged,
- the base anchors for the vent stack on the Unit 4 containment were lifted 10 mm [3/8 inch],
- ductwork from the radioactive waste building to the vent stack failed due to hurricane generated missiles,
- the nonsafety high-water tank collapsed, and fell on various fire-protection pumps and pipes, rendering one of the fire protection systems inoperable.

In spite of the severe damage to a number of nonsafety items at Turkey Point, the safety-related structures, systems and components of the two nuclear reactors withstood the storm without damage and the reactors did not pose a radiological hazard to nearby communities. A systematic evaluation of the available logs and data by the licensee indicated that there were no unexpected radiation levels onsite or offsite.

The licensee had completed the external events analyses of Turkey Point for wind and fire in June of 1991. The analysis for wind indicated a need to modify the flood wall and improve the emergency procedure for Category 5 hurricanes. The revised procedure allowed the licensee to adequately prepare for severe events, such as Hurricane Andrew. In developing the response to Generic Letter 88-20, Supplement 4, the licensee indicated that the potential consequences (in terms of core damage frequencies) of chimney failure were considered in the analysis and the results were found acceptable. However, the potential failure of the high-water tank was not explicitly considered.

NRC Regulatory Guide 1.29, "Seismic Design Classification," recommends that nonsafety structures and equipment (including supports and anchorages) be designed to withstand postulated seismic events if their failure could reduce the safety function of any of the safety-related features. Section 3.3.2 of the NRC Standard Review Plan includes a similar provision for postulated tornado loadings. The practical implication of these provisions is that either the nonsafety structures and equipment are designed to withstand the postulated events, or an assessment is made to assure that the consequences of their failure would not disable the safety functions of safety-related structures, systems and components (also termed as II over I consideration). These documents were issued in 1975. A number of pre-1975 plants have been evaluated for II over I considerations under postulated external events. However, this may not be the case for some pre-1975 plants.

All licensees were requested in GL 88-20, Supplement 4, to perform systematic examinations of their plants for plant-specific vulnerabilities to severe accidents from external events which include all plant systems and components whose failures contribute to core damage frequency or the conditional probability of containment failure. Specifically, Section 5 of NUREG-1407 states that all licensees should compare the information obtained from the review for conformance to the 1975 Standard Review Plan (NUREG 0800) criteria and perform a confirmatory walkdown of the plant. The walkdown should be concentrated on onsite outdoor facilities that could be affected by high winds, onsite storage of hazardous materials, and offsite occurrences.

As noted in GL 88-20, Supplement 4, the quality and extent of the results derived from an IPEEE will depend on the vigor with which the licensee applies the method of examination and on the licensee's commitment to the intent of the IPEEE. Matters relevant to an IPEEE analysis include the nonsafety items (onsite and offsite) whose failures under loads generated by various credible external events could potentially disable safe shutdown capability and the compensatory measures that would alleviate such conditions.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

*B.K. Grimes for*  
Brian K. Grimes, Director  
Division of Operating Reactor Support  
Office of Nuclear Reactor Regulation

Technical contacts: Hans Ashar, NRR  
(301) 504-2851

John T. Chen, RES  
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Attachment:  
List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED  
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
94-32	Revised Seismic Hazard Estimates	04/29/94	All holders of OLs or CPs for nuclear power reactors.
94-31	Potential Failure of Wilco, Lexan-Type HN-4-L Fire Hose Nozzles	04/14/94	All holders of OLs or CPs for nuclear power reactors.
90-68, Supp. 1	Stress Corrosion Cracking of Reactor Coolant Pump Bolts	04/14/94	All holders of OL or CPs for pressurized water reactors.
94-30	Leaking Shutdown Cooling Isolation Valves at Cooper Nuclear Station	04/12/94	All holders of OLs or CPs for nuclear power reactors.
94-29	Charging Pump Trip during a Loss-of-Coolant Event Caused by Low Suction Pressure	04/11/94	All holders of OLs or CPs for pressurized water reactors.
92-51, Supp. 1	Misapplication and Inadequate Testing of Molded-Case Circuit Breakers	04/12/94	All holders of OLs or CPs for nuclear power reactors.
94-28	Potential Problems with Fire-Barrier Penetration Seals	04/05/94	All holders of OLs or CPs for nuclear power reactors.
94-27	Facility Operating Concerns Resulting from Local Area Flooding	03/31/94	All holders of OLs or CPs for nuclear power reactors.
94-26	Personnel Hazards and Other Problems from Smoldering Fire-Retardant Material in the Drywell of a Boiling-Water Reactor	03/28/94	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License  
 CP = Construction Permit

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\* See previous concurrence  
 \*\* Per memo 9/10/93  
 \*\*\*Per E-mail 4/26/94

OFFICE	*TECH ED	*AC/OGCB:DORS	D/DORS:NRR	
NAME	MMejac	JBirmingham	BKGrimes <i>CG</i>	
DATE	09/10/93	04/25/94	04/28/94 <i>for</i>	
OFFICE	DSIR/SAIB/RES	ECGB/DE/NRR	C/ECGB/DE/NRR	DSIR/SAIB/RES
NAME	JChen***	HAshar***	GBagchi**	CAder***
DATE	04/26/94	04/26/94	09/10/93	04/26/94

OFFICIAL DOCUMENT NAME: 93-53SP1.IN

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NAME	JChen***	HAshar***	GBagchi**	CAder***
DATE	04/26/94	04/26/94	09/10/93	04/26/94

OFFICIAL DOCUMENT NAME: ANDREW3.JLB

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 \*\*\*Per memo 2/15/94

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DATE	09/10/93	04/25/94	04/ /94	
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