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

August 23, 1995

NRC INFORMATION NOTICE 95-33: SWITCHGEAR FIRE AND PARTIAL LOSS OF OFFSITE POWER AT WATERFORD GENERATING STATION, UNIT 3

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) to alert addressees to a switchgear fire and subsequent partial loss of offsite power at Waterford Generating Station, Unit 3. 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

On June 10, 1995, Waterford 3 was operating at 100 percent power with an operations staff consisting of a shift supervisor (SS), a control room supervisor (CRS), and two reactor operators. At 8:58 a.m. a generator trip occurred in response to failure of a lightning arrester on a remote offsite substation transformer. The generator trip resulted in a fast transfer activation. All 6.9 kV and 4.16 kV buses transferred as designed except the 4.16 kV A2 bus. A fire and electrical fault on the 4.16 kV A2 bus normal power supply breaker caused a voltage and frequency perturbation on the 6.9 kV A1 bus, which caused an underspeed condition on rector coolant pumps 1A and 2A. This circumstance resulted in a reactor trip and a loss of offsite power to the 4.16 kV nonsafety-related A2 bus and the associated 4.16 kV safety-related A3 bus. Emergency Diesel Generator A started and loaded to power the A3 bus. At 9:06 a.m., an auxiliary operator informed the control room of heavy smoke within the turbine generator building. At that time, the SS did not activate the plant fire alarm or dispatch the fire brigade, but directed two auxiliary operators to don protective gear and investigate whether a fire existed. At 9:35 a.m., the operators reported seeing flames above the A2 switchgear and the SS activated the fire brigade. Operators requested assistance from the local offsite fire department and declared an Unusual Event in accordance with emergency response procedures. The fire brigade was unable to suppress the fire using portable fire extinguishers. The offsite fire department arrived on the scene at 9:58 a.m. and extinguished the fire with water at 10:22 a.m., after the A2 bus was deenergized. During the cooldown transition from Mode 4 to Mode 5, operators discovered that the isolation valves for both trains of shutdown cooling did not operate properly.

The plant cooldown to Mode 5 was delayed approximately 38 hours while these valves were repaired.

Discussion

During the period of June 13-16, 1995, the NRC conducted an augmented inspection team (AIT) inspection to determine the causes, conditions, and circumstances relevant to this event. The results of this AIT inspection are documented in NRC Inspection Report 50-382/92-15, dated July 7, 1995. The AIT identified three primary issues: fire protection, fast bus transfer design, and shutdown cooling valve inoperability. These three issues are discussed in greater detail in the following sections.

Fire Protection

Several recent events at U.S. nuclear power plants have included a fire concurrent with a plant transient. The fire at Waterford 3 highlights the importance of (1) training for timely and effective response to initial indications of a plant fire, (2) ensuring personnel are not assigned potentially conflicting duties, and (3) plant staffing.

An auxiliary operator (a trained fire brigade member) noticed heavy smoke in the turbine generator building and notified the control room. The auxiliary operator was asked if there was a fire in the room and responded that he did not see flames because of the presence of heavy smoke. The CRS did not declare a fire until 29 minutes after receiving the report of heavy smoke. Activating the fire brigade required the SS to assume the responsibilities of the CRS (the designated fire brigade leader), who was directing plant personnel responding to the event. Following the event, operators stated that the loss of the CRS from the control room did not adversely affect their ability to respond to this event and noted that a fire scenario, which requires that the CRS leave the control room, is routinely used during requalification training.

Before the local offsite fire department was allowed to extinguish the fire with water, the fire brigade attempted to extinguish the fire using portable carbon dioxide (CO_2), halon, and dry chemical fire extinguishers. The use of portable extinguishers was not effective in extinguishing the fire. When the fire department arrived, it recommended the use of water to extinguish the fire. The fire brigade leader did not allow the use of water until about 20 minutes later. The fire was finally extinguished by the offsite fire department within 4 minutes of using water. The use of water is consistent with documented NRC staff positions. The AIT determined that the operators were reluctant to apply water to an electrical fire based on previous training that had emphasized the use of water as a last resort on electrical fires.

Although the appropriate fire alarms had activated in the control room, the control room crew was not aware of the alarms because of (1) other auditory alarms caused by the event and (2) the lack of a visual fire alarm signal on a front panel of the control room. Control room operators did not refer to the fire alarm panel when the auxiliary operator reported seeing heavy smoke. In this instance, the ineffectiveness of the fire alarms did not directly affect

the response to the fire because an auxiliary operator alerted the control room to heavy smoke in the turbine building. Nevertheless, fire alarms that are inaudible under actual operational conditions and lack redundant visual signals can inhibit prompt identification of, and response to, plant fires. Also, it is important for operators to refer to the fire alarm panel upon any verbal report of a potential fire, in order to ensure that the fire is not wider spread than visually reported. NRC fire protection requirements and guidelines specify that fire drills include an assessment of fire alarm effectiveness.

IN 91-77 "shift staffing at Nuclear Power Plants", reminded licensees that Section 50.54(m) of Title 10 of the Code of Federal Regulations (10 CFR 50.54 (m)) addresses minimum staffing levels for licensed personnel. It does not address availability of personnel for performing all actions specified in the licensee's administrative procedures required during an event. NRC fire protection requirements and guidelines provide flexibility in assigning personnel to a fire brigade (e.g., the brigade leader may possess either an operator's license or an equivalent knowledge of plant safety-related systems). The potential exists for personnel to be assigned duties that, during certain events, may present concurrent and conflicting demands. Such conditions could significantly delay or degrade the response of those individuals.

Fast Bus Transfer Design

The Waterford 3 fast bus transfer design consists of an automatic transfer of safety and nonsafety-related station auxiliary loads from the normal power supply (from the main generator through the unit auxiliary transformer) to the alternate power supply (from the offsite transmission network through the startup transformer). All supply breakers are General Electric, Magne-Blast type. During a fast bus transfer, the normal supply breakers are designed to open in five cycles and the alternate supply breakers are designed to close in seven cycles, resulting in a two-cycle deadband on the respective buses. To prevent simultaneous closing of both the supply breakers, some other fast bus transfer designs include mechanical or electrical interlocks. The Waterford 3 design does not include interlocks.

During this event, when the fast bus transfer was initiated, the A2 bus normal supply breaker did not open in five cycles but the alternate supply breaker closed within seven cycles. As a result, (1) the A2 bus was connected to both the offsite transmission network and the main generator, (2) both supply breakers to the A2 bus received overcurrent trip signals, (3) while the A2 bus alternate supply breaker adequately isolated the offsite transmission network, the A2 bus normal supply breaker did not isolate the main generator, (4) the A2 switchgear cubicle for the normal supply breaker caught fire, and (5) the cable bus for the normal supply breaker also caught fire.

Shutdown Cooling Valves

During the plant cooldown to Mode 5, the shutdown cooling isolation valves failed to operate properly when operators attempted to align low-temperature overpressure protection relief valves in preparation for placing shutdown

cooling into service. The Loop 1 shutdown cooling suction header isolation valve (SI-405B) failed to fully open and automatically closed after approximately 15 minutes. The Loop 2 shutdown cooling suction header isolation valve (SI-405A) fully opened; however, several hours later, the valve hydraulic pump was observed to be running continuously instead of cycling as designed. These two valves isolate low-pressure portions of the shutdown cooling system from the reactor coolant system and must be opened in order to complete plant cooldown below 200 °F (Mode 5). Troubleshooting revealed that both valves contained inadequate hydraulic oil levels in the valve actuator reservoirs. The cause of the low levels was inadequate instructions for a periodic maintenance task for the valves.

Related Generic Communications

BUL 75-04, "Cable Fire at Browns Ferry Nuclear Power Station," dated March 24, 1975.

BUL 75-04A, "Cable Fire at Browns Ferry Nuclear Power Station," dated April 3, 1975

BUL 75-04B, "Cable Fire at Browns Ferry Nuclear Power Station," dated November 3, 1975.

IN 85-80, "Timely Declaration of an Emergency Class, Implementation of an Emergency Plan, and Emergency Notifications," dated October 15, 1985.

IN 91-57, "Operational Experience on Bus Transfers," dated September 19, 1991.

IN 91-77, "Shift Staffing at Nuclear Power Plants," dated November 26, 1991.

IN 93-44, "Operational Challenges During a Dual-Unit Transient," dated June 15, 1993.

IN 93-81, "Implementation of Engineering Expertise on Shift," dated October 12, 1993.

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

Dennis M. Crutchfield

Dennis M. Crutchfield, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Technical contact: Eric J. Benner, NRR
(301) 415-1171

Attachment:
List of Recently Issued NRC Information Notices

Attachment filed in Jacket

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
95-10, Supp. 2	Potential for Loss of Automatic Engineered Safety Features Actuation	08/11/95	All holders of OLs or CPs for nuclear power reactors.
95-32	Thermo-Lag 330-1 Flame Spread Test Results	08/10/95	All holders of OLs or CPs for nuclear power reactors.
95-31	Motor-Operated Valve Failure Caused by Stem Protector Pipe Interference	08/09/95	All holders of OLs or CPs for nuclear power reactors.
95-30	Susceptibility of Low-Pressure Coolant Injection and Core Spray Injection Valves to Pressure Locking	08/03/95	All holders of OLs or CPs for nuclear power reactors.
94-66, Supp. 1	Overspeed of Turbine-Driven Pumps Caused by Binding in Stems of Governor Valves	06/16/95	All holders of OLs or CPs for nuclear power reactors.
95-29	Oversight of Design and Fabrication Activities for Metal Components Used in Spent Fuel Dry Storage Systems	06/07/95	All holders of OLs or CPs for nuclear power reactors.
95-28	Emplacement of Support Pads for Spent Fuel Dry Storage Installations at Reactor Sites	06/05/95	All holders of OLs or CPs for nuclear power reactors.
95-27	NRC Review of Nuclear Energy Institute, "Thermo-Lag 330-1 Combustibility Evaluation Methodology Plant Screening Guide"	05/31/95	All holders of OLs or CPs for nuclear power plants.

OL = Operating License
CP = Construction Permit

order to complete plant cooldown below 200 °F (Mode 5). Troubleshooting revealed that both valves contained inadequate hydraulic oil levels in the valve actuator reservoirs. The cause of the low levels was inadequate instructions for a periodic maintenance task for the valves.

Related Generic Communications

BUL 75-04, "Cable Fire at Browns Ferry Nuclear Power Station," dated March 24, 1975.
BUL 75-04A, "Cable Fire at Browns Ferry Nuclear Power Station," dated April 3, 1975
BUL 75-04B, "Cable Fire at Browns Ferry Nuclear Power Station," dated November 3, 1975.
IN 85-80, "Timely Declaration of an Emergency Class, Implementation of an Emergency Plan, and Emergency Notifications," dated October 15, 1985.
IN 91-57, "Operational Experience on Bus Transfers," dated September 19, 1991.
IN 91-77, "Shift Staffing at Nuclear Power Plants," dated November 26, 1991.
IN 93-44, "Operational Challenges During a Dual-Unit Transient," dated June 15, 1993.
IN 93-81, "Implementation of Engineering Expertise on Shift," dated October 12, 1993.

This information notice requires no specific 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.

Dennis M. Crutchfield, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Technical contacts: Eric J. Benner, NRR
(301) 415-1171

Attachments:
1. List of Recently Issued NRC Information Notices

DOCUMENT NAME: G:\IN\WATERFOR.INR *See Previous Concurrence
To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	PECB:DRPM	ADM:PUB	SC/PECB:DRPM	C/SPLB:DSSA	C/EELB:DE
NAME	EBenner*	Tech Editor*	EGoodwin*	CMcCracken*	JCalvo*
DATE	07/21/95	7/24/95	8/2/95	7/25/95	7/27/95

OFFICE	C/HHFB:DRCH	RIV	D/DSSA	PECB:DRPM	C/PECB:DRPM
NAME	CThomas*	RHuey*	GHolahan	RKiessel	AChaffee
DATE	8/1/95	8/2/95	8/4/95	8/9/95	8/9/95

OFFICE	D/DRPM				
NAME	DCrutchfield				
DATE	/95				

OFFICIAL RECORD COPY

Related Generic Communications

BUL 75-04, "Cable Fire at Browns Ferry Nuclear Power Station," dated March 24, 1995

BUL 75-04B, "Cable Fire at Browns Ferry Nuclear Power Station," dated November 3, 1995

BUL 75-04A, "Cable Fire at Browns Ferry Nuclear Power Station," dated April 3, 1995

IN 85-80, "Timely Declaration of an Emergency Class, Implementation of an Emergency Plan, and Emergency Notifications, " dated October 15, 1985

IN 91-57, "Operational Experience on Bus Transfers," dated September 19, 1991

IN 91-77, "Shift Staffing at Nuclear Power Plants," dated November 26, 1991

IN 93-44, "Operational Challenges During a Dual Unit Transient," dated June 15, 1993

IN 93-81, "Implementation of Engineering Expertise on Shift," dated October 12, 1993

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

Dennis M. Crutchfield, Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Technical contacts: Forrest R. Huey, RIV
(510) 975-0342

Eric J. Benner, NRR
(301) 415-1171

Amarjit Singh, NRR
(301) 415-1237

David R. Desaulniers, NRR
(301) 415-1043

Sikhindra K. Mitra, NRR
(301) 415-2783

Thomas A. Bergman, NRR
(301) 415-1021

Attachments:
1. List of Recently Issued NRC Information Notices

CONCURRED AS MARKED

DOCUMENT NAME: G:\IN\WATERFOR.IN
To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	PECB:DRPM		ADM:PUB		SC/PECB:DRPM		C/SPLB:DSSA		C/EELB:DE	
NAME	EBenner		Tech Editor		EGoodwin		CMcCracken		JCalvo	
DATE	07/21/95		7/24/95		8/22/95		9/25/95		7/27/95	

OFFICE	C/HHFB:DRCH		D/DRCH		C/TQMB:DOTS		RIV		PECB:DRPM	
NAME	CThomas	E	BBoger		SBlack		RHuey		RKiessel	
DATE	8/1/95		/95		/95		8/29/95		/95	

OFFICE	PECB:DRPM		D/DRPM							
NAME	AChaffee		DCrutchfield							
DATE	/95		/95							

OFFICIAL RECORD COPY