Duke Energy

W. R. McCollum, Jr.
Vice President

Duke Energy
Oconee Nuclear Station
7800 Rochester Highway
Seneca, SC 29672
(864) 885-3107 OFFICE
(864) 885-3564 FAX

November 05, 2001

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: Oconee Nuclear Station
Docket Nos. 50-269
Licensee Event Report 269/2001-02, Revision 0
Problem Investigation Process No.: O-01-3367

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report 269/2001-02, Revision 0, concerning a Reactor trip that resulted when the Turbine /Generator automatically tripped due to Isolated Phase Bus problems.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(iv). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

W. R. McCollum, Jr.

Attachment

IE22

cc: Mr. Luis A. Reyes
Administrator, Region II
U.S. Nuclear Regulatory Commission
61 Forsyth Street, S. W., Suite 23T85
Atlanta, GA 30303

Mr. L. Olshan, Project Manager
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Mr. M. C. Shannon
NRC Senior Resident Inspector
Oconee Nuclear Station

INPO (via E-mail)

NRC FORM 366 (1-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 6-30-2001

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 1	050-269	1 OF 7

TITLE (4)
Reactor trip After Auto Main Turbine Trip Due to Isolated Phase Bus Problem

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										050-
09	12	01	2001	- 02 -	00	11	05	01	FACILITY NAME Unit 1	DOCKET NUMBER 050-269

OPERATING MODE (9)	1
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) (11)

	20.2201(b)		20.2203(a)(3)(ii)		50.73(a)(2)(ii)(B)	50.73(a)(2)(ix)(A)
	20.2201(d)		20.2203(a)(4)		50.73(a)(2)(iii)	50.73(a)(2)(x)
	20.2203(a)(1)		50.36(c)(1)(i)(A)	X	50.73(a)(2)(iv)	73.71(a)(4)
	20.2203(a)(2)(i)		50.36(c)(1)(ii)(A)		50.73(a)(2)(v)	73.71(a)(5)
	20.2203(a)(2)(ii)		50.36(c)(2)		50.73(a)(2)(v)(B)	OTHER
	20.2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)	Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iv)		50.73(a)(2)(i)(A)		50.73(a)(2)(v)(D)	
	20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(vii)	
	20.2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)	
	20.2203(a)(3)(i)		50.73(a)(2)(ii)(A)		50.73(a)(2)(viii)(B)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
L.E. Nicholson, Regulatory Compliance Manager	(864) 885-3292

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
"B"Design	TB	DISC	D312	Y					

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE).	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On September 12, 2001, Oconee Unit 1 was operating in Mode 1 at 100% power. At approximately 1813 hours Unit 1 tripped due to problems with the Isolated Phase Bus disconnect switch. During the plant trip, due to difficulties with the Z phase of the Isolated Phase Bus, an indication of a loss of power (as monitored on Z phase) actuated the 4kV switchgear undervoltage relays. This resulted in the loss of the Hotwell and Condensate Booster Pumps, which in turn caused the Main Feedwater (MFW) Pumps to trip. The Emergency Feedwater System actuated on loss of both Main Feedwater pumps. Steam Generator levels were correctly maintained by the Emergency Feedwater System.

The unit post trip response was normal except for the MFW not being available. The plant was maintained in Mode 3.

Investigation determined that the electrical generator disconnect switch on the "Z" phase had failed. Corrective actions to prevent recurrence were to replace the damaged disconnect switch and to improve the performance of the Isolated Phase Bus cooler.

The health and safety of the public was not compromised by this event.

EVALUATION:

BACKGROUND

This report addresses a Reactor trip, which is reportable per 10CFR50.73(a)(2)(iv) as "any event or condition that resulted in a..automatic actuation of.. the Reactor protection System."

The Reactor Protection System (RPS) [EIIS:JC] is a safety related system which monitors parameters related to the safe operation of the plant. The RPS provides a two-of-four logic for tripping the reactor in response to unit/system conditions that require a unit trip.

One of the parameters monitored by RPS is the Main Turbine Trip. If the Main Turbine [EIIS:TA] should trip or both Main Feedwater (MFW) [EIIS:SJ] Pumps should trip, then the RPS will automatically trip the Reactor [EIIS:RCT].

The Emergency Feedwater (EFW) System [EIIS:BA] is designed to start automatically upon loss of MFW or low level in either Steam Generators S/G. The EFW system ensures sufficient feedwater supply to the S/G of each unit, in the event of loss of the Condensate/Main Feedwater System, to remove energy stored in the Reactor core [EIIS:AC] and primary coolant [EIIS:AB]. The EFW system consists of two motor driven pumps and one turbine driven pump.

The main electric generator [EIIS:TB] supplies power through an isolated phase bus to the unit step-up and unit auxiliary transformer. The unit auxiliary transformer is connected to the bus between the generator disconnect switches and the unit step-up transformer. During normal operation, station auxiliary power is supplied from the main generator through the unit auxiliary transformer. During startup, shutdown, and after shutdown, station auxiliary power is supplied from the 230kV system through the startup transformer.

The original design for isolation and disconnecting the Main Generator consisted of disconnecting flex links housed in each Isolated Phase Bus. These flex links are very heavy and cumbersome to remove and install. This awkwardness created a significant personnel safety concern and damage to the flex links because of repeated handling. This damage could result in poor connections and therefore hot spots.

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Oconee Nuclear Station, Unit 1	050-269	2001	- 02 -	00	3 of 7

NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

The solution was to install a disconnect switch in each Isolated Phase Bus in lieu of the flex links. Modifications for the Isolated Phase Bus disconnect switches were done on Units 1 and 2 during their last refueling outages. Unit 3 modification was to be completed during the 2001 fall refueling.

Prior to this event Unit 1 was operating at 100% power with no safety systems or components out of service that would have contributed to this event.

EVENT DESCRIPTION

On September 12, 2001, at approximately 1813 hours, Control Room Operators for Unit 1 observed an Isolated Phase Bus Ground flickering alarm (not locked in). Within approximately 15 seconds Unit 1 tripped from 100% power due to problems with the Isolated Phase Bus disconnect switch. No abnormal events, testing or maintenance procedures were in progress immediately before or during the time this event occurred.

The Reactor Trip was due to a problem with the main generator disconnect switch on the Z phase. The event recorder indicated that the problem existed for more than 15 seconds prior to the trip. The electrical system protective relays monitor the Z phase for loss of power. The Z phase voltage transient prior to and during the trip actuated the under voltage relays in the non-essential 4kV switchgear. This resulted in the loss of Secondary Side Pumps (Hotwell Pumps, Condensate Pumps, etc.) causing the Main Feedwater Pumps to trip.

With the main feed pumps not being available to remove decay heat from the S/Gs, the Operators entered the Abnormal Procedure (AP) for loss of Main Feedwater. The Emergency Feedwater pumps auto started because of the loss of both MFW Pumps and maintained post trip S/G levels per design.

All plant systems responded normally to the plant trip with the exception of the Secondary Systems Pumps. The plant was maintained in Mode 3.

A post trip investigation found that the Z phase disconnect switch of the Isolated Phase Bus had failed because of apparent high temperature. Testing was done to determine if a fault in the

electrical system caused the disconnect switch to fail or if the disconnect switch failure caused the fault. The results from the testing eliminated system faults as the cause of damage to the disconnect switch. The disconnect switch was inspected and found to be properly installed.

The Isolated Phase Bus disconnect switches were rebuilt and a modification to the disconnect switch enclosures was completed to allow for thermal imaging while at power.

The plant was placed back on line and power raised to 100%. Engineering monitored temperatures at the disconnect switches and Isolated Phase Bus, while at 100%, using thermal imaging, local temperatures and computer points. This data indicated that temperatures were still high. Unit 1 power was decreased to approximately 92%. The cooling medium for the Isolated Phase Bus cooler was changed from Recirculating Cooling Water (RCW) to chilled water to help improve Isolated Phase Bus cooling air temperature. This temporary chilled water modification will be in effect until the next Unit 1 refueling (Spring 2002).

Concurrently, the Unit 2 Isolated Phase Bus, which had the same style disconnect switches, was exhibiting elevated temperatures. Consequently Unit 2 was taken off line and the disconnect switches were replaced with a solid bus. This action was completed on September 30, 2001.

Unit 3 Isolated Phase Bus modification has been postponed until resolution of the disconnect switch problem.

CAUSAL FACTORS

The cause for the Isolated Phase Bus disconnect switch failure was high operating temperature. The high temperatures at the disconnect switch could have been caused by either: 1) Inadequate airflow or airflow distribution through the Isolated Phase Bus cooling ducts, or 2) Inadequate capacity of the disconnect switches.

The root cause for this event is still under investigation. Once the root cause is determined, Oconee will address the design of these disconnect switches and/or the Isolated Phase Bus cooling system to rectify the problem. If significant information becomes

available when the root cause is completed then a supplement to this LER will be submitted.

CORRECTIVE ACTIONS

Immediate:

1. Operators took the appropriate actions to maintain the plant in Mode 3.

Subsequent:

1. The Unit 1 Isolated Phase bus disconnect switches were replaced with spare disconnect switches.

2. The cooling medium for the Isolated Phase Bus coolers was changed from Recirculating Cooling Water (RCW) to chilled water to help improve Isolated Phase Bus cooling air temperature. This temporary chilled water modification will be in effect until the next Unit 1 refueling (Spring 2002).

3. Unit 2 was taken off line and the disconnect switches were changed to solid bus pieces.

Planned:

1. The root cause process for the Isolated Phase Bus disconnect switches on all three Units will determine the permanent corrective actions. Problem Investigation Process (PIP) O-01-03367 will document the permanent solution.

There are no NRC Commitment items contained in this LER.

SAFETY ANALYSIS

The loss of Main Feedwater is an anticipated transient and is described in Section 10.4 of the Updated Final Safety Analysis Report (UFSAR). Loss of MFW initiates a reactor trip and starts the EFW System to provide decay heat removal. In this event all the systems and equipment operated as designed to mitigate the consequences of the loss of MFW. During this event, the turbine driven EFW pump and both motor driven EFW pumps automatically started and properly controlled S/G

levels to remove decay heat from the reactor coolant system (RCS). The unit was maintained at mode 3.

The motor driven EFW pumps are considered essential loads and are not tripped by undervoltage. Instead a power switching logic transfers the power from the faulted source to an alternate source. Therefore, the motor driven EFW pumps and all other safety pumps were not affected by the initiating event and were available to operate to mitigate the loss of MFW as described.

If the Unit 1 EFW pumps had not started, the Emergency Operating Procedures (EOP) and Abnormal Procedures (AP) direct operators to align EFW from one of the other two Oconee units. The EOP and AP also include the use of High Pressure Injection (HPI) [EIIS:BG] forced cooling and/or use of the Standby Shutdown Facility (SSF) [EIIS:NB] Auxiliary Service Water (ASW) [EIIS:BA] Pump. At the time of this event: 1) both trains of the HPI were available to provide feed and bleed decay and sensible heat removal, 2) Units 2 & 3 were at power and all three EFW pumps, for each unit, were available to provide EFW, and 3) The SSF and its ASW pump was available to provide heat removal via the S/Gs.

The core damage significance of this event has been evaluated by considering the availability of the EFW system, the SSF and the HPI system to provide S/G and feed and bleed cooling. The estimated increase in core damage probability associated with this event was determined to be insignificant.

Therefore, there was no actual impact on the health and safety of the public due to this event.

ADDITIONAL INFORMATION

There were no releases of radioactive materials, radiation exposures or personnel injuries associated with this event.

The trip of the Reactor constitutes a Maintenance Rule functional failure and is considered reportable under the Equipment Performance and Information Exchange (EPIX) program. The root cause is still under investigation but the NRC code is "B" because it is either the design of the disconnect switches and/or the Isolated Phase Bus cooling.

FACILITY NAME (1)	DOCKET (2) NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Oconee Nuclear Station, Unit 1	050-269	2001	- 02 -	00	7 of 7

NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

A review of reportable events indicated that no reactor trip events have occurred within the past two years due to the root cause identified in this event.